THE PROCEEDINGS OF THE LINNEAN SOCIETY OF NEW SOUTH WALES

FOR THE YEAR

1913

Vol. XXXVIII.

WITH THIRTY PLATES.

SYDNEY:

PRINTED AND PUBLISHED FOR THE SOCIETY

BY

W. A. PEPPERDAY & CO., 119A PITT STREET

AND

SOLD BY THE SOCIETY

1914.

W. A. PEPPERDAY AND CO.,
GENERAL PRINTERS,
119a PITT STREET, SYDNEY.

CONTENTS OF PROCEEDINGS, 1913.

PART I. (No. 149).

(Issued 17th September, 1913.)

PART II. (No. 150).

(Issued 5th November, 1913).

PART III. (No. 151).

(Issued 19th December, 1913).

PART IV. (No. 152).

(Issued 23rd March, 1914).

CORRIGENDA.

Page 65, line 15—for *Lygestria*, read *Lygestira*.
Page 65, line 26—for *L sulci-*, read *L. sulci-*
Page 67, line 13—for *metallicus* Westw., read *metallicus* Macl.
Page 76, line 34—for *P. elongatus* Macl., read *P. elongatulus* Macl.
Page 99, line 3—for *C. Mustersi*, read *P. Mastersi*.
Page 99, line 5—for *C. aculeatus*, read *P. aculeatus*.
Page 104, line 9—for *C. varicolor*, read *T. varicolor*.
Page 109, line 11—for *Sturnus vulgarus*, read *Sturnus vulgaris*.
Page 119, line 30—for *Mourlonia rotundatum*, read *Mourlonia rotundata*.
Page 272, line 28—*for* STRIGELLA SINCERA, *read* STRIGILLA SINCERA.
Page 539, line 3—under Western Australia, read *Actinodium*, 1 species.
Page 563, line 5—for *Poranthera* [preoccupied], read *Porantheris*.
Page 564, line 21—*for* Porantheras, *read* Porantheres.
Page 651, line 4—*for* POLYGONUM PLEBIUM, *read* POLYGONUM PLEBEIUM.
Page 653, line 35—*for* P. TASMANICA, *read* F. TASMANICA.
Page 662, line 5—*for* Plates xxv -xxvii., *read* Plates xxvii.-xxix.
Pages 664, 666, 667, 669, in the references to figs. 1-6—*for* Pl. xxv., *read* Pl. xxvii.
Pages 673, 674, 675, 681, 689, in the references to figs. 7-11—*for* Pl. xxvi., *read* Pl. xxviii.
Pages 694, 697, 699, in the references to figs 13-15—*for* Pl. xxvii., *read* Pl. xxix.

LIST OF NEW GENERIC NAMES PROPOSED IN THIS VOLUME(1913).

* Preoccupied. *See* Corrigenda.

LIST OF PLATES.

PROCEEDINGS, 1913.

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

WEDNESDAY, MARCH 26TH, 1913.

The Thirty-eighth Annual General Meeting, and the Ordinary Monthly Meeting, were held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, March 26th, 1913.

ANNUAL GENERAL MEETING.

Mr. W. W. Froggatt, F.L.S., President, in the Chair.

The Minutes of the preceding Annual General Meeting (March 27th, 1912) were read and confirmed.

The President delivered the Annual Address.

PRESIDENTIAL ADDRESS.

During the past year, twenty-five individuals passed the ballot, but only twenty of them accepted the obligations of membership. A new edition of the Rules, with an up-to-date List of Members, has been distributed with Part 3 of the Proceedings for 1912, from which it will be seen that the number of Ordinary Members now on the Roll is 167—a larger number than the Society began with in 1875 (105), but a smaller number than it has had at some periods of its history.

Though this meeting is only the Thirty-eighth Annual General Meeting, I may remind you that the Society had a predecessor, the Entomological Society of New South Wales, which, had it survived, would have been in a position to celebrate its jubilee last year. The first Monthly Meeting of the Entomological Society was held on 5th May, 1862. The meetings were continued until July, 1873, at somewhat irregular intervals towards the last; and then the Society came to an end. Meanwhile the Society published ten annual Parts of its Transactions, forming two complete volumes, Part i., having been issued in 1863, fifty years ago this year. These publications are of special interest, because they were the first scientific serial publications issued by a scientific society in New South Wales. The half-century anniversaries to which I have alluded, though interesting in themselves, because suggestive of the great development in education generally, and especially in science, of which we to-day are cognisant, are also of particular, though melancholy, interest to us, by reason of the recent deaths of two of the veterans, Mr. George Masters, and Dr. James C. Cox, within a few months of each other.

George Masters was born in Kent, England, in July, 1837. He emigrated to Tasmania, while still a young man, and subsequently entered the service of the late Dr. Howitt, of Melbourne, who formed the Howitt Collection of Insects, now in the National Museum, Melbourne. His association with Dr. Howitt may be supposed to have stimulated Mast rs' interest in natural history, and especially in entomology. Be that as it may, the pamphlet on the "Fauna of Tasmania," published by Mr. G. Krefft, in 1868, is said by the author, to be based on the observations of Mr. George Masters. We first hear of Masters, in connection with scientific matters, as a visitor, introduced by Sir William (then Mr.) Macleay, at the third meeting of the recently established Entomological Society of New South Wales, on 7th July, 1862. He had just returned from an important collecting visit to Port Denison, then newly settled, undertaken in the interests of Sir William Macleay's Collection. Hence it is a reasonable supposition, that Mr. Masters came to Sydney in the year 1860, or perhaps early in 1861. The Port Denison collection provided the material for Sir William's earliest contributions to the Entomological Society of New South Wales.

Subsequently Mr. Masters joined the Society. For about two years after his return from Port Denison, he assiduously collected insects in the neighbourhood of Sydney, and in the western portion of the County of Cumberland, at Eastern Creek and Windsor, as well as in other localities not specified. The exhibition of Mr. Masters' choice collections, from time to time, was one of the most interesting features of the meetings of the Society.

In 1864, Mr. Masters joined the staff of the Australian Museum, Sydney. The official notice of his appointment states that: "An Assistant Curator, of considerable practical experience, has been appointed, who takes an active part in the arrangement of the collection, and occasionally travels in search of natural history specimens; a very large and highly valuable collection, comprising many new genera, has been brought together." During his connection with the Australian Museum, which lasted for ten years, very large and important general collections were made for the Museum. From June to December, 1864, the first year of his appointment, the additions of vertebrates consisted chiefly of birds, together with 5,000 specimens of insects, but localities are not mentioned. Thereafter, he made extensive collections in South and West Australia, at Pine Mountain and in other localities in Queensland, again in West Australia, at Lord Howe Island, at Maneero, at the Snowy Mountains, and in the Wide Bay District, Queensland, whence he brought back nineteen specimens of *Ceratodus*. The Coleoptera obtained on this trip, amounted to nearly 16,000 specimens, representing over 1,100 species, according to Sir William Macleay. In 1867, Mr. Masters collected in Tasmania. On his return, after his collection had been exhibited to the Trustees at a Board Meeting, he was specially thanked by letter for his zeal, diligence and skill in making such a splendid collection, and made the recipient of a gift in token of the appreciation of the Trustees. A lengthy account of the history and contents of "The Sydney Museum" will be found in the "Evening News" of May 22nd, 1868, in which appreciative reference is made to Mr. Masters' share in the development and arrangement of the collections.

During the period 1871-74, Mr. Masters published a "Catalogue of the Described Coleoptera of Australia," in five parts, founded upon Gemminger and Harold's "Catalogus Coleopterorum," revised, as far as possible, both as to species incorrectly included, and as to localities. Also, in 1873, a "Catalogue of the Described Diurnal Lepidoptera," and a "List of Australian Longicorns." These useful compilations, though now out of date, did much to help and stimulate Australian entomologists, at that time, when access to, and a knowledge of, the necessary literature, was so difficult to acquire. They are referred to, in an appreciative manner, by Professor Westwood in his Presidential Address to the Entomological Society of London, in 1873.

Mr. Masters retired from the Australian Museum to take up the position of Curator of the Macleay Collection, offered to him by Sir William Macleay, in February, 1874. About a year earlier, Sir William had intimated, to the Senate, his intention of presenting the Macleay Collection to the University of Sydney at some future time. That is to say, Sir William had only an alternative choice in the ultimate disposal of the portion of the Macleay Collection which he had inherited—the original collection of his uncle, Mr. Alexander Macleay, enlarged, and still further developed, by his cousin, Mr. W. Sharp Macleay; and the only other course open to him, was to arrange for its return to a University in England. But Sir William was too keenly interested in Australia, and in an endeavour to put entomology, in common with other branches of Natural Science, on a firm basis in New South Wales, to take any other course than he did.

With the appointment of Mr. Masters, the Macleay Collection began to develop rapidly—by purchase, by the efforts of special collectors, as the result of collecting trips by Sir William and Mr. Masters, sometimes accompanied by Professor Stephens, and especially by the acquisition of the extensive marine and other collections obtained during the expedition to the north-east coast and to New Guinea, in the "Chevert" in 1875. Some record of the consequent expansion of the collection, will be found in the earlier volumes of the Society's Proceedings, and need not now be referred to in detail.

In 1888, a suitable building having been provided for its reception, since then known as the Macleay Museum, Sir William transferred the entire collection to the University of Sydney, together with the sum of £6,000, for the maintenance of a Curator, with the proviso that Mr. Master should retain the position, which he had so creditably filled for fourteen years, and which he subsequently held up to the time of his decease, on 23rd June, 1912, within one month of the attainment of his seventy-fifth birthday.

I have dwelt at some length upon this notice of Mr. Masters' career, because some such recognition of his more than fifty years' service in the cause of zoological science is due to his memory, and also because of his active interest in the work of the Entomological Society of New South Wales, of his early and long connection with the Linnean Society of New South Wales, of which he was an Original Members, elected in 1874; and also because of his lengthy association with Sir William Macleay, and with the Macleay Collection, in the maintenance, and development of which, he played so important a part; and, lastly, because he was so well known to Australian entomologists, and especially to those of this State, who cannot but gratefully remember their indebtedness to his kindness of heart, to his courtesy and readiness to forward their studies, and to help them, in so far as it was in his power to do so. With the exception of Central Australia and the North-west, Mr. Masters had collected in some portion of every State in the Commonwealth. He was possessed of an unrivalled knowledge of the habits, and life-histories of Australian animals; and it is much to be regretted that his distaste for the literary side of the subject, has deprived us of much interesting matter, that it would have been advantageous to us to have had on record, because so much of its was acquired under most favourable conditions, when settlement was only just beginning to interfere with the native fauna.

James Charles Cox, M.D., Edin., F.R.C.S., was such a well-known figure in Sydney, that I need not dwell upon biographical details, beyond mentioning that he was the fifth son of Mr. Edward Cox, of Mulgoa, and grandson of Captain William Cox, of the New South Wales Corps, who came to Australia in 1800, and was the progenitor of the numerously-represented Australian branch of the Cox family. As the Chief Magistrate of the district—for at this time Captain Cox resided at Clarendon, on the Hawkesbury, between Windsor and Richmond—Governor Macquarie, in 1813, entrusted to him the responsible task of getting a road made across the Blue Mountains to the site now occupied by the town of Bathurst, shortly after Blaxland, Lawson, and Wentworth, and Evans had completed their labours; and which Captain Cox carried out very successfully in the face of many difficulties. After completing his medical studies at Edinburgh, Dr. J. C. Cox returned to Sydney, and therafter engaged in the practice of his profession. Among the official positions which he filled for some years, were Lecturer in Medicine at the University of Sydney, and Chief Medical Officer to the Australian Mutual Provident Society. He was elected to the Board of Trustees of the Australian Museum in 1865, and for a number of years, and up to the time of his death, he was Chairman of the Board. For a lengthy period, under the old régime, he was President of the Board of Fisheries, and took a great interest in the development of the fishing industry. He was a member of the Philosophical Society of New South Wales, founded in 1856, and contributed a paper "On the Wambeyan Caves," which was read on 9th July, 1862, and which was published in the Transactions of the Society, issued in 1866.

We have a special interest in Dr. Cox, because of his active and loyal support of Sir William Macleay in initiating and carrying on the work of both the Entomological Society of New South Wales, and the Linnean Society of New South Wales. He was an Original Member of both Societies. From its foundation in 1862 to 1865, he was Hon. Secretary of the former, and subsequently Hon. Treasurer. His connection with the Society appears to have stimulated his interest in entomology, and led him to make a collection; for the record of one of his exhibits, is of a very small species of *Trox,* which he had found in a Phalidura in his cabinet. From time to time, at the Meetings, he exhibited collections from various localities, some of them the results of his own collecting. But even at this time he must have been more interested in conchology. During the period from 1864-1873, he contributed seventeen conchologogical papers, descriptive, for the most part, of Australian or Pacific Islands Land-shells, the first to the Annals and Magazine of Natural History, for July, 1864, twelve to the Proceedings of the Zoological Society of London, two to the Journal de Conchyliologie, and one, upon Australian Oysters, to the Acclimatisation Society of New South Wales. In 1864, he issued, at his own expense, a "Catalogue of Australian Land-Shells"; and, in 1868, "A Monograph of Australian Land-Shells, with Drawings by Miss Scott, and Mrs. Edward Forde."

When the establishment of a Society of Natural History, which eventually assumed the name of the Linnean Society of New South Wales, was mooted in October, 1874, Dr. Cox was among the first to respond to the call of the promoters, and to offer himself for enrolment as an Original Member. He was elected a Member of the first Council, and retained his seat for a number of years, afterwards; and was the fourth President, in 1881 and 1882. He was the author of a number of papers, while a reference to the published "List of Contributors" to the first ten volumes of the Proceedings, and to the continuation in manuscript kept by the Secretary, and still awaiting publication, shows that he took some trouble to add to the interest of the Society's Meetings by bringing noteworthy specimens under notice, and offering observations on matters worthy of record. When the meetings were held in the city, and Dr. Cox resided in Macquarie Street, he was a very regular attendant, notwithstanding his professional engagements. But with advancing age, and his removal to a distant suburb, he became unable to keep up the active interest in the Society, which was, for so long a period, characteristic of him. Apart altogether from his work as medical man, the memory of Dr. Cox deserves to be held in kindly remembrance by all of us, in this State, interested in biology, for his untiring efforts to advance Natural Science, and for his honourable and long record of service extending over a full half century. Dr. Cox passed away on 29th September, 1912, aged 79.

We have also to mourn the loss, by death of the Rev. Thomas Blackburn, B.A., of Adelaide, the senior worker on the Coleoptera, in Australia; and a Corresponding Member of the Society since 1888. Mr. Blackburn left England in the seventies, to take up clerical work in the Hawaiian Islands. Being interested in entomology, he made a very praiseworthy effort to accumulate a representative collection of the insects of those islands. An account of some of the groups of the Coleoptera, by Dr. D. Sharp, will be found in the Transactions of the Entomological Society of London for 1878, and later volumes; and of the Hemiptera, by Mr. A. White, in the Annals and Magazine of Natural History for 1878. A few years later, Mr. Blackburn, came to Australia, and accepted charge of a parish of Woodville, near Adelaide, where he spent the rest of his life. Soon after his arrival, he took up the study of Australian coleoptera, and became the author of a considerable series of papers on the subject, comprising about thirty papers contributed to the Transactions of the Royal Society of South Australia, the first of which was read in December, 1886, and was published in Vol. x., 1886-87 (1887). The first of his papers contributed to the Linnean Society of New South Wales, was one entitled "Notes on the Hemiptera of the Hawaiian Islands" (Proc. 1888, p. 343); and this was followed by a series of twenty-nine papers descriptive of Australian coleoptera spread over the Proceedings from 1888 to 1904. Mr. A. M. Lea, of Adelaide, has prepared a more detailed biographical sketch than I am in a position to do, together with a bibliography, and an index of the species described by Mr. Blackburn, which will be most useful. This will appear in the Transactions of the Royal Society of South Australia for 1912.

Thirty-seven papers, covering the customary wide range of subjects, were contributed at the Monthly Meetings. Parts i.-iii. of the Proceedings for 1912, containing twenty of these, have been published and distributed, while the concluding Part is now in hand. Under existing conditions, which, are largely subject to the prevailing unrest in industrial matters during a transitional period, our printing does not proceed quite so rapidly as we have been accustomed to; but, so far, we have not been able to overcome the difficulty.

In last year's address, I referred to the Council's responsibility in the matter of the re-investment of the large sum of money comprised in the Society's major security, which matured in August, 1912. Anticipating the Hon. Treasurer's financial statement, I may state briefly, that, when the time came, the Council was able to arrange for a renewal of the great part of the loan on mortgage, for another year, at a somewhat higher rate; while satisfactory investments for the balance were entered into for periods of three or five years, at more satisfactory rates than we have had for some years past.

In the early part of the year, Mr. Henry Deane, resigned from the Council, in consequence of frequent absences through professional engagements, resulting finally in his removal to Melbourne; and at the end of the year, Professor J. T. Wilson also resigned, in consequence of his contemplated absence in Europe during this year. Both Mr. Deane and Professor Wilson have rendered signal service to the Society, as Members of the Council, as well as occupants of the Presidential Chair—Mr. Deane in 1895 and 1896, Professor Wilson in 1897 and 1898, in important periods in the Society's history; so that the Council parts, with both of them, with great regret. We may hope to welcome Professor Wilson back early next year. But Mr. Deane's removal to Melbourne in connection with the construction of the Transcontinental Railway, deprives us of an enthusiastic member keenly interested in botany and allied matters, whose presence and contributions added much to the interest of the Meetings for a number of years, until his official duties, entailing frequent absences from Sydney, interrupted these, as well as his investigations upon fossil plants, which began so auspiciously. Dr. J. B. Cleland was elected by the Council, under the provisions of Rule xiii., to fill Mr. Deane's place for the remainder of the session; while a successor to Professor Wilson will be elected at this Meeting, under the new Rules.

A very important matter carried out during the year, has been the revision of the section of the Society's Rules relating to elections to the Council, and some cognate matters. The existing Rules came into force fifteen years ago, at a time when the Society had taken over the responsibility of only one portion of the endowments, devised by Sir William Macleay. Since then, additional responsibilities have devolved upon the Council, in taking over and carrying out in its entirety, Sir William's scheme of endowments, the last item of which, namely, the endowment of four Fellowships, is now almost on the eve of realisation. When, therefore, in the early part of the year, the Council was approached by a private member, with some suggestions, it decided to consider the advisability of a revision of the Rules upon all points, which experience had shown to be capable of improvement. The whole matter was referred to the Society's solicitors for advice, and a Sub-committee was appointed to take action. Finally, after consideration by the Council, a draft of the proposed alterations of certain of the Rules, was put before the Members at a Special General Meeting, convened for the purpose, on 27th November, and carried; and subsequently confirmed at a Special General Meeting on 18th December, 1912. The most important alterations provide, if necessary, for a postal vote, instead of an ordinary ballot at the Annual Meeting; and for a three-fourths majority in the matter of any alteration in the Rules. As about 40 per cent. of the Members reside outside the metropolitan and suburban areas, in other countries or States, and are rarely able, or quite unable, to attend any of the Meetings, in addition to those who live nearer but are prevented, by professional or other engagements, from being present, a more extended franchise than we have hitherto had seemed to desirable, because the large amount of money, whose investment is controlled by the Council, is derived from the trust funds bequeathed by Sir William Macleay. The existing Rules are a legitimate development of the Society's original Rules, enlarged in scope, from time to time, to meet new conditions, arising out of the old ones, as experience required. Just as later Councils have endeavoured to carry out and develop, as new conditions required, the policy of the original Council, when Sir William Macleay was, as he has been described, "the head and heart," as well as the financier, of the Society. And so, as the Council of to-day, has had now more than twenty-one years' experience in the management of the Society's affairs, since the death of Sir William Macleay, in December, 1891, and the existing condition of things has come about in consequence; it was deemed desirable that the alteration of Rule lxiv., so as to provide for a three-fourths majority in the matter of the alteration of the Rules, should receive attention, so that the maintenance of a policy which is founded on precedent as well as experience, should be reasonably safeguarded.

In the bacteriological laboratory, the Macleay Bacteriologist has continued his research into the action of microbiological life in relation to soil-fertility. In the treatment of domestic sewage, it is pumped over poor soils or sandy wastes, and, in passing through, undergoes an amount of putrefaction, which enables the effluent to be discharged into rivers and harbours. After working actively for some time, the soils become clogged, and are so useless that they have to be rested. In the clogged condition, they are said to be sewage-sick, and it has hitherto been supposed that, in the absence of clay, the inactivity was due to the pores and spaces having become plugged with slime. Recently, however, Russell and Golding have claimed that the sickness is brought about by protozoa devouring the decay-bacteria, and preventing their exercising their beneficial function, in consequence of which the soil becomes useless. They were led to this opinion by the fact that, after treatment with heat and volatile disinfectants, the surviving bacteria increase in numbers above those in control tests. The experimental work in the Society's laboratory did not support this contention, for when the protozoa were destroyed by a moderate heat, the volatile disinfectation was able to bring about a considerable increase in the numbers of the bacteria. That the disinfectant has an action upon the fatty matters in such soils, was shown by the bacterial growths in the various layers of soil behaving as if the disinfectant had carried the fatty matters towards the surface while evaporating. The dry sewage-sick soil contained 9 per cent. of organic matter, and 19 per cent. of this consisted of fatty matter, and 9 per cent. of crude gum. The older idea that the inactivity of such soils is due, in the absence of clay, to the accumulation of slime and fatty matter, is more probable than that the protozoa limit the activities of the bacteria.

Previous work by Dr. Greig-Smith had shown that the increased fertility of soils, occasioned by the employment of heat or volatile disinfectants, was caused by the heat destroying, more or less, the bacteriotoxins, and by the volatile disinfectants altering the disposition of the agricere. But there remained the fact that phagocytic protozoa are in the soil, and that they may have some action, although not to the extent claimed by the Rothamsted investigators. Accordingly, the effect of directly adding protozoa to soil, was tested by noting their effect upon the growth of bacteria. The experimental work showed that the addition of a mixed protozoal fauna or of a pure Amœba-culture, did not lessen the numbers of bacteria. Instead of doing so, the bacteria always increased. The increase, which always was considerable, was traced to the freely-growing bacteria, which invariably accompanied the protozoa. The use of filtered soil-extracts, upon which Russell and Hutchinson based their idea concerning the activity of the soil-protozoa, did not bear out their contention, as there was so little difference betwen the action of filtered, as against unfiltered, extracts that it was concluded that the soil-protozoa have no action in limiting the number of bacteria in soils. This has since been supported by the work of Lipman in America.

Dr. J. M. Petrie, Linnean Macleay Fellow in Biochemistry, contributed two papers to last year's Proceedings—"The Chemistry of *Doryphora sassafras*," and "The Occurrence of Hydrocyanic Acid in Plants (other than Grasses), Part i."—which have appeared in Part ii. of the Proceedings. Part ii. of the latter paper is in preparation; and a systematic study of the occurrence of hydrocyanic acid in grasses, is in progress. About one hundred different grasses have been tested four times during one year, at intervals of three months; and the presence of hydrocyanic glucosides and their specific enzymes has been demonstrated in about twenty well-known species, but the occurrence is found to vary with the seasons. Other investigations are being carried out on the alkaloid Solandrine, on the alkaloids of *Duboisia myoporoides*, and *D.*

Leichhardtii F.v.M., from Queensland, on the occurrence of alkaloids in Australian species of the genus *Solanum,* and in the Native Tobacco and the Noogoora Burr, and on the poisonous properties of an introduced weed, *Stachys arvensis* Linn.

Mr. E. F. Hallmann, B.Sc., Linnean Macleay Fellow in Zoology, has been engaged, during the year, in a study of the Monaxonellid Sponges. A preliminary examination and classification of the available unnamed material have been carried out; and his first paper, embodying the results of his investigation of the Monaxonid Sponges described in Lendenfeld's Australian Museum Catalogue, will be ready for communication to the Society, in about three months' time.

Mr. A. B. Walkom has completed his investigations on the stratigraphical geology of the Permo-Carboniferous System in the Maitland-Branxton District, and also in the Glendonbrook District, near Singleton, and two papers, embodying his results, together with a third, giving notes on some recently discovered occurrences of the pseudomorph, Glendonite, will be communicated to the Society, at the meeting in April.

In answer to the Council's call for applications for three vacant Fellowships, issued last October, three applications for reappointment were received; but one of the applicants, Mr. A. B. Walkom, subsequently withdrew, in consequence of his appointment to the teaching staff of the Queensland University. I have now the pleasure of making the first public announcement of the re-election of Dr. J. M. Petrie, and of Mr. E. F. Hallmann to Linnean Macleay Fellowships, for another year, from 1st proximo; and in offering them the Society's best wishes for the successful development of the enterprises which they have in hand. I am glad of the opportunity, also, of offering Mr. Walkom the Society's hearty congratulations on his appointment to the Queensland University, coupled with best wishes for a prosperous and fruitful career.

I am glad of the opportunity likewise of offering the Society's congratulations to three other members—to Mr. J. E. Carne, F.G.S., on his safe return after a successful and adventurous geological expedition to New Guinea, and who, I may add, has kindly promised to show us a series of lantern slides, illustrating his experiences, at an early Meeting; to Dr. H. I. Jensen, who left us, in September last, to take up the position of Geologist of the Northern Territory, which will now, for the first time, have the advantage of a resident geologist; and, lastly, to Dr. W. G. Woolnough, who has recently left us to occupy the Chair of Geology, in the newly-established University of West Australia, in which capacity, all those who know Professor Woolnough, have no doubt that he will amply justify his appointment.

The establishment, by the liberality of the Government, of three new Chairs, in Botany, Organic and Applied Chemistry, and Economics, in the University of Sydney; and also of seven Science Research Scholarships, are matters of the greatest interest and importance, and will materially strengthen the number of those engaged in research work in this State. Botany, especially, is a subject very much in need of the assistance which a Professorship and all that that implies, can give; for while systematic botany has not been neglected, the study of the morphology and embryology of our most interesting flora has languished for lack of teaching, of financial support, and of laboratory facilities. I have great pleasure in offering the Society's congratulations, good wishes, and a hearty welcome, especially to Dr. Robert Robinson, Professor of Organic and Applied Chemistry, and to Dr. A. A. Lawson, Professor of Botany.

I should also like to offer the Society's congratulations to two of our Members, Mr. G. I. Playfair, and Mr. R. J. Tillyard, on their appointment to Science Research Scholarships, and who will now be able to give their whole time to their work, instead of merely their "wearied leisure" as heretofore; while, at the same time, wishing that their emoluments more nearly approached those of the Macleay Fellows.

Only a few weeks ago our hearts were stirred by the sorrowful news of the tragic but heroic ending of Captain Scott's otherwise successful journey to the South Pole, with the details of which you are all familiar, from the newspaper reports, supplemented by Professor David's heartfelt commentaries thereon. As soon as possible, after the receipt of the news, I forwarded, on the Society's behalf, a cablegram expressive of sympathy, to the President of the Royal Geographical Society of London. To this brief statement, I shall only add, that the Lord Mayor's Fund is still open, and offers to us, individually, an opportunity of showing honour to the memory of Captain Scott and his gallant comrades, as well as practical sympathy with those who are left to mourn their grievous losses.

We are all thankful for the safe return of those members of the Mawson Expedition, who have come back recently in the "Aurora." But our warmest sympathy is due to Dr. Mawson, in his delayed return to his base under circumstances so exceedingly trying and depressing, necessitating another period of exile from home; nor can we forget his six companions.

A Century of Civilisation from a Zoologist's Point of View.

Though Governor Phillip occupied New South Wales in 1788, the advent of civilised man cannot be said to have made any impression upon the Australian continent outside the circumscribed area round Port Jackson until 1812 (just about one hundred years ago), when the increasing flocks and herds were able to pass over the Blue Mountains, and spread out, north, south, and west. The advance of the pioneer stockowners once started, soon brought about very marked changes in these, until then, virgin lands, even though it was simply a pastoral occupation of them until many years later.

In 1824, the site of Brisbane was selected, and a northern settlement came into existence; while, at this date, Sir Gordon Bremer formed military stations on Melville Island, and at Raffles Bay, on the north coast. Though these northern settlements were abandoned seven years later, they left their mark on the Australian fauna through the introduction of the Indian buffalo, which, spreading into the swamps and marshes beyond, increased into large herds.

On the 1st of June, 1829, Captain Freemantle hoisted the British flag on the West Australian coast, and, between that date and 1832, a number of small but interesting expeditions were undertaken at the instance of Sir James Stirling, which greatly extended the knowledge of the western region.

About the same time, Victoria was invaded from the south by restless pioneers from the settlements in Tasmania, and from the north, across the Murray, by explorers and overlanders with their stock to occupy the rich lands of Australia Felix.

Soon after New Year, 1830, Captain Charles Sturt, who had left Sydney the previous year, started his adventurous voyage down the Murray, and reached South Australia, where, six years later, the town of Adelaide was laid out by Colonel Light.

With the settlement of Port Essington, on the north coast, when the military stations at Melville Island and Raffles Bay were abandoned in 1831, we may say that Australia was invested on all sides.

A remarkable idea, that had an important influence on the colonisation of Australia, was the general opinion of the settlers and explorers that the greater part of the central lands of the continent was marsh or desert, and much of the coast land useless for settlement. Captain Dampier, and the Dutch navigators, fresh from the rich tropical jungles of the East Indies, could see no future for the mud flats, and pindan scrub, which last hid the rich open forest-land of the north-west coast. It is also evident that it was the totally different aspect of the Australian bush-land, wind-swept plains, and stunted forests, with the parched soil clothed with tufts of brown bleached grass under a summer sun, which, compared with the green fields of England, damped the spirits of our pioneers.

The first inland explorers, working out westward in New South Wales, were very unfortunate in their seasons. First, they became entangled in the Macquarie Marshes; then they struck the River Darling in a time of drought, when the river had dwindled down to a stream of salt water; and, years afterwards, Sturt's account of his enforced residence at Mount Poole for nearly a year, stamped these western lands of New South Wales as absolute desert. North of Adelaide, there is a large area of salt pans and marshes, which seemed to be always in the path of explorers from the south, and most discouraging accounts were sent in regarding the desolation of the north lands.

Nothing could be more depressing than to travel through the mallee country of Victoria and New South Wales in midsummer; and even as recently as 1862, Tenison-Woods, in his "Geological Observations in South Australia," was only voicing the general opinion, when he said the Mallee Lands were worthless for settlement. Nevertheless, within less than twenty-five years, large areas are producing rich crops of wheat and fruit. In Victoria, in particular, they have been greatly developed under the Mallee Pastoral Leases Act of 1883. It is estimated that the area of Mallee Land in Victoria is about 12,000,000 acres; and that from 20 to 25 per cent. of this consists of open plains, and country timbered with pine, belar, bull-oak, and other scrub-trees. About 1,150,000 acres are under cultivation; and, in a second report, it was stated that, in spite of the dry season, the wheat-crops were much better in the Mallee than on the clay soils.

Twenty-five years ago, the wheat-farmers declared that cultivation could not be carried out on the red soil lands of the central area of New South Wales, and that ruin stared anyone in the face, who attempted cropping in the west; yet every year sees the wheat belt extending, and with improved methods of treatment and modern appliances, good returns are being obtained.

I would, in my address, try to point out some of the great changes that have been wrought by the advent of the white man with his domestic animals, in the displacement of the aboriginal population and the original fauna of this great continent, in a hundred years of civilisation.

The aboriginal population was estimated by Flanagan, in the whole of Australia, at 500,000. Krefft says that, in 1847, the natives in Victoria were estimated at 5,000 souls. Though these estimates were probably under the mark, and the native population was comparatively scanty, in proportion to the size of the country, they were uniformly scattered all over the land. A nation of hunters, they moved on with the game, and their numbers, in different localities, were regulated by the food-supply. Their hunting assistants were the dingos, which they were in the habit of catching as puppies, and training. In hard times, they often ate their dogs; and several explorers have recorded how the natives of the intrior guarded their dogs, in fear that the intruders might want them for the same purpose. Even the wild dingos used to come and wander round the camps of the natives during the lean times.

After aboriginals and dingos, the most deadly enemy of the marsupial was the eaglehawk, which would even attack and kill a large kangaroo. Ernest Giles, speaking of Central Australia, says, "The greatest enemy besides the blackman and the dingo, is the large eaglehawk, which, though flying at an enormous height, is always on the watch; but it is only when the wallaby lets itself out on the stony open ridges, that the enemy can swoop down upon it. The eagle trusses it with its talons, smashes its head to quiet it, and finally, if a female, it flies away with the victim for food for its young."

No one, unless he has lived in unstocked country, has any idea how numerous the eagles and hawks are, before poison has been laid. I once counted forty dead eagles round a poisoned carcase, on an out-station in the north-west. Gould, in 1859, remarks on the number of hawks in Australia, and records 40 or 50 kites (*Milvus affinis*) on a tree, on the Manning River; while, thirty years ago, the whistling eagles used to congregate around every western homestead, like the turkey-buzzards on the cathedral roofs in South American towns

The natives were expert hunters, and where permanent water existed, had many ways of getting food, such as their fisheries on the Barwon River, where large numbers of fish were trapped by means of stone barriers. They caught ducks with nets, sometimes 20 feet deep and 100 feet in length, spanned across a river or creek, into which they scared the frightened birds by throwing up an imitation hawk. Krefft says,* "I have seen from 50 to 100 ducks taken in this manner at a single haul." Enormous quantities of eggs were also collected by the natives in their wanderings, so that the increase of the large birds was kept down in several ways. The periodic droughts were much more far-reaching than in modern days; immense areas became waterless, and though the natives often died, large quantities of game also perished.

The grass-eating animals were kept so well in hand under the systems adopted by the native hunters, and the carnivorous birds, that the grass was never eaten down as on stocked land; therefore, towards the summer months, it was often several feet in height, and was regularly fired by the natives, to enable them to get over the country, to catch their game, and also to harass their enemies with grass-fires, and attack them under cover of the smoke.

Stuart was much troubled, when crossing from Adelaide to the north coast, and was attacked several times under cover of the clouds of smoke. At Frews waterholes, he had a narrow escape. He says, "To-day they have set fire to the grass round about us, and the wind, being strong from the north-east, it travelled with great rapidity. In coming into the camp, three miles back, I and the two that were with me narrowly escaped being surrounded by it; it was as much as our horses could get past it, as it came rolling and roaring along in one immense sheet of flame and smoke, destroying everything before it."

---

* Trans. Phil. Soc. N. S. Wales, 1862-65.

I had a similar experience in North Queensland, on the rolling downs country, where the natives set fire to the spinifex ridges on the head of the Gilbert River, and sent twenty miles of flame through the long grass. Giles constantly refers to this habit: "To the north, west, and south-west the natives were hunting, and, as usual, burning the spinifex before them." Again, he says, speaking of the intense heat at Uder: "Nevertheless, the natives were about, burning, ever burning, one would think they were the fabled salamander race, and live on fire instead of water."

Before the advent of white men, the greater part of the surface of Australia was fire-swept towards the end of the summer, even the coastal parts being sometimes burnt out in large areas, as happened on the historic Black Thursday, when, in 1851, the greater part of Victoria and New South Wales was one great bushfire.

We can now consider the most striking changes that came with civilisation, and the passing of the aboriginals as a nation of hunters, the first of which was the enormous increase of the indigenous animals and large birds, not only caused by the disappearance of the native, but also by the partial extermination of the dingos and wild dogs, both of which lived upon the native fauna. The laying of poisoned baits by the squatters, for these pests, killed off large numbers of carnivorous birds, which also checked the undue increase of wild game.

This remarkable increase of marsupials, in particular, was very noticeable even in the early fifties. Wheelwright, in his "Bush Wanderings," when speaking of game, says that his party of kangaroo-shooters killed 2,000 in the season within thirty miles of Melbourne. And all over the forest-country, kangaroo-drives were the only way of keeping the larger marsupials within bounds. In both New South Wales and Queensland, Acts were passed, making it compulsory for the squatters to destroy kangaroos; an assessment *per capita* was made on all sheep and cattle, inspectors were appointed, and a price fixed for scalps. In New South Wales, sixpence per scalp was paid all over the State, while, in Queensland, it varied from twopence to ninepence in different districts. This work was afterwards passed on to the Pastures Protection Boards, and Local Boards in each land district, with a General Council of Advice elected annually in Sydney.

Under the Pastures Protection Boards last year (1911), the following list of noxious animals destroyed, as proclaimed under the Act, was recorded, with the bonuses paid for them in New South Wales:—

Names.	*Numbers.*	*Bonus paid.*
Wallabies	505,129	£2,401 14 4
Kangaroo Rats	96,922	815 3 0
Padymelons	16,140	88 11 9
Wombats	255	7 6 0
Hares	163,064	1,205 19 3
Native dogs and pups	8,251	4,091 12 6
Foxes and cubs	26,278	3,561 11 3
Eaglehawks	5,328	428 7 0
Crows	89,133	2,311 16 0
Total	910,500	£15,511 12 1

In the Annual Report of the Department of Lands of Victoria, 1911-12, the cost of destroying vermin, under this Act, is given as £40,142 16s. 3d., including dogs and foxes.

During the last year (1912), a North Coast Crows and Flying Foxes Destruction Board was formed at Beinleigh, N.S.W., which includes ten shires.

The opossum, like the kangaroo, lost its enemies, and multiplied rapidly in all suitable localities. A writer in the *Journal of the Royal Society of New South Wales* (1885) considered that opossums were so numerous in several localities in Victoria, that, owing to the constant defoliation, large numbers of the forest gum-trees were actually dying. He pointed out that these forests, forty years before, had been the hunting ground of a tribe of 200 aboriginals, whose chief food-supply was opossums; and that, at the moderate estimate of 50 opossums a day, 200 natives would account for

18,000 a year. In New Zealand, where our opossums have been introduced and liberated only a few years ago, they have bred so quickly, free from all enemies, that they are now looked upon as a pest.

The emu, about which so much has been written as a vanishing bird, with a partial protection is more plentiful now in many inland districts, than it was when the natives caught the young birds in the long grass, hunted for the eggs, and would hide all day on the edge of a water-hole to kill them when drinking. Under the same conditions, we seldom saw a cassowary in the Cairns scrubs, in North Queensland, in 1880, when the blacks were numerous; but six years later, when I hunted over the same ground, they were quite common, because there were no blacks.

The next important change brought about in new country by stocking, was the hardening of the surface of the soil, the eating-off of the rough grass, and the consequent improvement of the pasturage. This is known to every stockman, and I had a striking example brought under my notice on the King's Sound Pastoral Company's station in North-West Australia, where, in the midst of about two million acres of unstocked land, there was a fenced-in paddock of about ten thousand acres, upon which the station sheep were depastured. Within three years, the enclosed land, though very lightly stocked, was transformed into a different and better class of country from that outside the ring-fence, which was poor and thinly grassed.

The original condition of the greater part of the sheep and cattle lands before stocking, was loose, friable soil, black loam, or sand ridges covered with scattered tufts of grass and herbage. This land, in the dry season, opened out in great cracks and fissures, or became loose, shifting sand, under the influence of summer sun and wind-storms. This was changed again, under the action of the fierce winter rains, into a quagmire, over which even the kangaroo found it difficult to travel. The carts and drays of the pioneers travelling over the road-less plains and ridges, sank so far into the soil, that the deeply cut tracks often remained for years, useful guides to later travellers.

Dr. Woolls, in his "Plants of the Darling," says: "When, in 1865, Mr. E. Ford was surveying in that district, he wrote that it was quite impossible to find a moist spot on the Darling, everything being dry, parched and burnt up, whilst the ground was cracked in all directions with deep fissures."

The rapidity with which, even after heavy rains, the clay-pans, swamps, and marshes dried up in the interior, was startling to the traveller. Many of our large inland lakes and swamps, which have been permanent sheets of water for the last forty years, were, in the early days of settlement, only sheets of water through the winter and spring, and were quite dry long before the end of summer. This is evident from the fact, that there are many of these swamps and lakes, even at the present time, surrounded with a frings of gaunt, dead skeletons of gum-trees, many of which must have been very old trees before the altered conditions came about, and they were killed by the accumulated water. The Kow Swamp, in the north of Victoria, is an example of this; from the present low-water mark at the end of summer, hundreds of dead, bleached red-gums encircle the clear water as far in as the low-water mark of olden times; while outward, to the high-water mark, the large red-gums grow with all their usual vigour. This swamp was perfectly dry in the great drought of 1865, but since the floods of 1870, it has been a permanent sheet of water, with an average depth of 2-3 feet at the end of the summer.

Not only did the stocking improve the pasturage, but the constant padding of the soil by the feet of the cattle, horses, and sheep, puddled the soil, so that the beds of the clay-pans, water-holes, creeks, and swamps, which previously had retained the surface-water for a very short time after rain, became so hardened and puddled, that the water became more or less permanent. The habit of sheep in following each other in strings, gives rise to regular beaten tracks (sheep-pads), which, trending in all directions, usually lead down into the watercourses, forming regular gutters. There the accumulated water is still further retained in the clay-pans, because the fine clay and sediment, carried in the water, settles and forms a skin or coating on the bottom.

This is corroborated by Mr. W. E. Abbott,* who says, "The difference between stocked country and that which has never been stocked, is apparent even after a few years; the surface becomes firmer, and water runs where it never ran before." This makes a great difference in the quantity of surface-water that runs into rivers and swamps, and very soon rivers run with half the amount of rain that they did previously.

Stockowners were soon confronted with the important problem of the conservation of water for their stock during the summer months, and the further inland they moved out, the more serious the question of water became. The first method adopted was the formation of dams across the creeks, constructing embankments of earth when the creeks were low, and backing up the water, with a bywash on the side. These dams, however, were constantly breaking away with the sudden floods, so common in the interior, and necessitated constant watching and repairing.

The next step was the digging out of deep excavations with sloping sides, usually on the edge of some swamp or water-course, and the surrounding area cut with gutters leading into the excavation. These were known as tanks. Private owners soon found the value of this impounded water, and, in 1869, the Government of New South Wales saw their advantages, and started similar watering places at intervals along the main stock-routes; these were afterwards known as Government Tanks. The sum of £5,000 was voted for the construction of watering places between Booligal and Wilcannia under the supervision of the Roads Department, and these were found to be so valuable that similar excavations were carried out in other places; so that between 1882 and 1883, the sum of £103,000 was expended by the Government. These Government

* "Water-Supply in the Interior of New South Wales," Journ. Proc. Roy. Soc. N. S. Wales, xviii., 1884, p.85.

Tanks were fitted with pumps and watering troughs for travelling stock; and were sublet by the Lands Department to contractors, who took charge, and had a fixed scale of prices for supplying travellers with water.

Water was also sought for by sinking wells, but with few exceptions, in the dry country the supply of water obtained was scanty; and though sufficient for the homestead or passing traveller, made very little difference to the development of the surrounding country. The next great factor in Australian settlement was the discovery of artesian water under a very large area underlying some of the most waterless country in the interior. One of the first suggestions as to the possibility of finding artesian water in this country, was made in a work entitled "Journals of Several Expeditions made in Western Australia, 1829-32, under the sanction of Sir James Stirling," published in London in 1833. In the introduction, the author says: "Now our journalists assure us that they have always found water by digging, sometimes with their bare hands, only to the depth of one foot; if this be true, as there is every reason to suppose it is, the common mode of well-sinking would be tolerably certain of obtaining a supply, and the method of boring so successfully attempted in France and England, called the Artesian Well, might finally be called to the settler's aid with an entire dependence upon its efficacy."

The geologists always hoped to obtain artesian water, and, in 1851, experiments were carried out in putting down bores through the Hawkesbury Sandstone, but the results were nil.

In 1879, Mr. H. C. Russell, Government Astronomer, at a meeting of the Royal Society of New South Wales, stated that the rainwater which fell in the interior of Australia, did not flow down to the sea in the river-drainage, but sank into the soil, and accumulated underground. The actual demonstration of the existence of artesian beds was first recorded by Mr. C. Wilkinson* at Officer's Killarah Station, near the Darling River, where water was struck at a depth of from 134 to 142 feet, and shot up above the tube a distance of 26 feet. In 1901, according to Mr. Pittman, 158 bores

* Proceedings of the Linnean Soc. of New South Wales, vi., 1881, p.155.

were sending out artesian water at an estimated yield of over 77,000,000 gallons per day, the deepest bore being 4,086 feet, with a flow of 745,200 gallons a day.

Artesian water is now found beneath a very large area in Central Queensland; and, in similar country in New South Wales, it is estimated to extend under 83,000 square miles.

Quite recently another area containing artesian supplies, in a different geological formation, has been tapped in Western Australia, so that the artesian basin of the dry lands may extend over a very large area yet to be proved.

By the discovery of these great underground reservoirs, most wonderful changes have been wrought. In country where stock and stockmen struggled, and often perished for want of water, artesian supplies tapped, it may be, 3,000 feet below, shoot up above the top of the bore-pipes in a glittering fountain, spreading round into the neighbouring lagoon a bountiful supply for all.

In 1881, I saw 300 head of fat cattle stampede for want of water, between the Saxby and the Flinders Rivers, and these died along the back track, where now there are several fine bores. In the same district, between Taldora and Cambridge Downs, on the mail route to Normanton, we had a waterless track for 80 miles, during the midsummer months, which is now supplied with artesian water.

The alteration of forest-lands may next claim attention. With the exception of the fringe along the slopes of the eastern coast of Queensland and New South Wales, spreading out in Gippsland and Cape Otway in Victoria, and also the south-west corner of Western Australia, there is little of what we may call true forest in the 2,944,600 square miles comprising Australia. There are, however, large areas of scrub, and open, stunted forest-land, where grass and herbage struggle for existence. Under the various Land Acts which came into force in the different States, certain conditions were generally made, allowing the leaseholders certain vested rights, when they expended money in making permanent improvements. Among these, one form of improvement largely availed of, by the squatters, was known as ringbarking.

Ringbarking is a simple method adopted in this class of country for killing off the timber without the expense of cutting down or digging up the trees. It consists of cutting a scarf through the bark, right round the trunk, with a second one a few inches below, and then tearing off the detached ring of bark between; later on, experience showed that one scarf was just as effective. This caused the gradual death of the trees thus treated; and a greatly increased growth of grass and herbage ensued in consequence. According to Mr. Abbott,* this method was first adopted on the watershed of the Hunter River in 1860; ten years later, it was general in other districts; in 1880, fully three-fourths of all the purchased, and much of the leasehold land on the Hunter had been ringbarked. The landholders soon noticed the wonderful improvement in the quantity and quality of the grass on ringbarked land in comparison with the stock-carrying capabilities of the natural scrub-land; and this rapid and cheap method of improving the pasturage was universal over this class of country in Australia. When first adopted in 1860, many of the squatters declared that the destruction of the forest-trees and scrub would tend to the drying up of all the intersecting creeks and watercourses. After careful observations, extending over ten years, Abbott stated, in the paper previously quoted, that, in the Hunter River district, ringbarking had produced the opposite effect, for while, between 1850-1860, the creeks were seldom running, and were usually quite dry in the summer months, he fonnd, after the death of the timber, that these watercoures became permanent creeks with a constant flow of water. This, he considered, might be due to two causes; first, that the dead roots acted like drain-pipes through the soil into the creeks, or, secondly, that the live roots of the trees had sucked up the greater part of the rainfall prior to the ringbarking.

Time has since shown that, in many places, ringbarking added much more to the fertility of the soil, than grubbing out and burning off the green timber. The slow decay of the roots beneath, and the rotting of the falling leaves, bark, and branches, returned more

* "Ringbarking and its Effects," Journ. Proc. Roy. Soc. N. S. Wales, xiv., 1880, p.97.

to the soil than the ash from the burning of heaps of dry timber. This is frequently demonstrated, in a smaller way, in orchard-lands, results showing that fruit-trees planted in "green land"—that is, directly the living forest has been cleared off—do not thrive as well as those set out in land in which the trees and scrub had been killed and retained, before being taken up for an orchard.

On some of the ringbarked western lands, the owners now find it is often advisable to leave all the smaller bits of wood and bark from the dead trees, upon the surface of the ground, when clearing up; for they act as a mulch, and keep the surface-soil from being cut up and blown away by the action of the summer sun and winds.

The stocking of the country in the western lands and the consequent suppression of bush-fires on the plains and in open country, from the absence of grass, brought about other conditions. One of the most conspicuous of these, was the appearance of millions of small pine-trees, which overran thousands of acres of land on the back-blocks of the Lachlan and other parts of Western New South Wales, land which had previously been open and lightly timbered, or well grassed plains.

This became so noticeable about 1880, that many theories were advanced to explain the cause of this wonderful growth of pine-seedlings. The most general idea was that the wholesale ring-barking, which had been instituted by the squatters for some years, not so much to improve the scrub-lands, as to secure the leaseholds against the free selectors, had brought about this new evil.

There were, however, probably several causes, all working together. First, the stocking of the land with sheep to its fullest capacity, as was the custom about this time, left no dry summer grass, and there were consequently no bush-fires. Next, ring-barking the existing timber opened the soil to light and air, but, in consequence of the value of the timber for fencing and house-building, all the large, mature, cypress pine-trees were left untouched; therefore, the pine seeds dropped on to resting soil, and were scattered far and wide by the wind. Thousands of sheep passing through the dead scrub, and finding shade under the big pine-trees, helped to bury the seeds in the loose soil.

Within a few years, very large tracts of good open grazing land had changed into impenetrable scrub, through which it was hardly possible to ride. The appearance of this "pine-scrub" was one of the reasons that led the New South Wales Government to pass an Act to restrict ringbarking or the cutting of timber under a certain size, without special permission from the authorities. There have been many instances, in other parts of Australia, of the gradual encroachment of trees and scrub upon open grass-land, when the conditions that restricted their advance have been removed.

On the other hand, we have records, by some of our earlier explorers, of dense undergrowth and scrub, in places which now we find only open forest; as on some of the old roads over the slopes of the Blue Mountains. There are many causes, besides bush-fires, that bring about these changes. Wattle and gum-scrub are often destroyed by wood-boring insects. I do not think that the bush-fires have altered the face of our coastal forest-lands, for the recovery and rapid growth of trees after these fires, is characteristic of this country. The development of the rich sugar-lands of the Queensland coast, and the dairying industry in the northern districts of New South Wales, have been responsible for the destruction of most of our eastern forests; but this has been inevitable, for the land was too rich and productive to remain virgin forest. It is only history repeating itself, for the whole of Southern Europe, from Turkey to Southern France, was, in the dawn of history, covered with huge forests, of which, now, not a vestige remains.

There are large areas of rugged broken land in all the States, that are of little value for settlement; and these should be reserved for forest-conservation, and scientific re-afforestation. The forest-reserves in the sand-hill, and box and cypress country, should not be thrown open for selection; at the most, many of them would only support three or four families, if cleared and burnt-off; whereas under a proper supervision, they will produce timber-trees and firewood for centuries, for the surrounding settlers.

Many noxious plants and weeds have been accidentally introduced; some, after a brief course of luxuriance, die out, while others like the briars, Lantana, and prickly-pear, have made good their footing; but this aspect of the question cannot be dealt with here. Increasing land-values and closer settlement will be the chief factors in reclaiming such lands.

The transformation of Australia has been effected by the introduction of the domestic animals of Europe, and the vanguard nearly always consisted of cattle. It was cattle that first went down the passes of the Blue Mountains to the Bathurst plains; and they spread rapidly. Mitchell found many cattle running on the Lachlan, when going south-west on his expedition in 1835; and on his return from crossing Victoria, in the following year, he met many mobs with the overlanders going south, from New South Wales cattle-stations.

Cattle and horses trample down the soil, eat off the rough grass, and improve the land for later occupation by sheep. In many instances, particularly in North Queensland, in the "sixties," sheep men made very heavy losses through disregarding this rule, and hundreds of sheep were killed through the seeds of the spear-grass.

There was no indigenous animal in Australia allied to horned cattle, and all the early importations came direct from England, except a few obtained at the Cape on the way out, so that all our original stock were free from stock-diseases prevalent in other parts of the world; and they throve and increased accordingly.

There were some outbreaks of pleuro, chiefly in the coastal districts; but there was no epidemic until the outbreak of Cattle-tick Fever or Redwater, in the Northern Territory, in 1885. This virulent disease, which frequently destroyed 50 per cent. of the herds, first made its appearance among the working bullocks and travelling stock on the Roper River; while its immediate spread into Queensland was due to the establishment of boiling-down works on the Norman and Albert Rivers, and the consequent influx of tick-infested cattle.

A similar outbreak had occurred in the south-western portion of the United States, in 1868, and the results of the scientific investigations carried out in America, gave our stockowners some data to start upon, and the disease, in Australia, was proved to be identical with, and caused by the same kind of tick. In 1896, a Tick Conference was held by the Queensland and New South Wales Governments, when it was shown that the whole of the northern half of Queensland, taking a line from Longreach to Townsville, was tick-infested; and only a few years later, the cattle-tick reached the northern boundary of New South Wales. The cattle-tick also travelled westward, and soon infested most of the cattle-stations on the north-west of Western Australia.

Until recently, Redwater, or Tick-fever, was supposed to have been introduced from India or Timor with the buffalos; but later investigations show that the buffalos are immune, and that the disease was introduced from the Dutch East Indies with cattle from that region. The buffalos have made their mark in the north, though seldom ranging far beyond the swamps and marsh-land; but some idea of their increase and number is indicated by the fact that 100,000 buffalo hides have been exported from the Northern Territory during the last thirty years.

In spite of periodic droughts since the industry of cattle-breeding has been carried on in Australia, and the frequent losses in consequence, and in spite of the devastating Tick-fever, the growth of our herds has steadily increased. From the last returns available, there are 11,744,714 cattle in Australia and Tasmania, of which 5,131,699 are in Queensland.

The horse has followed the cattle, and without his aid much of Australia would have remained unexplored for many years. The horse thrives in all parts of Australia, under domestication, and in many of the more rugged or timbered districts, horses escape from the paddocks, and running wild, have increased until they became a regular pest on the runs. They were popularly known as "Brumbies," and in many places were hunted and shot for the sake of their hides. On a large station in Riverina, in the early "seventies," over 2,000 wild horses were thus destroyed at a cost of three shillings per head. At the present time, the number of horses in Australia and Tasmania is set down at 2,146,049.

The first sheep landed in Australia came from the Cape of Good Hope with Captain Phillip's fleet, in 1788, and were 19 in number.

In 1795, Macarthur had raised his flock to 1,000. In 1810 only 167 lbs. of wool were among our exports; but the introduction of the merino increased both the quantity and value of the fleece, and, in 1843, the wool industry was well established.

Though some of the coastal country was found unhealthy and fluke-infested, the open forest and ranges, with the great western plains, were found to be ideal country for the development of sheep; and, in about 1841, the supply had increased beyond the demand, and good sheep were selling for eighteen pence a head. Catarrh appeared in many of the flocks, and 70,000 died, in one season. This was followed by the accidental introduction of the Sheep Scab, which spread with alarming rapidity, so that at the time of the opening out of the gold-diggings, all the southern flocks were infected. In New South Wales, between 1848 and 1855, many squatters were ruined, and it was worse again from 1863 to 1867, on account of the arrival of large mobs from Victoria. Active measures thus came into force, and the Government, by constant supervision and regular dipping, finally stamped it out, and the State was proclaimed clean in 1868. South Australia was infected in about 1850-1 by imported sheep from Tasmania or Victoria, but similar legislation stamped it out in 1866-67. Scab never entered Queensland, but was common in West Australian flocks down to 1890. It is said to have come direct from England about 1830, with a small consignment of sheep imported by a company of settlers.

Though immense losses have taken place during the great droughts, and millions of sheep have died, the number of sheep in Australia has regularly increased; so that, at the present time, there are over 92,000,000 sheep in Australia and Tasmania, and the wool-clip in 1910 was worth £14,727,000.

The last of the larger domestic animals introduced into Australia, was the camel. The generally accepted idea that the greater part of inland Australia was a desert, suggested that "the ship of the desert" should be used for transport. As far back as 1837-43, Captain Stokes, in his "Discoveries in Australia," advised that camels should be introduced from India; and he suggested that they could be landed on the north-west coast of Australia at a very reasonable cost. It was not until 1860, however, that the first camels, twenty-four in number, with their native drivers, were imported from Peshawur, India, by the Committee of the Burke and Wills Exploring Expedition. Of these, Burke took sixteen with him in his reckless dash across to the north, of which only one reached Cooper's Creek on the return march. Camels were not used in the construction of the Transcontinental Telegraph Line (1870-2), but Colonel Warburton took seventeen in his expedition across Western Australia in 1873, only two of which reached the Oakover River. About the same date, Messrs. Smith and Elder imported camels for use on their inland stations from Adelaide, and fitted Ernest Giles out with seventeen camels for his second expedition across Western Australia. From this date, camels have been used in considerable numbers for carrying stores and wool, in the northern and western lands of Australia. They were first used in Western Australia by Mills, who brought thirty from South Australia to Northampton to carry on the construction of the telegraph line thence to Carnarvon; and later, in 1886, Mr. McNulty (the present Under-Secretary of Agriculture, W.A.), brought, so he informs me, ten camels to explore the country round Nullarbar Plains and Queen Victoria Springs.

When the Kimberley Goldfields were discovered, camels were imported in large numbers; and, in 1887, one lot of three hundred were landed on the north-west coast, and many of them sold at very low rates. They are, at present, used in considerable numbers in the interior, and the latest statistics give their numbers as 3,000 in South Australia, 1,200 in New South Wales, and   in Western Australia.

Though the introduction of the camel has not done much in altering the natural conditions of the country, it has had a good deal to do with opening up the dry lands of Central Austrtalia, and has thus added to the development of the States.

The introduction of the rabbit (*Lepus cuniculus*) has done more to alter the natural conditions of animal and plant-life in Australia, than the vast herds of cattle and mobs of sheep. The wild rabbit, originally a native of Spain, was introduced into England at a very early date. An Act was passed, in 1605, by Queen Elizabeth, dealing with the unlawful hunting of deer and conies. In the reign of George III., persons stealing rabbits from unenclosed warrens, could be transported for seven years, "or suffer such other lesser punishment by whipping, fine or imprisonment as the Court shall at their discretion award and direct."

We have no accurate account of when the first rabbits reached this country, but the first record of their existence in Australia is to be found in Captain Stokes' "Discoveries in Australia" (Vol. ii., p. 426). Speaking of Corner Inlet, Victoria, he says: "During the examination of this great useless sheet of water, the ship lay near a small islet, close to the promontory, about seven miles from the entrance, which, from the abundance of rabbits, we called Rabbit Island. I have since learnt that these animals multiplied from a single pair, turned loose by a praiseworthy sealer, six years before, and encourages me to expect a similar result from the gift I had bestowed on Kent Group." Thus, though not on the mainland, they were plentiful quite close to Wilson's Promontory seventy years ago. Mr. J. H. Kershaw, who first called my attention to this record, informs me that the descendants of these rabbits are still plentiful, but, through inbreeding, have all become much smaller than those on the mainland, and are almost black in colour.

There were, doubtless, many attempts made to acclimatise the rabbit in Australia. In 1858, a colony was established on the Upper Murray, which, after flourishing for three years, died out. It appears that, in 1860, the rabbit, as a wild free animal, was unknown in Victoria, for, in a Prize Essay on Agriculture, printed at that date, the author (Mr. Storey) advocated the introduction of the wild English variety.

It has been generally asserted that the progenitors of the present plague rabbits were liberated between Geelong and Colac, by a well-known landholder, for sport, sometime between 1864 and 1870; but the exact date will always be a matter of doubt, for no one is anxious to claim the distinction. The President of the Acclimatisation Society of Victoria, at the Annual Meeting in 1890, while noting the spread of the rabbit, "desired to state that the Society was not responsible for the introduction of this terrible rodent-pest."

In South Australia, Mr. Samuel White, between 1854 and 1855, turned out rabbits on his land at Wirrabeen, where they remained without any rapid increase in numbers until about 1868, when they began to spread out, and, by 1870, covered a large area. In 1876, they were recognised in South Australia as a pest, and the Government passed a Bill for their destruction. Under this Act, destruction-camps were formed, and large sums of money expended in trying to exterminate them.

Legislative action was first adopted in Victoria in 1880, when power was granted to the Municipal Authorities to destroy rabbits; but this not meeting the requirements, the Act was repealed, and the Government passed the Vermin Destruction Act.

It is somewhat remarkable that, just about the same year, the rabbits from the Stony Rises, about Colac and Geelong, in Victoria, and also the rabbits in South Australia, began to move on northward. I knew the Murray country, from Euchuca to Swan Hill, Victoria, in 1875, before the vanguard of the advancing army of rabbits had reached our country; but, in 1879, they were swarming through all the sand-hills, flats, and mallee-scrub. In 1879, they were killed near Balranald, though these may have been stragglers from the South Australian invasion. In 1880, the rabbits crossed over at Murray Downs Station into New South Wales, and spread rapidly over the south-west.

The seriousness of the pest was so apparent, that the New South Wales Government passed the "Rabbit, Nuisance Act," in May, 1883. Under this Act, inspectors were appointed, and, later on, a Rabbit Branch was created in the Department of Mines. Under the regulations of the Board, the owners of infested lands were compelled to engage gangs of men to destroy rabbits; and, between the date of the passing of the Bill and the end of 1886, the Government paid out £361,492 in the purchase of rabbit-scalps, and incidental expenses, and recorded the collection of 7,852,787 scalps. At the same time, many landholders had expended large sums to stem the advance of the rabbit, with very little success; for, at this date, not a single Station from the South Australian border, in the west, to the 146th parallel, or forming a line from Brewarrina on the north and Gundagai on the south, was free from rabbits.

After crossing the Murray, the rabbits travelled steadily northward, spreading east and west as they advanced, at the rate of sixty miles per year; and crossed the Queensland border, at a dozen different places, in 1887. Here they met the western rabbits, which had moved on from South Australia towards the Warrego River, and joined forces in Queensland.

In 1888, the New South Wales Government appointed a Rabbit Commission, the members of which met in Sydney, and considered the various projects brought forward to exterminate rabbits by introducing contagious diseases. Dr. Watson, of Adelaide, suggested the importation of Rabbit Scab from Germany. Drs. Ellis and Butcher carried out a number of experiments to destroy the rabbits with an indigenous disease at Tentonalogy, near Wilcannia; and Pasteur offered the microbe of chicken-cholera from Paris. At the conclusion of this conference, the Government offered £25,000 for an approved satisfactory specific to destroy the rabbits. In 1890, the New South Wales Government passed a New Rabbit Act, superseding the Rabbit Nuisance Act of 1883, under which it was estimated that £1,543,000 had been expended in fighting rabbits. This money was first obtained through a direct tax upon all landholders, but the sum collected was so inadequate, that it had to be supplemented by £503,786 from the consolidated revenue. The natural enemies of the rabbit were studied, at home and abroad; wild cats did a little; monitor lizards are specially protected under the Stock Act, on account of their known habit of eating rabbit, but, though they do eat young rabbits, they are deadly enemies to the opossum and other harmless creatures, and are carrion feeders.

Someone imported 120 mongooses, but they, fortunately, died out, and the experiment was not repeated. The fox has even been regarded as a friend, by some of the large landholders, because, while rabbits are plentiful, he leaves the young lambs alone.

All sorts of mechanical methods have been tried—digging out, suffocating by forcing bisulphide of carbon fumes into the burrows, trapping, the burning up of all logs and stumps, and finally wire-netting fences. Under the regulations of the present Act, poisoning has been enforced on all rabbit-infested land, the local Boards having power to summons and fine neglectful landowners.

The erection of wire-netting fences has been encouraged. Queensland, New South Wales, and West Australia have spent large sums in erecting barrier-fences, some hundreds of miles in length, to check the spread of the rabbits. In New South Wales, the State rabbit-proof fences total 1,322 miles, erected at a cost of £69,885; private owners have put up 81,235 miles of wire-fencing, at a cost of £4,611,427; while the Pastures Boards own another 348 miles, which cost £14,459.

The Under-Secretary of the Department of Public Lands, in Queensland, informs me that the range of the rabbit in that State is as follows:—"The Warrego district, the western part of the Maranoa, with the Carnorvan, Gregory North, and Mitchell districts more lightly infested." The estimated length of all the rabbit-proof fences, at the end of 1911, was 19,303 miles, including the Government Border fences of 732 miles; and the expenditure by the Department for that year, in dealing with the rabbits, was £24,699. The total cost of operations since the Boards came into force is, Government expenditure £842,478, and by the District Boards and Run-owners, £893,977, or a total of £1,736,455. This, however, does not include the outlay of the runholders on the destruction of rabbits, which runs into a very large amount of money.

The rabbits entered the eastern boundary of Western Australia from South Australia, and the vanguard of the army reached Eucla in 1898. They are now spread over a large area, from the South Australian border to the Barrier Fence, about 180 miles from the coast, that runs from the Great Australian Bight, and strikes the Indian Ocean about 100 miles north of Condon. Between the Barrier Fence, and what is known as the No. 2 Fence, about eighty miles further west, there are a number of rabbits in places.

In 1896, the pastoralists of New South Wales collected a sum of money for the purpose of bringing out a specialist from the Pasteur Institute of Paris, to experiment on the practicability of inoculating the rabbits with some virulent organism that would spread and destroy them. Dr. Danysz came out, and, under the supervision of the Board of Health, carried out his investigations at Broughton Island; nothing practical, however, eventuated.

Though when years of drought come round, the rabbit plague decreases; yet, as soon as good seasons take their place, the rabbits, if neglected, are as abundant as ever, in spite of the enormous sums expended in trapping, hunting and poisoning, in experiments carried out to infect them with contagious diseases, and in the miles of wire-netting encircling the pastoralists' holdings.

The only thing that will control the rabbit, is closer settlement, subdivision of paddocks, and wire-netting. Of course, some new factor may spring up, and the balance of nature be restored. There has been a marked difference in the native flora since the introduction of rabbits, for they have not only eaten out the grass by the roots in many places, but all kinds of herbage, plants, shrubs, and seedlings have been eaten down or barked, even to the smaller scrub-gums, until the land has become "rabbit-sick"; and even with good seasons, it will be years before many of these plants will reappear.

In several of the methods used in fighting the rabbits, the native animals and birds have suffered as severely as the plants. The universal distribution of phosphorus and pollard by means of the poison-cart, claimed to be one of the most effective methods of destroying rabbits, has killed off an enormous number of the most useful insectivorous birds, so that the magpie, laughing jackass, stone plover, and other birds have almost disappeared where the poison-cart is regularly employed. In some of the western land, where poisoned water is used, often in a very careless manner, all conspicuous living things die out with the rabbit.

Besides the destruction of the flora and fauna, there is another very important aspect of the rabbit-question, that cannot be overlooked. The effect that the constant killing of rabbits, often in a very brutal manner, has upon the minds of the people engaged in rabbit-trapping, is to be deplored. The callous way in which boys and girls treat maimed rabbits, has been frequently noted. The School Inspector of the Yass district recently reported that 20 per cent. of the children in the smaller schools were engaged in trapping. When rabbiting is seriously undertaken, it occupies a great part of the time of the children when out of school, and seriously encroaches on their hours of sleep, as they work at the traps till late at night. Opinions differe among the teachers as to its effect, but there is a general consensus of opinion that it induces not only physical, but also mental and moral deterioration. In the Mudgee district, over two hundred children are engaged in rabbiting, from four to six months in the year.

On the other hand, it is claimed that the rabbit has created an important industry, employing a great many people at good wages, collecting and distributing a valuable food-supply. The pecuniary value of the rabbit-industry is certainly important. Frozen rabbits and hares exported from New South Wales last year (1912) were valued at £252,053, and exported skins at £318,930, while the estimated value of by-products totalled another £57,000. The total for the Commonwealth, for frozen rabbits and skins, reached £1,053,331.

In spite of this large sum returned from rabbit-trapping, it is not a true source of wealth, but a parasitic growth upon our most important wealth, the sheep and wool; and Australia would be much richer without it. The rabbit has, and still is, destroying annually millions of pounds' worth of our best assets. On one station alone, in a single season, a bonus of sixpence per scalp was paid on 500,000 rabbits, in one season. In New Zealand, in 1886, it was estimated that the rabbits were eating the grass of from five to six millions sheep, and costing, per annum, at least £1,500,000.

The hare (*Lepus europaeus*) is so closely related to the rabbit, that it is hardly necessary to deal with it in detail. It was introduced into Australia in the same manner as the rabbit; but, though thoroughly established over the greater part of the settled districts of the southern and eastern States, with a few exceptions, it has done no very serious damage. Its chief depredations have been in orchards, where it delights to gnaw the bark of fruit-trees, and in cultivation-paddocks. It is somewhat remarkable that, when the rabbits come into a district, the hares move out.

The fox (*Canis vulpes*) was introduced into Australia, it is said, about 1868, by some of the members of a Hunt Club, for the purpose of indulging in the noble sport of fox-hunting. They were turned out in Southern Victoria, about the district of Geelong or Colac; but as no one, now, wishes to claim the honour of the introduction of the fox into Australia, it is very difficult to get any accurate records on the subject. Like the rabbit, it was some years before the fox became acclimatised, and established itself under the new conditions of life; for it was nearly twenty years later, that foxes were first noticed on the southern border of New South Wales. At first, they made their way northward through Gippsland, keeping to the forest and scrub-lands of the eastern coast; but within the last ten years, they have spread all through Riverina out into the scrub-lands of the western plains, and are now generally distributed all over the State. It is evidently only a matter of time, when the fox will be found all over Australia. Last year, the Armidale Pastures Protection Board paid for the scalps of 367 adult and 117 cub foxes, while the combined bonus of all the Protection Boards in New South Wales amounted to £3,561 for the scalps of 26,278 foxes.

A very large portion of Australia is admirably adapted for the home of the fox, and it is very easy for them to make their "earths," or to enlarge rabbit-burrows in the scrub and sandhills, where the natural food of the fox (the rabbit) is plentiful. That the fox has not become such a serious pest to the sheep-breeders as was at first expected, is due to the abundance of rabbits; what they will do when the rabbits are reduced down to normal, it is hard to say; and though, in England, they are almost omnivorous, feeding upon rats, beetles, and even snails and worms in hard times, here, in the great open spaces, lambs in paddocks will be much more palatable food.

Though many of the squatters have rather tolerated the fox, or, at least, have not taken active measures against it, on account of its rabbit-hunting habits, it has not been the case with the farmers who breed poultry. In fact, the advent of the fox into the southern districts, has been a very serious blow to poultry- and turkey-breeding in particular. All poultry had to be shut up at night in wired-in yards; and, in many places, this profitable branch of farming has been abandoned, simply on account of the trouble with foxes.

Another change that the fox is bringing about is the destruction of the larger ground-nesting birds, such as the lyre-bird and scrub-turkey, in the coastal brushes; and, in the west, the mallee hen, pigeons, and wild ducks will all share the same fate.

Of course, there is very often an unseen enemy that appears and evens up things, and with the foxes frequenting the coastal scrubs north of Sydney, this appears to have come in the shape of the common bush- or dog-tick. An observant friend informs me that, this last year, on his land at Narrabeen, he has found several dead foxes in the scrub, showing signs of tick-infestation.

In this necessarily brief summary, I have tried to show some of the new conditions that have come about during a century of civilisation; and that, in spite of mistakes due to the want of knowledge of the life of this new land, we have steadily gone ahead, as an agricultural and pastoral community. Australia is a land capable of growing rich crops of cereals, lucerne, and other fodder-plants, under scientific cultivation. The latent fertility of our driest lands has been shown, where water can be applied; with a close study of the climatic conditions, the composition of the soil, and the selection of the most suitable hardy varieties of wheat and other cereals, our farmers are reaping the reward of their intelligence and industry. We are rapidly developing a nation of farmers, who will be able to hold their own in the markets of the world. The improvement in the character of our live stock has been also going on; our stockowners have imported the very best stud-cattle obtainable, while the Government has helped the smaller herds of the dairy farmers with their stud-cattle farms.

Above all, Australia is a land capable of carrying great flocks of sheep, with a climate exactly suited to the fine-woolled sheep of the merino type; and our stock-owners comprise a large number of men who have spared no expense, or attention, in the production of the finest fleeces, both in quality and quantity, our wool is improving every year, and is competed for by the manufacturers of the world.

The old antagonism between the woolgrowers and the wheat-growers dates from the time when the free selectors cut up the sheep runs; but now we see the squatters finding that they can grow wheat profitably, and the farmer has his sheep in conjunction with his crops.

The sheep will not decrease in Australia, as some writers suggest, but will increase as rapidly under the new conditions as the wheat, though they will be divided up into smaller flocks. In Great Britain, so small in area, compared with Australia, there were in 1911, 26,,494,992 sheep, most of which are made up of flocks of a few hundred in number.

The civilisation of the empty spaces of the interior will go on as it has in the past nearer the coast, slowly but surely, until the flocks and herds meet from the east and west.

Mr. J. H. Campbell, Hon. Treasurer, presented the balance sheet for the year 1912, duly signed by the Auditor, Mr. F. H. Rayment, F.C.P.A., Incorporated Accountant; and he moved that it be received and adopted, which was carried unanimously. *Abstract:* General Account, Balance from 1911, £139 3s. 1d.; income, £1,044 5s. 0d.; expenditure, £956 18s. 9d.; transfer to Bookbinding account, £18 18s. 0d.; balance to 1913, £207 11s. 4d. Bacteriology Account, Balance from 1911, £71 1s. 3d.; income, £483 10s. 3d.; expenditure, £489 5s. 9d.; transfer to Capital account, £26; balance to 1913, £39 5s. 9d. Linnean Macleay Fellowships Account, Income, £1,562 4s. 5d.; expenditure, £1,001 15s. 0d.; transfer to Capital account, £560 9s. 5d.

The Scrutineers having handed in their report, the President declared the following elections for the Current Session to have been duly made :—

President : Mr. W. S. Dun.

Members of Council (to fill seven vacancies) : Messrs. R. H. Cambage, F.L.S., J. H. Campbell, J. E. Carne, F.G.S., H. G. Chapman, M.D., B.S., J. B. Cleland, M.D., Ch.M., T. Storie-Dixson, M.B., Ch.M., and Alex. G. Hamilton.

Auditor : Mr. F. H. Rayment, F.C.P.A.

On the motion of Mr. Maiden, seconded by Mr. Cambage, a very cordial vote of thanks was accorded, by acclamation, to the retiring President.

The Linnean Society of New South Wales.

GENERAL ACCOUNT.

Balance Sheet at 31st December, 1912.

Liabilities.

	£	s	d
Capital: Amount received from Sir William Macleay during his lifetime	14,000	0	0
Further Sum bequeathed by his Will, £6,000, less Probate Duty, £300	5,700	0	0
	£19,700	0	0
Bookbinding A/c	57	15	0
Income A/c, at 31st December, 1912	207	11	4
	£19,965	6	4

Assets.

	£	s	d
Society's Freehold	1,600	0	0
Investments: Loans on Mortgage...	17,600	0	0
Commercial Banking Co. of Sydney Ltd. (Current A/c)	765	6	4
	£19,965	6	4

Audited and found correct. Securities produced.

F. H. Rayment, F.C.P.A., Auditor.

Sydney, 14th February, 1913.

J. H. Campbell, Hon. Treasurer.

INCOME ACCOUNT, year ended 31st December, 1912.

Dr.

	£	s	d	£	s	d
To Salaries and Wages... ..				452	0	0
,, Printing (Publications)	281	5	10			
,, Illustrations...	124	18	10			
				406	3	10
,, Rates	20	1	11			
,, Insurance...	7	13	8			
				27	15	7
,, Postage, Telegrams, Advertising and Petties...	35	15	9			
,, Printing (sundries), Stationery, etc....	8	4	0			
,, Maintenance Fee, Sir Wm. Macleay's Grave	1	10	0			
,, Audit Fee (proportion of)	1	15	0			
,, Telephone...	2	4	7			
,, Repairs	16	6	6			
,, Bank Charges	0	19	6			
				66	15	4
,, Legal Expenses...				4	4	0
,, Bookbinding A/c				18	18	0
,, Balance to 1913				207	11	4
				£1,183	8	1

Cr.

	£	s	d	£	s	d
By Balance from 1911				139	3	1
,, Subscriptions—						
1912...	137	11	0			
Arrears	12	12	0			
In advance	2	2	0			
				152	5	0
,, Entrance Fees				18	18	0
,, Interest on Investments				741	9	2
,, Sales (including 100 copies of Proceedings purchased by Government)...				115	12	10
,, Rent (Bacteriology A/c)				16	0	0
				£1,183	8	1

Audited and found correct. Securities produced.

F. H. Rayment, F.C.P.A., Auditor.

J. H. Campbell, Hon. Treasurer.

Sydney, 14th February, 1913.

BACTERIOLOGY ACCOUNT

Balance Sheet at 31st December, 1912.

Liabilities.	£	s	d
Capital: Amount bequeathed by Sir William Macleay, £12,000, less Probate Duty, £600	11,400	0	0
Accumulated Interest ordered by Council to be added to Capital	1,600	0	0
Interest invested—			
To 31st December, 1911	874	0	0
At 31st December, 1912	26	0	0
	13,900	0	0
Income Account at 31st Dec., 1912...	39	5	9
	£13,939	5	9

Assets.	£	s	d	£	s	d
Investments:						
New South Wales Inscribed $3\frac{3}{4}$% Stock				13,900	0	0
Cash, Government Savings Bank				39	5	9
				£13,939	5	9

INCOME ACCOUNT, year ended 31st December, 1912

Dr.

	£	s	d	£	s	d
To Salary and Wages... ...	426	3	4			
,, Rent	16	0	0			
,, Rates	6	14	0			
,, Insurance...	1	5	4			
,, Gas...	5	12	7			
,, Apparatus & Chemicals	3	13	8			
,, Telephone...	2	4	10			
,, Audit Fee (proportion of)	1	15	0			
,, Pettty Cash	24	8	6			
,, Journals and Printing	0	19	0			
,, Bank Expenses...	0	9	6			
				489	5	9
,, Accumulated Interest Invested				26	0	0
,, Balance to 1913...				39	5	9
				£554	11	6

Cr.

	£	s	d	£	s	d
By Balance from 1911... ...				71	1	3
,, Interest on Investments				476	16	11
,, Tuition Fees...	20	0	0			
,, Less Bacteriologist's proportion	13	6	8			
				6	13	4
				£554	11	6

Audited and found correct. Securities produced.

Sydney, 14th February, 1913. F. H. Rayment, F.C.P.A., Auditor. J. H. Campbell, Hon. Treasurer.

LINNEAN MACLEAY FELLOWSHIPS' ACCOUNT.

Balance Sheet at 31st December, 1912.

Liabilities.				£	s	d
Capital: Amount bequeathed by Sir William Macleay, £35,000, less Probate Duty, £1,750				33,250	0	0
Balance of Income Account capitalised in terms of bequest or available for such purpose—						
To 31st Des., 1911	6,808	13	0			
At 31st Dec., 1912	560	9	5			
				7,369	2	5
				£40,619	2	5

Assets.	£	s	d	£	s	d
Investments: Loan on Mortgage	29,192	4	9			
New South Wales Inscribed $3\frac{3}{4}\%$ Stock...	7,715	0	0			
Commercial Bkg. Co., Fixed Deposit ...	1,500	0	0			
				38,407	4	9
Cash: Commercial Banking Co. ...				2,040	0	3
Savings Bank of N.S.W. ...				171	17	5
				£40,619	2	5

INCOME ACCOUNT, year ended 31st December, 1912.

Dr.	£	s	d
To Salaries of Linnean Macleay Fellows	1,000	0	0
,, Audit Fee (proportion of)...	1	15	0
,, Amount transferred to Capital A/c	560	9	5
	£1,562	4	5

Cr.	£	s	d
By Interest on Investments	1,562	4	5
	£1,562	4	5

Audited and found correct. Securities produced.

F. H. Rayment, F.C.P.A., Auditor.

J. H. Campbell, Hon. Treasurer.

Sydney, 14*th February*, 1913.

ORDINARY MONTHLY MEETING.

March 26th, 1913.

Mr. W. S. Dun, President, in the Chair.

The Donations and Exchanges received since the previous Monthly Meeting (27th November, 1912), amounting to 28 Vols., 274 Parts or Nos., 63 Bulletins, 14 Reports, and 18 Pamphlets, received from 101 Societies and 2 Individuals, were laid upon the table.

NOTES AND EXHIBITS.

Miss S. Hynes showed fruits of *Hernandia bivalvis* Benth., from Queensland, and a coloured illustration of the fresh fruits; and another instalment of illustrations of native plants, from coloured drawings by Mrs. Rowan, prepared for teaching purposes.

Mr. E. I. Bickford exhibited a flowering branch of *Eucalyptus macrocarpa* Hook., remarkable for its very large crimson flowers, and large fruits; from York, W.A.

Mr. Tillyard reported that the two-year old seedling of *Nuytsia floribunda*, the Western Australian Christmas Tree, of which he had exhibited a photograph a year ago, had been destroyed by a bush fire in January last.

NOTES ON AUSTRALIAN MARINE ALGÆ, i.

By A. H. S. Lucas, M.A., B.Sc.

(Plates i.-v.)

FUCOIDEÆ.

Turbinaria Lamour.

T. ornata J.Ag.—Mr. C. Hedley collected several specimens of *Turbinaria* on Murray Island, Torres St., which agree with *T. ornata* except that the receptacles are all distinctly racemose and not at all cymose. The largest measured 20 cm. in length, the peltate laminæ were in general 17 mm. in diameter, including the teeth of the margin. A second crown of teeth was present on a few of the laminæ. The "leaves" were hollowed out into vesicles. Stolons were borne abundantly on the lower stipes, but I could not find any buds upon them. The species is widely distributed over the Pacific and Indian Oceans, and throughout the Malay Archipelago. On the Queensland coast it has been gathered as far south as Port Denison. Mr. Hedley's form may be distinguished as forma *racemosa*.

Some years ago I picked up a fragment of a *Turbinaria*, probably of this species, which had been carried south with the pumice of the northern island volcanoes, and thrown up on the beach at Bronte, near Bondi.

The branching Turbinarias found on our north coasts are *T. conoides* Kuetz., and *T. decurrens* Bory. A third slender branching form, *T. gracilis* Sond., from West Australia, was figured by Harvey (Phyc. Austr., Pl.131).

Of the simple forms, *T. trialata* Kuetz., recorded from W. Australia by Labillardière, was figured by Kuetzing (Tab. Phyc. x., t.69). It is not listed as Australian by Sonder, who was, however, acquainted with it from San Domingo in the West Indies. *T. ornata* was already figured by Turner.

A. and E. S. Gepp have figured *T. murrayana* of the latter, from specimens collected in the Seychelles by J. Starkie Gardiner during the "Sealark" Expedition to the Indian Ocean (Trans. Linn. Soc. Lond., Vol. xii., Pt.4, 1909). This form has been recorded from Macassar and from New Guinea, and may well be found in the future on the islands of Torres St. and perhaps on our tropical coasts. In *T. murrayana* there are no vesicles, the leaves being solid. May not the simple unbranched form with solid leaves be a reef-growing stage of *T. decurrens?* One is so familiar with non-development of vesicles until they are functionally needed in other Sargassaceæ, notably *Sargassum* and *Cystophora*, that one may expect to find evesiculose individuals in the case of normally vesiculose species of *Turbinaria*. In fact, there is a similar variety, *evesiculosa* Bart., of *T. conoides*. Both vesicled and unvesicled forms of this species grew in the Seychelles on reefs exposed at dead low tide, but in different localities.

Cystophyllum J.Ag.

C. muricatum (Turn.) J.Ag., has a wide range, from the Tropics to Tasmania. It is recorded from the Sunda Islands and Australia(Freycinet, Preiss, Gaudichaud), and the Admiralty Islands(Dickie). Harvey says it is found throughout the Indian Ocean. It probably occurs all round the Australian coasts. Thus Harvey gives the range "from King George's Sound to Port Jackson, in various places." Victorian records are Port Phillip(F. v. Mueller), Geelong(Lucas), Port Phillip Heads and Western Port (J. B. Wilson). Sonder gives Georgetown, Tasmania. In New South Wales I have found it in Botany Bay and Port Stephens. Mr. D. Stead sent me specimens from Wallis Lake, where it is regarded as a nuisance on the oyster-banks; and Sonder gives Clarence River. Queensland localities are Moreton Bay(Lucas), Port Denison, Rockingham Bay, Cooktown, and Whitsunday Island(Sonder). This is a remarkably extended distribution for a brown alga whose habitat is sheltered harbours.

Figured, Turner (Hist. Fuc. ii., Pl.112), Harvey (Phyc. Austr., Pl.139). The fruiting receptacles are very similar to those of *Sargassum*, and are produced in the summer about Sydney.

De Toni includes *Sirophysalis binodis* Kuetz.,(Tab. Phyc. x., t.59, f.2) as *C. muricatum* var. *binodis*(Kuetz.). The description is: " Fronds muricate; aculei rather lax, thickened at the apex, bi- or tri-dentate, divaricate; vesicles in pairs, rarely threes, lanceolate. Australia(Kuetzing)." I have not seen the type of this variety, but individuals of our species seem to answer well enough to this description.

C. onustum(Mert.) J.Ag., Holdfast Bay, W.A (F. v. Mueller), and Mus. Paris, and *C. australe* Sonder, Holdfast Bay (F. v. Mueller) are nearly allied forms to *C. muricatum.* De Toni does not list the latter, which is recognised by Harvey in his Syn. Cat. I have not seen either.

Hormosira Endl.

H.(?) *articulata*(Forsk.) Zan.—I had the good fortune to discover this singular species, with its remarkable triquetrous stem with interrupted alternate wing-expansions, growing on a rocky shelf around a small island in the upper reaches of Port Stephens. It was growing in company with *Cystophyllum muricatum*, and could be gathered while wading at low tide.

To make sure of my identification of this species, which is known as a Red Sea species, possibly occurring also in the China Sea, I submitted a specimen to Mrs. E. S. Gepp, who kindly compared it with the specimens of *H. articulata* in the British Herbaria. She confirms the identification.

Judging from the distribution so far known, we may expect to find this plant further north. Like *C. muricatum*, it appears to affect the quieter waters of sheltered harbours.

Notheia Bail. & Harv.

N. anomala Bail. & Harv.—This interesting parasite is only listed by De Toni from New Zealand and Tasmania. Harvey, however, recorded it from the south coast of Victoria at Port Fairy and Port Phillip Heads. I found it growing abundantly at Barwon Heads, and J. Bracebridge Wilson at Western Port. I have since traced it along the coast of New South Wales from Twofold Bay to Port Stephens. It is evidently, then, widely distributed around the shores of the south-east Australasian seas. Personally I have only found it growing on the varieties of *Hormosira banksii.*

HALISERIS Targioni-Tazzetti.

Frond laminar, membranaceous,* dichotomous, midribbed, segments broadly linear, formed of two layers of cells, interior cells rather angular, those constituting the midrib non-approximated, cortical cells subcubical, monostromatic, densely packed with endochrome. Spores scattered on both surfaces of the frond. Tetraspores collected in naked sori, sublinear or in patches, evolved on both surfaces of the frond. Paranemata separate from the sporiferous sori, in small clumps, articulate, club-shaped. Antheridia clustered in sori.

None of the Australian species show marginal veins.

i., Fronds membranaceous, with no veins from the midrib.

H. polypodioides(Desfont.) Ag. A form of wide distribution, Europe, Atlantic, S. Africa, Red Sea, Persian Gulf, Japan.—"Tasmania(Harvey)" De Toni.

H. woodwardia(R.Br.) J.Ag. = *H. polypodioides* var. *denticulata* Sonder.—Has the habit of *H. polypodioides*, but the margins of the fronds are beset with numerous denticles.

Cape York(Daemel), Rockingham Bay(Dallachi), Ballina(Henderson).—Sarawak(Zanardini), China Sea(Kuetz).—Figured by Kuetzing(Tab. Phyc. ix., t.53).

H. muelleri Sonder, Linnæa(Vol.25; Fig., Harvey, Phyc. Austr., Pl.180).—Sori of tetraspores in oblong cloud-like patches, confluent over the greater part of the frond from the midrib to the margins. Axils rounded, margins entire. Fronds to 50 mm. wide. Proximal part of frond gradually denuded. Tufts of paranemata scattered equally over the whole frond, alternately on one face and on the other.

West and south coasts of Australia (Sonder, Harvey), Anglesea, Barwon Heads, Port Phillip (Lucas), Port Phillip Heads and Western Port (J. Br. Wilson), Cape Schank(Mrs. Barker).—Tasmania(W. H. Archer).

* Coriaceous in the Brazilian *H. areschougii* J.Ag.

Both Harvey and Sonder included the following under *H. muelleri*.

H. acrostichoides J.Ag., Till. Algernes System, v.—Sori of tetraspores on each side of midrib in an elongated linear patch, recalling arrangement of sori in *Blechnum*, leaving wide sterile margins. Axils rather acute, margins entire. Fronds to 12 mm. in width, lanceolate. Proximal part of frond terete. Tufts of paranemata larger than in *H. muelleri*, and more conspicuously arranged in arcuate, subparallel rows, curving back from the midrib to the margins, those of alternate lines on opposite faces of the frond, not as De Toni writes, "per laminam sine evidenti ordine sparsa." Radix a stupose mass, reaching up to several ounces in weight.

Tasmania (R. Gunn), Port Fairy (Harvey), Port Phillip Hds., and Western Port (J. Br. Wilson), Port Jackson and Port Stephens (Lucas), Moreton Bay (G. Gross).

Probably Sonder's record of *H. muelleri* for Cooktown properly belongs to this species.

H. pardalis Harv., Trans. Roy. Irish Acad., xx. Fig., Harvey, Phyc. Austr., Pl. 29.—Sori of tetraspores forming deflexed lines proceeding from the midrib to the margins. Tetraspores oval, with wide colourless perispores. Axils widely angular, segments very patent, margins entire, segments to 15 mm. (Harvey's fig.), proximal portion of stem becoming more or less denuded of lamina. Paranemata not seen.

"Cast ashore from deep water," Fremantle, W.A. (Harvey, Clifton).

H. crassinervia Zanard.; Phyc. Austr. nov. sub n.5.—Sori not seen. Axils rather acute, segments distant, widely linear, obtuse, margins entire. Paranemata not seen. Stout conspicuous midrib blackening on drying; rest of frond firm, turning dark brown on drying.

Lord Howe I. (Fullagar, Lind). Needs elucidation.

ii., Fronds membranaceous, with veins running from midrib to margins.

H. australis Sond., Alg. Mueller., Linnæa xxv. Fig., Kuetz., Tab. Phyc. ix., t.54.—Sori not seen. Axils rather acute, margins entire, segments broad linear, obtuse, to 25 mm. wide. Numerous very fine veins running out from the midrib obliquely toward the margins, easily detected by the naked eye. Paranemata not seen.

Lefebre Peninsula(Sonder), "Port Denison &c. Australiæ" (Kilner, F. v. Mueller). Needs elucidation.

H. plagiogramma Mont., Cent. i. Fig., Kuetz., Tab. Phyc. ix., t.57.—Sori forming a subcontinuous spot along each side of the midrib. Axils rather acute, margins entire. Numerous fine veins running out from the midrib obliquely to the margins, about 1 mm. apart. Paranemata not recorded. Frond small, scarcely 12-14 cm. long.

Atlantic, Sandwich Islands.—Australia(Zanardini).

Spermatochnus Kuetz.

(Plate i.)

S. lejolisii(Thur.) De Toni.—This graceful and delicate alga was a sore puzzle, as it seems to be without fruit, and no fucoid of our Australian list seemed to even approach it. I accordingly forwarded a specimen to Mrs. E. S. Gepp of the British Museum, who has most kindly helped me out of other difficulties. She wrote "A new record for Australia! Dr. Kuckuck, the authority on this group, is now working here, and he named it, so there is no doubt about it. He is making a new genus on *S. lejolisii*, and has studied the European specimens of it."

Shores of France(Le Jolis) and England(Holmes). I found it growing on fronds of a *Dictyota*, on a shelf of rock made accessible at low water, on an island in the inner harbour of Port Stephens.

Myriocladia J.Ag.

M. sciurus Harv.—Mr. L. Rodway sent me this alga, gathered by him at Retreat, on the Derwent River, Tasmania. It had previously only been found in Victoria (Port Fairy), and New South Wales (Newcastle). Harvey did not secure fruiting specimens. The Tasmanian specimens were in full fruit, the sporangia being characteristic of the genus as defined by J. Agardh.

Ulva lactuca L.—Our common Ulva, which I take to be *U. lactuca*, is, when only 2 mm. wide, a flat or gently waved membrane. I have never seen any appearance of a tube or horn. Very old individuals develop, in the basal part of the frond, an anterior layer which gives to it a much greater thickness and solidity. I append drawings of sections of this basal dark green portion, which, if seen alone and reaching some inches in dimensions, has the appearance of a totally different plant(Plate v.).

The following seem to be new species.

NITOPHYLLUM SINUOSUM, sp.n.

(Plates ii.-iii.)

Fronde breviter stipata, tenue membranacea, avenia, circumscriptione ovali, densissime circumcirca lobata et undulata: stipite cuneato ad 6 vel 7 mm. longo, mox evanescente; margine integerrimo in breves sublineares lobos egrediente, apicibus loborum obtusis fere rectilinearibus: cystocarpiis rotundatis 1 mm. diametro metientibus, numerosis in media regione frondis, angusta pallidiori zona concentrice cinctis; soris oblongis, axi majore in marginem frondis verso, 2 mm. longo, per totam superficiem frondis superioris, zona satis lata prope marginem excepta, sparsis. Magnitudo frondis maxime variabilis, usque ad 35 cm. × 20 cm. Laciniæ rarius visæ. Color pulchre roseus.

A handsome species belonging to the same Group as the Atlantic *N. punctatum*(Stackh.) Grev., and *N. crispatum*(Kuetz.) J.Ag., which appears to be its representative on both sides of Bass Straits. It differs from both in the general outline, being broad rather than long, and the lobes being short and square-edged. It is of a rich carmine when fullest coloured. This colour changes to orange after a few hours' standing in seawater, but returns on drying. The substance is thin and membranaceous, and the fronds adhere most closely to paper.

I have found it only in Botany Bay, where it grows in a few fathoms on the leaves of *Zostera* and *Cymodocea*. It may be obtained in fruit of both kinds, on different individuals, in any month of the year. The oblong sori of tetrasporangia radiate outwards towards the edge of the frond.

POLYSIPHONIA COMPACTA, sp.n.

Caespite densissimo, pulvinato; filis tenuibus, omnino articulatis et ecorticatis; primariis decumbentibus vel repentibus implicatis, largiter radicantibus; secundariis adscendentibus a basi erectiusculis, parcius dichotomis vage ramulosis; ramulis sparsis angustis axillis erectiusculis; articulis plerumque 9 siphoniis, filorum primariorum diametro sesquilongioribus, secundariorum aequalibus, ramulorum ultimorum gradatim brevioribus; apicibus simplicibus vel saepe furcatis fibrillis coronatis: tetrasporangiis in medio ramulo immersis seriatis, apparenter e singulo siphone transformatis: cystocarpiis nondum visis. Colore obscure rubro vel brunneo purpureo; substantia mollissima.

Grows in cushion or moss-like patches which cover and follow the inequalities of the rock. Variable in outline, irregularly oval; the patches may attain a longest diameter of 80 mm. or more, and may become confluent. The lower layer forms a firm imbricate reticulum; the upper, rising to a height of 10-15 mm., consists of free ramuli, very soft to the touch

The primary filaments, somewhat stouter than the secondary, creep over the rock surface, and are attached to it by numerous simple or forked colourless rhizoids. These do not arise from every joint, but as many as five may spring from one articulus. Each rhizoid, or division of a rhizoid, terminates in an expanded adhesive disc. The rhizoids were generally about twice as long as the joint to which they were attached, and their diameter was about $\frac{1}{4}$ or $\frac{1}{5}$ of that of the joint.

The tetrasporangia not moniliform, but extending in a series of to nine or more in the middle of the ramulus. Fertile ramulus not infrequently branched, sometimes bearing an immature fertile ramellus. No cystocarps or antheridia as yet observed.

A narrow colourless zone, at each articulation, separated the siphons of adjacent joints. Siphons nearly constantly nine.

Hab. Rock pools left by falling tide; Farm Cove, Port Jackson. Associated with *Ceramium clavatum.*

New records for New South Wales.

Chondria curdieana Harv., MS. —I have gathered this at Wollongong, Botany Bay, and Port Stephens. Herr J. Kretschman recently forwarded handsome specimens to the National Herbarium from Port Hacking. Some of these attained to a length of 24 cm., with an equal spread of branches. The species is of a beautiful iridescent blue while growing in the water, in this particular resembling its near ally, *C. caerulescens*(Crouan) Falk., of the Atlantic and Mediterranean. It was sent to Harvey from Victoria.

Bryopsis baculifera J.Ag.—Miss M. Flockton found this elegant *Bryopsis* growing in a hemispherical mass on the muddy bottom of the Parramatta River at Ryde. The bright green filaments are so dense that the mass appears almost black in the water. Radius of mass about 2½ inches. The branching is most characteristic, the ramuli coming off in general alternately, at rather long intervals, except at the tips of the branches, constricted at the base, very obtuse and very long. It was found by J. Bracebridge Wilson in Port Phillip, probably on the flats about Mud Island.

We take the opportunity of reproducing photographically (Plate iv.) a well-grown specimen of *Sonderia bennettiana*(Harv.) F.v.M. The specimen was among the Algæ left by Mr. Charles Moore in the offices of the Botanical Gardens. There is no record of it, but it was probably dredged in Port Jackson by Dr. E. P. Ramsay. I have never obtained it either cast up or by dredging.

New records for Tasmania.

Mr. L. Rodway, Government Botanist, in May, 1912, forwarded to me, for identification, a very fine collection, made by him, of Tasmanian Algæ. I have so far identified 173 species. The collection contains a number of forms of great interest. Mr. Rodway's specimens are from the Derwent and Huon Rivers, the D'Entrecasteaux Channel, Southport, and Eaglehawk Neck, and a few from other localities. The Channel especially furnishes rarer species.

The following, so far as I know, have not been hitherto recorded from Tasmania.

FUCOIDEÆ.

Sargassum linearifolium(Turn.) Ag. Ralph's Bay.
S. paradoxum(R.Br.) Harv. Derwent, Channel.
Cystophora siliquosa J.Ag. Derwent.
C. torulosa(R.Br.) J.Ag. Devenport, Derwent, Southport.
Gymnosorus variegatus J.Ag. Channel.
Cutleria multifida(Sm.) Gmel.
Myriocladia sciurus Harv. Derwent.
Elachista australis J.Ag. Derwent.
Colpomenia sinuosa(Roth.) Derb. & Solan. Derwent.
Asperococcus compressus Griff. Derwent, Eaglehawk Neck.
Cladostephus verticillatus(Lightf.) Ag. Southport.

FLORIDEÆ.

Bangia atropurpurea(Roth.) Ag. Derwent, Blackman's Bay.
var. *roseo-purpurea* Kuetz. Derwent.
Chantransia sp. Huon.
Pterocladia lucida(R.Br.) J.Ag.
P. capillacea(Gmel.) Born. & Thur. Thouin Bay.
Erythroclonium muelleri Sond. Near Actæon I.; dredged in 20 fathoms.
Rhabdonia robusta(Grev.) J.Ag. Ralph's Bay.
Hypoglossum heterocystideum J.Ag. Channel.
Phitymorpha imbricata J.Ag. Derwent.
Laurencia botryoides(Turn.) Gaill. Derwent.
Chondria succulenta(J.Ag.) Falk. Channel.
Polysiphonia cæspitula Sond. Eaglehawk Neck.
Ceramium clavulatum Ag. Eaglehawk Neck.
Grateloupia filicina Ag., var. *luxurians* A. & E. S. Gepp. Derwent.
Amphiroa(Metagoniolithon) granifera Harv. Devonport.

CHLOROPHYCEÆ.

Enteromorpha prolifera(Muell.) J.Ag. Derwent.

Chætophora elegans(Roth.) Ag. In fresh-water stream, Proctor's Road.

Chaetomorpha aërea(Dillw.) Kuetz. Derwent, Thouin Bay.

Cladophora pellucida(Huds.) Kuetz. Derwent.

C. flaccida Kuetz. Derwent.

C. confervoides(Roth.) Le Jolis. Channel.

Rhizoclonium tortuosum Kuetz. Derwent.

Bryopsis hypnoides Lamour. Eaglehawk Neck.

Caulerpa cactoides(Turn.) Ag. Near Actæon I., in 20 fathoms.

Codium bursa(L.) Ag.

C. galeatum J.Ag. Derwent.

Probably many other Victorian seaweeds will also be found on the other side of Bass Straits.

Good fruiting examples. of *Polysiphonia macrarthra* Zan., were sent. Cystocarps numerous, lateral on median branches, sphærico-urceolate, on short stout pedicels consisting of one zone(articulus) of siphons. Cystocarps 2-3 times as long as pedicel, with a diameter shorter than that of the ramulus to which they are attached.

The following species of *Ptilonia* appears to be new.

PTILONIA INTERMEDIA, sp.nov.

Fronde lineari ex ancipite plana, ad 30 cm. longa, decomposito-pinnata. Caule initio fere tereti a basi scutata mox ancipito plano; ramis in ambitu ovalibus alternis axillis rotundatis bis vel ter pinnatis, rachide ad 2 mm. lata; pinnulis planis, linearibus, membranaceis, pinnellis paucis quasi dentiformibus e margine excurrentibus. Fronde stratis tribus contexta, costa filis articulatis ramosis longitudinalibus, centrale distinctum cingentibus, cellis intermedii rotundato-angulatis majoribus, cellulis corticalibus parvulis radiatis. Cystocarpiis sphæricis parvulis, 300μ. diametro, muticis, apparenter terminalibus ex apice pinnellae praelongo evolutis. Color roseo-purpurea

D'Entrecasteaux Channel, Tasmania; November, 1910 (L. Rodway).

With the typical structure of frond and cystocarps of the genus, this graceful species, with the general habit of *Delisea*, appears to be intermediate between *P. australasica* Harv., and *P. subulifera* J.Ag.

EXPLANATION OF PLATES I.-V.

Plate i.

Spermatochnus lejolisii(Thur.) De Toni. (Half nat. size).

Plate ii.

Nitophyllum sinuosum, sp.nov. Tetrasporangiferous plant.

Plate iii.

Nitophyllum sinuosum, sp.nov. Cystocarpiferous plant.

Plate iv.

Sondera bennettiana(Harv.) F.v.M.[Syn. *Claudea bennettiana* Harv.].

Plate v.

Fig.1.—*Ulva lactuca* L., transverse section of basal portion.
Fig.2.—*Ulva lactuca* L.; longitudinal section of same.
Figs.3-4.—*Bryopsis baculifera* J.Ag.; tips of branchlets.

(Figs.1-2 from drawings by Miss M. Flockton.)

REVISION OF AUSTRALIAN SPECIES OF THE SUB-FAMILIES *CYPHALEINÆ* AND *CNODALONINÆ.*

(Fam. TENEBRIONIDÆ).

By H. J. CARTER, B.A., F.E.S.

(Plates vi.-vii.)

The Cyphaleinæ are almost entirely Australian, the only recorded exceptions being (*a*) the species of the genera *Crypsis* and *Artactes* from the Indo-Malayan Islands and Japan; (*b*) two species from New Guinea, described by Macleay as *Prophanes*, but which I consider to be *Cyphaleus*; and (*c*), a single species, *Cyphaleus valdivianus* Phil., from Chili. It is extremely probable that more will come to light as the fauna of New Guinea is more thoroughly investigated, while the single link with South America is an interesting fact of distribution. Its members include the handsomest of all the Tenebrionidæ, but endowed with strong powers of flight; and their habits and life-histories being almost unknown, comparatively few specimens are to be seen in ordinary collections. The subfamily presents strong evidence of belonging to an ancient but disappearing race, with its many genera and few species, and these sometimes not very closely related to one another.

The *Cyphaleinæ* are distinguished from the *Tenebrioninæ* by the following characters. *Head* flat, more or less enclosed in the thorax, eyes large and transverse, mandibles bifid at the extremity, antennæ generally long, with joints 6-10 successively enlarged. *Prothorax* generally bisinuate at apex and base, with the anterior angles well produced; the prosternum is in general strongly compressed or carinate, its process received behind into a wide cavity of the mesosternum. The intercoxal process wide, oval, or angular, tibiæ with short spines, not usually enlarged at apex, tarsi long.

Some of the genera (e.g., *Chartopteryx*, *Prophanes*, and *Cyclophanes*) present a feature which seems to have escaped notice, in the excavated, or strongly depressed central part of the apical segment of the abdomen. Most of the genera, including the above three, also *Paraphanes*, *Hemicyclus*, *Oremasis*, and *Cyphaleus*, show strong sexual characters, viz., (1) the protuberant ovipositor of the female, (2) the strongly enlarged three basal joints of the front tarsi, and, to a less extent, of the intermediate tarsi. The ovipositor has not been mentioned, so far as I am aware, by other writers, and should not be mistaken for the male organ. It is linear-lanceolate, slightly enlarged towards the apex, sulcate or convex on its upper surface, bifid at its extremity, with two small linear appendages, and a few hairs near apex. It has been customary for writers on this group to insert an apology for adding a new genus. In adding four new genera to the present list, the author would rather apologise for not adding more, since some of the existing genera, especially *Cyphaleus* and *Chartopteryx*, contain species of strikingly different facies. The possession of more material, however, is necessary before an author can sacrifice or mutilate rare specimens for dissection; and until this is done, it is better to include such doubtful species under existing genera, if their salient characters render the classification suitable. As a partial compensation, two of the existing genera are omitted, *Tetraphyllus* as being a genus of the Subfamily *Cnodaloninæ*, recorded only from Madagascar; the two Australian species *T. Reaumuri* Castel., and *T. sumptuosus* Hope, belonging to other genera (*vide infra*); while *Decialma* Pasc., = *Olisthæna* Erichs., and must be sunk. Pascoe had evident doubts on this subject, when proposing the genus *Decialma*. The slight difference in the antennæ may readily be explained by an error of observation, and the great difficulty in estimating the ratio of length to breadth of small antennal joints (*vide* note on *Decialma*, infra). There is very little distinction between *Hectus* and *Olisthæna*, save in the wider form and more widely separated eyes of the former. For the present, I would retain *Hectus* until intermediate forms appear. Pascoe's Table of Genera (Ann. Mag. Nat. Hist (4.) iii., 1869, p. 288) is misleading, in placing *Prophanes* and *Cyphaleus* under the heading "Prosternum *not* prolonged or compressed." All the species known to me (the majority of the described species) have the prosternum strongly compressed, as stated by Lacordaire and Westwood. In the new Catalogue of Junk, Herr Gebien has included *Ephidonius* Pasc., in this subfamily, but the strongly exserted head, with its broad front, its small widely separated eyes, its long tibial spurs, and differently clothed tarsi, *inter multa alia*, separate it so widely from the other genera of the Cyphaleinæ, that it cannot be so included. Both *Ephidonius* and *Brises*, as Bates remarks,(Trans. Ent. Soc. London, 1872, p.280) occupy an uncertain position. The distinction between "epipleuræ entire" and "epipleuræ abruptly narrowed behind," is a very untrustworthy character for distinguishing some of the genera in Pascoe's Table, and the author has included under *Prophanes* only those species which have the more strongly characteristic spinose prothorax and elytral apex. *Oremasis*, *Cyclophanes* and *Prophanes* have abruptly terminated epipleuræ clearly defined, while *Chartopteryx*, *Cyphaleus*, *Mœrodes*, *Anausis* and others have it to a modified extent. Pascoe's classification was published in 1869; the following tabulations of genera and species include those since added by Haag-Rutenberg, Bates, Lea, Blackburn, and the author.

Since writing the above, the author has received a number of specimens from the British Museum, that have been compared with types, or otherwise identified, together with some valuable notes on the types by Mr. K. G. Blair. Thus on *Apomestris*, Mr. Blair writes: "The genus does not seem to me really distinct from *Altes*, which also has the anterior femora with a similar tooth, though the hind femora are plain. The sculpture is the same in both, and there is the same indistinct ridge from the humerus to the tip of the elytra."

Mœrodes westwoodi Macl.—There seems to be a strong presumption that this is identical with *Prophanes aculeatus* Westw., the type of the genus *Prophanes*. Four specimens sent by the British Museum include one, named by Pascoe as *P. aculeatus*. If this synonymy be maintained, the genus *Mœrodes* must be sunk. Unfortunately the type of *P. aculeatus* is in the Melly

Coll., (Geneva ?), and as Westwood gives Swan River as its habitat, whereas *Merodes* is, I believe, confined to East Australia, there is a doubt which can only be removed by reference to the actual type. It is certain, however, that *M. Westwoodi* Macl., and the new species, *M. Kershawi*, are not congeneric with *M. Mastersi* Pasc.

Genera of the Cyphaleinæ.

1(41) Prosternum prolonged, compressed or carinate anteriorly.
2(26) Antennæ rather short, not extending beyond the base of prothorax, joints 7-10 considerably thicker and shorter than preceding.
3. Tibiæ dilated at apex .... *Lepispilus* Westw.
4(26) Tibiæ not dilated at apex.
5(7) Elytra striate-punctate.
6. Body glabrous.... .... *Platyphanes* Westw.
7. Body pilose............. .... *Laonicus* Haag.
8. Elytra seriate-punctate ....*Opigenia* Pasc.
9(26) Elytra irregularly punctate.
10(22) Body glabrous.
11(15) Anterior angles of prothorax little produced.
12(14) Form convex and subcylindric.
13. Prosternum and clypeus very short, legs long............ . *Trisilus* Haag.
14. Prosternum and clypeus longer, legs short . ...*Ctimene* Bates.
15. Form depressed.......... ....*Mitrephorus*, n.gen.
16(22) Anterior angles of prothorax strongly produced.
17. Elytra subgibbous, eyes rather close.........................*Toreuma*, n.gen.
18(20) Elytra depressed.
19. Elongate subparallel, eyes widely separated...........*Olisthæna* Erichs.; *Decialma* Pasc.
20. Elytra wider and subovate, eyes closer..... ....**Hectus* Pasc.
21. Form ovate-elliptic, very convex, pronotum scarcely explanate.......... ....*Bolbophanes*, n.gen.
22. Form hemispherical, pronotum widely explanate....*Hemicyclus* Westw.
23(26). Body pilose.
24. Pro- and metafemora dentate.............. ....*Apomestris* Bates.
25. Profemora dentate, elytra with two humps at base....... .... *Altes* Pasc.
26 Femora simple, elytra without humps.................*Amarygmimus* Bates.
27(41) Antennæ long, extending beyond the base of prothorax, joints 7-10 little enlarged.
28(36) Anterior angles of prothorax advanced but not spinose.
29. Basal joints of posterior tarsi nearly as long as the rest united............ ....*Chartopteryx* Westw.

---

* Genus unknown to the author in nature.

30(36)Basal joint of posterior tarsi much shorter than the rest united.
31. Epipleuræ prolonged.. ..*Cyphaleus* Westw.
32(36)Epipleuræ abruptly narrowed behind.
33(35)Elytra irregularly punctate.
34. Elytra spinose at apex, form elliptic........................ ..*Oremasis* Pasc.
35. Elytra not spinose at apex, form widely ovate........*Cyclophanes*, n.gen.
36. Elytra seriate-punctate, form parallel . ...*Paraphanes* Macl.
37(41)Anterior angles of prothorax spinose.
38(40)Eyes moderately distant.
39. Body very convex, widely ovate, coloured..............*Prophanes* Westw.
40. Body depressed, elongate, black or obscure bronze....*Mœrodes* Waterh.
41. Eyes much closer, colours variegated........................*Anausis* Bates.
42(46)Prosternum not compressed nor carinate.
43(45)Mesosternum notched.
44. Eyes partially covered by prothorax, tarsi pilose beneath..................
....*Lygestria* Pasc.
45. Eyes free, tarsi partially clothed beneath... ....*Barytipha* Pasc.
46.—Mesosternum not notched........ . ...*Mithippa* Pasc.

The numbers within brackets, denote how far down the first column the specified character applies.

Tables of Species.

Lepispilus Westw.

1(3)Elytra with ocellate depressions clothed with white pubescence.
2. Sides of prothorax widely rounded..... ....*rotundicollis* Blackb.
3. Sides of prothorax subangulately rounded, sinuate behind. ... .
....*sulcicollis* Boisd.
4. Entirely black, without pubescence... .... *stygianus* Pasc.

L. rotundicollis Blackb., is, I believe, distinct from *L sulcicollis*, though both appear to be variable. I have taken it at Kosciusko, and on the Blue Mts., while *L. sulcicollis* is widely distributed throughout Australia and Tasmania

L. stygianus Pasc., occurs plentifully in the higher levels of the Australian Alps, and on Mt. Kosciusko. Both Mr. Lea and the author have previously commented on its distinction from Boisduval's species.

Platyphanes Westw.

1(8)Elytra with 14 lines of punctures.
2(7)Elytra strongly striate-punctate.
3(5)Widely ovate (length much less than twice breadth).
4. Colour golden-green, with purple margins.. ... . *superbus* Blsckb.

5. Colour uniform dark green or bronze........................ *gibbosus* Westw.
6. Less widely ovate (length about twice breadth)...............*Clarki*, n.sp.
7. Length greater than twice breadth ....*creber* Blackb.
8. Elytra lineate-punctate (smaller than preceding)....... . .. *cyaneus* Pasc.
9(11) Elytra with 12 rows of punctures (besides a short scutellary row).
10. Ovate; elytra striate-punctate......... ....*ellipticus*, n.sp.
11. Parallel; elytra lineate-punctate........................... *parallelus*, n.sp.
12(21) Elytra with 10 lines of punctures (besides a short scutellary row).
13(15) Colour above black.
14. Elongate, parallel(23 × 9 mm.), elytra deeply sulcate(?)......................
.... *striato-punctatus* West.(Macl.).
15. Oblong-ovate(19 × 9 mm.), striæ shallow.................. *elongatulus* Macl.
16. Colour variegated, purple and green.....................*chalcopteroides*, n.sp.
17. Head and pronotum black, elytra blue, form parallel...........................
...........*cyaneipennis*, n.sp.
18(23) Colour bronze.
19. Elytra ovate, (nitid golden-bronze).............................*Frenchi*, n.sp.
20(23) Elytra parallel, (colour darker).
21. Size large(22 mm. long, legs dark..........................*oblongus* Waterh.; *Godeffroyi* Haag-Rut.
22. Size small(12 mm. long), legs red...................................*minor*, n.sp.
23. Elytra with 10 lines of punctures, *without the short scutellary row.*
Anterior angles acutely dentate..........................*quadrifoveatus*, n.sp.
Anterior angles rounded...var. *subangulatus*.

P. vittatus Westw., has been omitted above, as unknown to the author, and too briefly described for classification. Type in Coll. Melly(Geneva ?).

P. Godeffroyi Haag = *P. oblongus* Waterh.—I concur with Blackburn's surmise on this point. Its author states that it was sent to Bates for determination, but the latter apparently did not compare it with Waterhouse's type, since he considered it to belong to a new genus.

OLISTHÆNA Erichs.,(= *Decialma* Pasc.).

1. Whole surface nitid black................ *nitida* Erichs.; *Erichsoni* Champ.
2(4) Elytra greenish or bronze.
3. Underside brown... ....*tenuitarsis* Pasc.
4. Underside black, head more densely punctured than in 3...*Pascoei* Bates.

O. Erichsoni Champ. = *O. nitida* Erichs.— The descriptions and figures given by their respective authors establish this identity. A specimen labelled *O. nitida* Erichs., from the British Museum, differs from specimens labelled *O. Erichsoni*, in the "subangularly widened posterior tibiæ." This is, I consider, only sexual, and a male character. The distinction of *O. Pascoei* Bates, from *O. tenuitarsis* is very doubtful, depending on slight differences noted in the brief diagnosis of the former(Trans. Ent. Soc. Lond. 1873, p.358). Mr. Blair notes that Pascoe's type appears to be an immature specimen, thus increasing the probability of the synonymy. The two species described as *Decialma* by Macleay, are evidently slight colour-varieties of the same species. I have examined the types. They do not belong to this genus, and will be found under *Chariotheca*(Cnodaloninæ).

Hemicyclus Westw.

1. Legs dark metallic.
2. Elytra smooth and mirror-like.......*Reaumuri* Casteln.; *grandis* Westw.; *metallicus* Westw.
3. Elytra distinctly punctate...*punctulatus* Pasc.
4. Legs yellow..*flavipes*, n.sp.

Synonymy.—*H. metallicus* Macl. = *H. grandis* Westw. = *H.* (*Tetraphyllus*) *Reaumuri* Casteln. The descriptions are almost identical, and Castelnau's name has the priority. *H. metallicus* is evidently the male, and *grandis* the female of the same species. I have examined a considerable number of specimens; and Mr. Blair has examined the types, and confirms my conclusions. *Tetraphyllus sumptuosus* Hope, is almost certainly = *Espites basalis* Pasc. Unfortunately its type appears to have been lost. Professor Poulton has made a search amongst the Hope Collection in vain for it. The genus *Tetraphyllus* thus disappears from the Australian lists, and is apparently only from Madagascar.

Bolbophanes n.gen.

1(3)Colour bronze with metallic reflections.
2. Elytra smooth, nitid, and finely punctate, legs red.........*Dumbrelli* Lea.
3. Elytra longitudinally ridged, legs blue..........................*rugatus*, n.sp.
4. Colour purple or green, elytra less nitid, closely rugose-punctate.......................*varicolor*, n.sp.

Chartopteryx Westw.

1(6)Body pilose.
2(5)Form very convex.
3. Elytra with lichen-like clothing, forming a pattern at apex...........................*Childreni* Westw.

4. Elytral colours more or less in vittæ, apex spined...... ...*Mastersi* Macl.
5. Elytral colours intermixed, apex unspined... ....*victoriensis* Blackb.
6. Form subdepressed, elytral punctures much smaller than in 5..............
.... *Blackburni*, n.sp.
7(11) Body glabrous.
8. Colour nitid bronze, irregularly punctate .... *glaber* Macl.
9(11) Colour rather dull chocolate-brown.
10. Size very large, punctures distinct............. ... .*imperialis* Cart.
11 Size much smaller, punctures obscure........ ....*planus*, n.sp.

The above probably belong to three different genera, of which the first four are true Chartopteryx. *C. imperialis* Cart., and *C. planus* have the general form and tarsi of the genus, but differ so markedly in clothing and sculpture as to constitute a distinct group; while *C. glaber* Macl., differs from the others, except *C. Blackburni*, in its much less convexity. Three specimens of *C. glaber* were taken by the author at Acacia Creek, N.S.W., as well as *C. planus*, by beating dense creepers in the scrub. Single specimens of *C. Blackburni* and *C. planus* are amongst the British Museum specimens sent for determination.

Cyphaleus Westw.

1(4) Apex of elytra not mucronate in either sex.
2(5) Body pilose.
3. Pronotum black, elytra variegated or purple...... . ...*formosus* Westw.
var., elytral punctures less crowded . *iopterus* Westw.; *insignitus* Pasc.
4. Whole surface black. .... *rugosus* Gray; *aterrimus* Gray.
5. Pronotum green or blue, elytra variegated, size larger than preceding. Apex of elytra bluntly mucronate in ♀ ....*fulgidipennis* Boisd.; *Schmeltzi* Haag-Rut.
6(8) Body glabrous.
7. Pronotum obscure green or blue, elytral punctures much smaller and less deeply impressed than in the preceding......... *æreus* Waterh.
8. Pronotum brilliant copper, elytral disc blue, sides golden . .. .
...........*cupricollis* Macl.

C. insignitus Pasc. = *C. iopterus* Westw. = *C. formosus* Westw.

Synonymy.—Mr. Blair has compared the types of *C. iopterus* Westw., and *C. insignitus* Pasc., and finds them identical. He says: "Pascoe was probably misled by a much broken example with greenish head and thorax, labelled *C. iopterus* Westw., in the British Museum Coll., wrongly (a better example, included in the consignment sent, = *C. Schmeltzi* Haag ex desc.)". Pascoe was, no doubt, influenced also by the catalogues, which give *C. iopterus* Westw., as a synonym of *Chrysobalus fulgidipennis* Boisd. This is certainly a mistake, as the scanty description of Boisduval contains the words "thorace cyaneo," whilst in *C. iopterus* that segment is quite black. *C. formosus* Westw., (specimens compared with types of both, are sent) only differs from *C. iopterus* Westw., as the description states, in "the smaller size, more regular and slighter punctures of the elytra, and the uniform violet-purple colour" of *C. iopterus.* In the author's opinion, these distinctions are rather individual than specific. In the whole group, the species with large punctures (e.g., *Prophanes Mastersi* Pasc.) are subject to wide variation in the disposition and closeness of these punctures; while in colour, the variation is between concolorous purple to a brilliant variegation of green, blue, and purple; and in size, from $18 \times 8\frac{1}{2}$ mm., to 24×12 mm.(the measurements of a ♂ and ♀ specimen now before me).

C. Schmeltzi Haag-Rut., = *C. fulgidipennis* Boisd.—The description of Boisduval does not err on the side of completeness of detail, but every word of it applies to the large species so named in our museums. The only difference noted in *C. Schmeltzi* is the mucronate apex of the elytra. Having examined several specimens, I find that, while identical in other respects, some specimens exhibit these blunt teeth at the elytral apex, but in others the tooth is wanting. All the former are ♀, the latter ♂, as shown by the widely dilated basal joints of the anterior tarsi, and the longer antennæ in the ♂ specimens. *C. æreus* Waterh., is rare. I have two specimens from Brisbane and Sydney respectively. *C. cupricollis* Macl., is a fairly common Queensland species.

Cyclophanes n.gen.

1. Underside black, size large, punctures coarse................ *gloriosus*, n.sp.
2(4) Underside brilliantly metallic, size smaller.
3. Elytra variegated, slightly nitid, with lateral vitta......... *variegatus*, n.sp.
4. Elytra brilliant green (purple reflections), without vitta, punctures much finer.. *splendens*, n.sp.

PROPHANES Westw.

1(3)Elytra bronze.
2.Head, pronotum, and underside black. ....*aculeatus* Westw.
3.Head, pronotum and underside nitid purple-bronze...........*ducalis*, n.sp.
4(6)Elytra blue (purplish in *brevispinosus*).
5.Elytra sparsely foveate-punctate.....*Mastersi* Pasc.; *chalybeipennis* Macl.
6.Elytra closely, finely punctate..............................*brevispinosus*, n.sp.

P. cupreipennis Macl., and *P. submetallicus* Macl., from New Guinea, have non-spinose pronotum and apex of elytra, and are more at home under *Cyphaleus.*

P. spinosus Waterh., and *P. tricolor* Haag, are transferred to the genus *Anausis* (*vide infra*).

P. striatopunctatus Westw.—There are two specimens so named in the Macleay Museum, which are Platyphanes of the elongate, 10-striate type. They are labelled New South Wales (Westwood's type came from Melbourne), and correspond to Westwood's very brief diagnosis, except that the elytra are black instead of "cæruleo-nigris." It may be noted that Westwood considered *Anausis metallescens* and *Lygestira simplex* as included under his genus *Prophanes.*

MŒRODES Waterh.

Elytra with punctures fine and irregular........................*Westwoodi* Macl.
Elytra striate-punctate ....*Kershawi*, n.sp.

ANAUSIS Bates.

1.Head and pronotum brown, apex of elytra produced beyond spines........
....*Macleayi* Bates.
2(4)Head and pronotum black, apex of elytra not thus produced.
3.Hairs on elytra long, punctures large..............*quadrispinosus* Waterh.; *tricolor* Haag.
4.Hairs on elytra short and sparse, punctures smaller..........................
...........*metallescens* Westw.; *spinosus* Waterh.

The synonymy of *A. tricolor* Haag, with *A. quadrispinosus* Waterh., has been noted above. From the description, it seemed likely that *Prophanes spinosus* Waterh., was merely an abraded specimen of *A. metallescens* Westw. While writing this, I receive

* Species unknown to the author in nature.

a letter from my friend, Mr. G. E. Bryant, who has collected widely in Australia, and who has been kind enough to send me drawings of the types of the above. From the drawing of *A. Macleayi* Bates, the apices of elytra, though produced, are not certainly produced so far as the spines. Of this species, Mr. Bryant writes, "It differs from the other two" (*A. spinosus* and *A. metallescens*) "in being smaller and narrower, and the thorax more thickly punctured, and is a much bluer colour." (A specimen in Mr. Lea's collection, from Mullewa, W.A., exactly answers to this description.) Of the others he says "*P. spinosus* Waterh., is a much broader insect, and the eyes are wider apart. *P. metallescens* Westw., happens to agree with one of the specimens put with *P. spinosus*; it differs from *P. spinosus* only in having the anterior angles of the thorax sloping in, instead of out; in colouring, they are exactly alike, and I dare say the shape of the thorax is sexual." He also says, "I believe *A. Macleayi* Bates, *P. spinosus* Waterh., and *P. metallescens* Westw., are, in all probability, the same species." I must here state my agreement with the sexual differences. Three specimens of *A. metallescens* are before me, of which one is male, two female; the male has the thoracic spines straight, or slightly in-sloped; the two females have them distinctly pointing outwards; while the species varies considerably in size and width (one of the females has the ovipositor extruded; the male has the front tarsi slightly enlarged). I would, for the present, hold *A. Macleayi* Bates, as distinct, the single type-specimen recorded having certain defined distinctions; while its widely different locality is noteworthy (Champion Bay). My specimens of *A. metallescens* Westw., are from Cootamundra, N.S.W.; Gippsland, and Queensland, while that of *A. quadrispinosus* Waterh., was taken by myself at Acacia Creek, Northern New South Wales.

LYGESTIRA Pasc.

The species are correctly stated in Junk's Catalogue. Blackburn has pointed out the synonymy of *L. funerea* Pasc., with *L. simplex* Westw., while the second species, *L. lata* Waterh., is easily distinguished by its wider form and finer punctuation.

L. simplex Westw., is widely distributed in New South Wales and Victoria, while my specimens of *L. lata* Waterh., are from the Tweed River, N.S.W., and South Queensland.

Mithippia Pasc.

1. Prothorax widest at apex, punctures coarser, elytra striate-punctate.... .... *aurita* Pasc.
2. Prothorax with parallel sides, punctures finer, elytra irregularly punctate .... *Jansoni* Bates.

I have the former from the Blue Mountains. Of the latter, I have a cotype from West Australia, kindly given me in exchange from the British Museum.

As it is impossible to identify *Prophanes striato punctatus* Westw., from the ten words of its description, I append a description of the insect so labelled in the South Australian Museum, kindly lent me, and which applies also to the two specimens in the Macleay Museum, the first from Brisbane, the latter labelled New South Wales. It is a *Platyphanes*, the largest of the elongate group.

Platyphanes striato-punctatus Westw.

Elongate ovate, black, moderately nitid, pronotum and under side with brownish tint, palpi, antennæ, and tarsi reddish.

Head: labrum emarginate; epistoma straight in front, rounded at sides, making an angle with the strongly raised and subcornute canthus, the latter straight at the sides; eyes bordered on the inside by a carina, separated by a distance equal to the 2nd and 3rd antennal joints combined, the whole clearly and not very closely punctate. Antennæ not extending to base of prothorax, enlarged towards apex, joint 3 little longer than 4, 3-7 obconic, 8-11 oval, longer than wide, 11 longer than 10. *Prothorax* $4\frac{1}{2} \times 7\frac{1}{2}$ mm., length measured in the middle, width at base, arcuate-emarginate at apex, the anterior angles strongly advanced and subacute but rounded at the tips; sides nearly straight, extreme border thickened anteriorly, finer posteriorly and on front angle; posterior angles widely acute (about 80°), and very slightly produced, base bisinuate; disc with two foveæ at the anterior corners, and two smaller foveæ at base, clearly but not deeply punctate. *Scutellum* curvilinear-triangular. *Elytra* 19 x 10½ mm., very convex, wider than prothorax at base, shoulders widely rounded, widest in front of middle, and gradually tapering, without sinuation, to the apex, narrowly bordered and channelled, the channel subobsolete at apex; each elytron with ten rows of large, round, very deep punctures, separated longitudinally and transversely by convex intervals, forming promiscuous reticulations, besides a short scutellary row of smaller punctures, and an abbreviated row of similar size to these between the 3rd and 4th series; also a lateral row on extreme sides, almost concealed by the channel, all the series subobsolete at apex, the punctures in series often confluent or so closely placed as to give the appearance of lying in deep sulci. *Epipleuræ* smooth, apical segment of abdomen finely punctate, the basal segments striolate and coarsely punctate, sides of metasternum pustulose, their episterna rugose-punctate; *prosternum* carinate, produced and rounded behind; tibiæ with a short spine, hind tarsi with basal and apical joints of equal length. *Dimensions*, 25 x 10½ mm.

Hab.—Brisbane; also New South Wales

The elytra are described as "cœruleo-nigris" in Westwood's laconic diagnosis of ten words. He also gives "*Melbourne*" as the habitat, while its dimensions are given as "magnitudo *P. simplicis*."

It is nearest *P. creber* Blackb., the type af which, in the Mel bourne Museum, has been lent me for examination, through the courtesy of Mr. Kershaw *P. creber* differs in the following particulars: larger size, less convex, colour nitid bronze, eyes not bordered by carina, head and pronotum less strongly punctate, the lateral border of the latter uniformly thickened, its sides sinuate; elytra without scutellary row of punctures, the punctures in series smaller; there are about fourteen rows, the lateral series ill-defined; but all are continuous to apex (no abbreviated row), and nowise reticulate, or sulcate, *inter multa alia*.

PLATYPHANES CLARKI, n.sp.

Widely ovate, brilliantly nitid, head metallic green and purple, pronotum and elytra dark olive-bronze, the margins of both and the epipleuræ of the latter metallic gold or purple; legs and underside metallic black, the former very, the latter moderately nitid, apical joints of antennæ piceous, tarsi and tibiæ with golden pubescence.

Head truncate in front of epistoma, its sides rather straightly widening, with a large foveate impression at each angle, and separated from front by a wide concavity with an arched suture; front convex, the forehead rather sparsely, the clypeal area more thickly dotted with fine but evident punctures; eyes separated by a space equal to the transverse diameter of one eye; antennæ robust, not reaching the base of thorax, with joints 8-11 strongly enlarged, 3 little longer than 4, 5-7 gradually widening, 8-10 nearly circular, 11 ovoid, larger than 10. *Prothorax* moderately flat, glabrous, twice as wide as long (5 × 10 mm.), arcuate-emarginate at apex, anterior angles advanced but rounded, sinuate-emarginate at base, with a wide central lobe, and acute posterior angles produced backwards; sides narrowed anteriorly but uniformly rounded, lateral margins widely furrowed, extreme border reflexed and partly continuous on sides of apex; surface very nitid, minutely and sparsely punctate (punctures only visible under a lens). *Scutellum* transversely triangular, its centre convex, sides depressed. *Elytra* rapidly widening behind the prothorax, humeral angles subobsolete, middle two-thirds parallel, apex rather abruptly narrowed and unarmed, with uniformly narrow margin throughout, extreme border raised, the channel within of a bright metallic colour; very convex, gibbous in the humeral regions, convexity greatest in front of middle, sutural region depressed behind scutellum, faintly striate-punctate, the striæ only perceptible when viewed from the side, with fourteen lines of small punctures becoming obliterated on sides and apex, and very faintly impressed near suture, otherwise distinct and in general placed at a distance nearly equal to that between the striæ; intervals scarcely convex, smooth and polished. *Abdomen*:

last segment minutely and closely punctate, in the other segments punctures somewhat obscured by the close and fine striolation, sides of mesosternum and epimera with larger punctures, prosternal process widely rounded behind, compressed (saddle-like, not carinate), and strongly produced forward, mesosternal cavity rounded, its branches very tumid; anterior tarsi not apparently enlarged, posterior tarsi with basal joint longer than second and third combined, the claw-joint as long as the other three combined. *Dimensions*, 23-25 x 12-14 mm.

Hab.—Tenterfield (Dr. C. D. Clark); Dorrigo (sent by Mr. French).

Two specimens, both male, under examination, which I name in honour of the friend who first roused my interest in entomology, and whose collection contained one of the handsome specimens. The species is readily distinguished from its nearest allies, *P. creber* Blackb., and *P. superbus* Blackb., being narrower (in proportion to length), darker, granulated near the eyes, with sides of prothorax sinuate, and with its elytra "cancellato-punctulatis," while *P. superbus* is separated by colour, and its convex elytral intervals, amongst many other differences. Type in the author's Coll.

There are specimens also in the Macleay Museum, Sydney, and in the Adelaide Museum.

PLATYPHANES CHALCOPTEROIDES, n.sp.

Elongate, subparallel, moderately convex; underside and legs black, head greenish-black, pronotum dark green with a purple patch on each side, and purple tinge at apex and base; elytra variegated, the colours not arranged in vittæ but gradually merging (*i.e.*, the suture blue, disc chiefly green, sides purple with the external interval golden).

Head: labrum emarginate, epistoma evenly rounded, canthus little raised, suture faintly impressed, eyes partially covered by prothorax, separated by a space equal to the transverse diameter of one eye, evenly and closely punctate, antennæ not reaching the base of prothorax, joint 3 scarcely longer than 4, 5-7 gradually widening, 8-10 nearly round, 11 shortly ovoid. *Prothorax* 5 × 8 mm., arcuate-emarginate at apex, anterior angles advanced but rounded, sides evenly rounded, wider at base than at apex; posterior angles obtuse, base sinuate, central lobe produced, lateral borders round and reflexed, narrowly channelled within, the border slightly produced, on apex gradually evanescent towards the middle, disc closely and evidently punctate, with two small foveæ near the middle, central line only indicated on basal half by some lævigate spaces. *Scutellum* large, triangular, its sides rounded, nitid and finely punctate. *Elytra* convex, nowhere gibbous, soon widening behind prothorax, then parallel for the greater part, and evenly rounded at apex, substriate-punctate, the striæ not always evident, with ten rows of punctures (besides a short scutellary row), the punctures successively larger from suture to the sides, those on the centre of disc somewhat as in *Chalcopterus iridicolor* Bless., but less evenly spaced; between rows 3 and 4 a short extra row starting from the base and suddenly ending at a distance slightly beyond the scutellary row, all punctures becoming obsolete at extreme apex; intervals flat and lævigate; legs and underside minutely punctate, base and sides of metasternum with transversely ridged punctures, its epimera with a few larger round punctures, prosternum compressed and carinate in front, rounded and produced behind into the corresponding mesosternal cavity; legs rather short, the tibiæ compressed and wide (the anterior and intermediate slightly curved), tarsi shorter than usual, the claw-joint of posterior tarsi as long as the rest combined. *Dimensions*, 20 × 10½ mm.

Hab.—Duaringa, South Queensland; Cairns, N.Q.

Two specimens, male and female, the former obtained from Mr. W. Duboulay, the latter from Cairns, are superficially like some of the larger species of Chalcopterus, especially in the colour, form and sculpture of the elytra, and are not very near any described species of the genus, though evidently belonging to the group that contains *P. elongatus* Macl., and *P. oblongus* Waterh. Specimens examined from Melbourne and Adelaide Museums. Type in the author's Coll.

PLATYPHANES MINOR, n.sp.

Ovate, dark coppery-bronze (sometimes greenish), very nitid; antennæ, palpi, legs, and tarsi chestnut-red, underside reddish-brown.

Head and prothorax closely punctate, the former with labrum slightly emarginate, epistoma evenly arcuate, canthus raised and earlike, eyes separated by a distance less than the transverse diameter of one eye, antennæ not reaching base of prothorax, their four apical joints strongly enlarged, 3 little longer than 4, subconic, 8-10 nearly round, 11 longer and wider than 10, ovoid. *Prothorax* rather squarely emarginate in front, anterior angles advanced, acute but rounded at tips, not much wider at base than at apex, sides nearly straight, feebly rounded anteriorly, feebly sinuate near base; posterior angles acute and pointing obliquely outward, margins raised, finely punctate, rather widely channelled within, narrowly continued on apical border as far as the eyes, base sinuate, without border. *Scutellum* nearly semi-circular, convex and punctate. *Elytra* ovate, moderately convex, wider than prothorax at base; humeral angle obtuse, scarcely gibbous on shoulders nor compressed on flanks, their outline (seen from the side) a regular curve, highest about the middle, margin very narrow, the groove within it containing an irregular row of large punctures, lineate-punctate, with about ten rows of large round punctures, closely placed (at a distance less than the diameter of one), and a short scutellary row, the punctures becoming larger and sometimes confluent and irregular on the flanks, intervals apparently quite impunctate and very nitid, sometimes transversely raised (subcancellate). Abdomen finely striolate, the two basal segments with large scattered punctures, the apical segment with close minute punctures, metasternal punctures similar to those of *P. ellipticus* (supra), the prosternal sculpture much finer (not at all rugose), the process narrowed but not carinate, mesosternal cavity and intercoxal process triangular; tarsi as in *P. ellipticus*. *Dimensions*, $12 \times 5\frac{1}{2}$ mm.

Hab. – Dorrigo, New South Wales (Mr. R. J. Tillyard).

I am indebted to that enthusiastic naturalist, Mr. Tillyard, for the two specimens described above, in which I cannot distinguish any sexual character. It differs from all described species in its small size, and comparatively coarser sculpture, which combined with its red legs and nitid colour, will enable it to be readily identified. In one specimen, the colour is greenish, with its punctures cuprescent and fiery. Type in the author's Coll.

PLATYPHANES PARALLELUS, n.sp.

Oblong, nitid black; antennæ, oral organs, coxæ and tarsi red; apex and underside of tibiæ, parts of sternum piceous.

Head and prothorax finely and very closely punctate, with labrum piceous and emarginate, epistoma evenly and widely rounded, suture clearly defined, canthus little raised, eyes partly concealed by prothorax and separated by a distance about half the transverse diameter of one eye; antennæ not reaching the base of prothorax, joint 3 longer than 4, 8-11 considerably widened and nearly round, 11 scarcely longer than 10. *Prothorax* ($3 \times 4\frac{1}{2}$ mm.) more convex than in the two preceding species, not much wider at base than at apex, widest at middle, apex with middle part subtruncate, anterior angles strongly advanced but widely rounded, sides rounded anteriorly, rather straightly narrowed posteriorly, posterior angles obtuse, disc with two small impressions near base; the whole narrowly bordered throughout. *Scutellum* equilaterally triangular, punctate. *Elytra* parallel, very little convex longitudinally, slightly gibbous at shoulders, humeral angle obtuse, apex bluntly rounded, very narrowly margined and channelled; lineate-punctate, with about twelve lines of punctures, besides a short scutellary row, the punctures increasing in size outwards, unequally spaced, the rows closer than in *P. minor*, the lateral punctures much coarser than in *P. ellipticus* or *P. cyaneus*, and at least as large as in *P. minor*, the lines on the flanks quite confused, the punctures there coarse and irregular; at apex the lineate punctures very small but distinct. Abdomen finely punctate and striolate; metasternum and its epimera sparsely punctate, mesosternal cavity and intercoxal process triangular; prosternum finely rugose, its process sharply carinate, produced and narrowly rounded behind; tarsi as in the two preceding. *Dimensions*, $14 \times 6\frac{1}{2}$ mm.

Hab.—Dorrigo, New South Wales(Mr. R. J. Tillyard).

Another of Mr. Tillyard's captures in this prolific district, in November, 1911. The species differs from the two preceding species in its more convex prothorax, with more rounded anterior and obtuse posterior angles, different elytral sculpture, and more parallel form, besides its colour distinctions. Type in the author's Coll.

Platyphanes Frenchi, n.sp.

Elongate-ovate; glossy bronze above, underside black; antennæ, tarsi and legs brownish-red.

Head finely and closely punctate, epistoma arcuate, its curve slightly interrupted at the canthus, limiting suture definite and curved, eyes separated by a distance greater than the apparent transverse diameter of an eye; antennæ with joint 3 shorter than 4-5 combined [joints 7-11 wanting]. *Prothorax* $4 \times 7\frac{1}{2}$ mm., widest at base, length measured in the middle, rather straight at apex, its angles little advanced and rather widely rounded, sides gently and arcuately widening to the base, a feeble sinuation near the acute posterior angles, base strongly bisinuate, produced at the middle and at the angles; lateral border somewhat thick, narrowly channelled within and continuous on apex behind the eye; an irregular depression from the anterior angles along the sides and base, interrupted on the central lobe; without any sign of medial line, disc punctate similarly to the head. *Scutellum* widely triangular. *Elytra* ovate and convex, thrice and one-half as long as the prothorax, shoulders obtuse, sides with narrow horizontal margin, almost disappearing at shoulders and apex; with ten rows (besides a short scutellary row) of small closely placed punctures, intervals quite smooth and very nitid; epipleuræ bronze, and finely punctate. *Abdomen* punctate-striolate, the last segment with a shallow depression; sides of metasternum and epimera with large pitted punctures; prosternum carinate, its process produced anteriorly, and fitting into a semicircular groove in the mesosternum behind; intercoxal process forming a wide pointed arch; apical joint of all tarsi as long as the rest combined. *Dimensions*, $19 \times 9\frac{1}{2}$ mm.

Hab. - Condamine River, Queensland; and New South Wales.

A single specimen, ♀, in the Melbourne Museum (French Coll.). I have seen also two specimens sent by Mr. Lea from the Adelaide Museum (one labelled Sydney), and one sent from the British Museum. Its form is between *P. cyaneus* Pasc., and *P. elongatulus* Macl., (less gibbous than the former, and wider than the latter). The head, thorax, and elytra are equally nitid and brilliant. Type in the National Museum, Melbourne.

PLATYPHANES QUADRIFOVEATUS, n.sp.

Elongate, parallel; head and underside black, pronotum and elytra olivaceous, nitid; legs and antennæ brown, apical joints of the latter and tarsi reddish.

Head: labrum prominent, epistoma truncate, canthus raised, rather square in front and parallel at the sides, limiting suture scarcely evident; eyes large, scarcely free of the prothorax, separated by a distance less than the transverse diameter of one eye; closely and finely punctate; antennæ not extending to base of prothorax, joint 3 little longer than 4, 7-11 considerably and successively widened, 8-10 wider than long, nearly round, 11 longer than wide. *Prothorax* 5 x 7½ mm., length measured in the middle, widest at middle, slightly convex, evenly arcuate at apex, anterior angles acutely and dentately produced and reflexed, sides sinuate behind angle, feebly rounded and narrowed behind, posterior angle obtuse, with narrow raised border at sides and apex, base bisinuate, disc with fine shallow punctures throughout, and four large, almost circular foveate depressions at equal distances in a straight transverse line across the middle, one (smaller) on each side near the margin, two (larger and deeper) on middle of disc. *Scutellum* cordate, finely punctured. *Elytra* elongate, parallel for the greater part, moderately convex, length nearly twice the width, wider than prothorax at base, shoulders round, not sinuate before the apex, narrowly and evenly margined throughout; striate-punctate, with ten rows of large, closely placed punctures, intervals slightly convex and impunctate, the last row (on sides) containing the largest punctures, those in the sixth and ninth rows somewhat confused, the sixth row terminating abruptly before the apical declivity, striæ and punctures obsolescent at apex; abdomen with first segment coarsely rugose, with a few large punctures, between the coxæ, these punctures and rugosity finer on the second segment, apical segments minutely and densely punctate; intercoxal process widely V-shaped, metasternum smooth, prosternum compressed, its process saddle-shaped, terminating anteriorly in a sharp angle, posteriorly bluntly rounded, with a corresponding mesosternal cavity, the latter strongly rugose or subtuberculate; legs stout, middle tibiæ slightly curved, tibial spurs very short, posterior tarsi with claw-joint nearly as long as the rest combined. *Dimensions*, $25 \times 10\frac{1}{2}$ mm.

Hab. – Queensland.

Var.(or ♀) *subangulatus*, smaller and more bronzed, legs and antennæ a paler red-brown, with anterior angles of prothorax produced *but rounded*, elytral intervals flatter, the punctures in striæ smaller, those in the sixth and ninth rows more irregular.

The species is near *P. oblongus* Waterh., but differs in the shape of prothorax, with its strongly dentate anterior angles, and nearly straight sides, reddish legs, and antennæ; moreover, the short scutellary stria (present in *P. oblongus*) is wanting. I have been much puzzled as to the relation between *P. quadrifoveatus* and the *var.* specified above, but being unable to find any describable differences of structure, except the remarkable one of its anterior angles, I prefer, for the present, not to consider the *var.* as a distinct species. I believe them to be of opposite sexes.

The type of *P. quadrifoveatus* is in the National Museum, Melbourne; var. *subangulatus* is in the author's Coll. There is a specimen of the former in the Macleay Museum and of the latter, one in the British Museum consignment, from the Richmond River; and I have since received another from Mount Tambourine, Q., through Mr. R. J. Tillyard.

Platyphanes ellipticus, n.sp.

Elongate-ovate, apex somewhat acuminate; dark coppery-bronze, nitid, sometimes greenish; epipleuræ bright bronze; underside, legs, and antennæ black.

Head and prothorax finely, closely punctate, the former with labrum ciliate and emarginate; epistoma truncate in front, rounded at sides, canthus not prominent, suture scarcely defined; eyes partly concealed by prothorax, separated by a distance wider than the transverse diameter of one eye; antennæ extending beyond the middle of prothorax, four apical joints considerably enlarged, 3 longer than 4, less than 4 and 5 combined, 8-10 nearly round, 11 ovoid. *Prothorax* wider at base than at apex, arcuate-emarginate at apex, anterior angles prominent and rather widely acute; sides evenly rounded, with round, raised, strongly thickened and finely punctured border, narrowly channelled within; posterior angles acute, and produced a little backward, border narrowed and continued on apex as far as the eye: base very sinuate, without a border, middle lobe wide, middle line faintly indicated by lævigate space on basal half. *Scutellum* triangular, depressed in middle, minutely punctate. *Elytra* slightly wider than prothorax at base, convex and a little gibbous at shoulders, these obtuse; sides subparallel on middle two-thirds, flanks a little flattened at middle: striate-punctate, with twelve faintly impressed striæ (besides a short scutellary one), the punctures irregular in size and distance (very similar to those in *P. cyaneus* Pasc.), both striæ and punctures becoming obsolete at apex, obscure and irregular on the sides, intervals flat and very minutely punctate. Abdomen finely striolate, apical segment only showing minute punctures, sides of metasternum with oval ridged punctures, epimera with large round punctures, intercoxal process wide, its apex truncate; prosternum coarsely rugose, its process narrowly conical, not carinate, narrowly rounded behind, produced and almost pointed at apex; mandibles bifid at apex; tarsi rather short, not enlarged in the male, posterior tarsi with basal joint as long as the next two, claw-joint not as long as the rest combined. *Dimensions*, 11-14 × $5\frac{1}{2}$-7 mm.

Hab.—North Queensland (Mr. F. Dodd).

Eight specimens, sent by Mr. Dodd, are near but distinct from *P. cyaneus* Pasc., from which it differs in its narrower and more elongate form, more widely rounded and thickened border to prothorax, sharper anterior angles and black tibiæ, *inter alia*. Both in *P. cyaneus* and in *P. ellipticus*, the colour may be coppery, green, or cyaneous, but is usually concolorous and variable in size. I have specimens of *P. cyaneus* Pasc.,(a common Queensland insect) from 13 × 7 to 16 × 8½ mm., from Rockhampton and the Dawson River.

Platyphanes punctipennis Cart. = *Trisilus punctipennis* Cart.—This species must be removed from this genus, from its not having striate-punctate elytra. Having recently identified *Trisilus femoralis* Haag, I consider that my species should be placed under *Trisilus*. For distinction, the following differences may be noted. In *T. punctipennis*, the form is less convex, anterior angles of prothorax more advanced, femora more slender. The prosternum and clypeus are short in both, but there is an evident, though short, space between the procoxæ and front margin of the prosternum, though Haag-Rutenberg stated that they touched this margin.

MITREPHORUS, n.gen.

Near *Olisthæna*, from which it differs in the following characters. Antennæ shorter and stouter, joint 3 scarcely longer than 4, apical joints more enlarged, eleventh larger than the rest, ovate. Head short and deeply received into the prothorax, the eyes partly concealed, less widely separated (than in *Olisthæna*): forehead subvertical. Prothorax very convex, subtruncate at apex, its anterior angles scarcely produced, obtuse and deflexed; very narrowly bordered at sides and apex, without any foliation or differentiation of disc to the border; sides little narrowed at apex. Legs short; tibiæ thin, glabrous, the middle and hind tibiæ slightly curved.

MITREPHORUS CONVEXICOLLIS, n.sp.

Elongate-ovate; whole surface above, beneath, and legs, nitid black; tarsi and apical joints of antennæ piceous-red.

Head closely and distinctly punctate, epistoma rounded, labrum not prominent, canthus little raised, parallel behind; suture straight, forehead vertical, eyes half concealed by prothorax, separated by a distance equal to the transverse diameter of one eye; antennæ reaching the base of prothorax, joints 3-5 short and slender, 7-11 moderately enlarged, 8-10 somewhat round, about as wide as long, 11 ovate, longer and wider than 10. *Prothorax* $2\frac{1}{2} \times 4$ mm., convex, feebly arcuate-emarginate at apex: anterior angles scarcely produced, deflexed and obtuse, the sides feebly rounded anteriorly, nearly straight behind; posterior angles subrectangular, widest at base, lateral border and channel very narrow, apical border still narrower, disc without any lateral foliation, and, like the head, densely and evenly punctate. *Scutellum* transversely triangular, nearly smooth. *Elytra* slightly wider than prothorax at base, moderately convex, scarcely parallel, sides narrowly bordered and channelled throughout, disc closely and irregularly punctate (very much as in *O. tenuitarsis* Pasc.). Abdomen with two apical segments minutely punctate, other segments striolate, intercoxal process triangular; metasternum coarsely punctate; prosternum rugose, widely carinate, its process received into a V-shaped notch of the mesosternum; legs and tarsi rather short, claw-joint of posterior tarsi scarcely longer than the basal joint. *Dimensions*, $9\frac{1}{2}$-11 × 4-5 mm.

Hab.—Tambourine Mountain, South Queensland.

Two specimens, taken by Mr. A. M. Lea and the author respectively, in January, 1912, can be readily distinguished from *Olisthæna* by their convex prothorax, with its wide and bent down anterior angles, the disc continuous to the lateral channel, less parallel form, etc. Type in the author's Coll.

TOREUMA, n.gen.

Elongate, subparallel, eyes large, rather close. Epistoma short and tumid, canthus little raised and rounded in front; antennæ short and very fine, penultimate joints not much enlarged, last joint of maxillary palpi small, securiform, of the labial obconic, prothorax moderately convex, explanate laterally, sides arcuately narrowed from base to apex, strongly emarginate at apex, elytra strongly arched longitudinally, gibbous near the middle, irregularly, subfoveately impressed; femora tumid, tibiæ thin, glabrous above, finely tomentose beneath, tarsi short, basal joint shorter than the apical, intercoxal process rather narrow, prosternum short and carinate; other characters as in *Olisthæna*.

A genus not very near any other, distinguished by its narrow parallel form, with unusual convexity—(τορευμα, embossed work).

TOREUMA CUPREUM, n.sp.

Elongate, parallel, convex; nitid coppery-bronze above, reddish-brown beneath; antennæ, tibiæ, and tarsi red.

Head finely and closely punctate, the epistoma rounded, labrum prominent; canthus oblique, little raised, scarcely angulate in front; suture straight and well marked, forehead widely canaliculate; eyes large, separated by a distance less than the transverse diameter of one eye; antennæ not reaching base of prothorax, joint 3 little longer than 4, 3-6 subcylindric, 7-10 obconic, 8-10 enlarged but not so wide as long, 11 oval. *Prothorax* 2 × 4 mm., length measured in middle, width at base, bisinuate at apex, the middle *moderately*, the angles considerably advanced and acute; sides arcuately widening to the base, the latter bisinuate, the posterior angles more sharply acute than the anterior; apex and sides with moderately thick border, the latter finely channelled within, explanate margins rather wide and opaque in colour, the disc very nitid, both disc and margins finely, not closely, punctate. *Scutellum* scutiform (triangular, with rounded sides), punctate. *Elytra* of same width as prothorax at base, very convex, with highest point in the middle; sides subparallel for the greater part, narrowly bordered and channelled throughout, the whole surface unevenly vermiculate-punctate, with unequal foveæ irregularly scattered, the vermiculate intervals closely and evidently punctate, some larger impressions near base. Apical segment of abdomen closely punctate, other segments distinctly striolate, intercoxal process triangular; sternum with fine shallow punctures; prosternum carinate, received into a semicircular notch of the mesosternum; tarsi short, the claw-joint nearly as long as the rest combined. *Dimensions*, 10 × 4½ mm.

Hab.—North Queensland (Mr. F. Dodd).

A single specimen(♂) sent by Mr. Dodd, is evidently separated from the described genera by the combination of characters noted above. Type in the author's Coll.

Paraphanes Macl.—Lea has described a species as *Paraphanes Dumbrelli*, that presents so many differences from Macleay's genus as to render it inadmissible to its ranks. As Macleay's description, as to some details, is a little vague, while that of *P. Dumbrelli* omits some essential characters, I propose the new genus *Bolbophanes* for Lea's species, and two other North Queensland insects; and I give below a comparison of the characters of *Paraphanes* and *Bolbophanes*, taken from specimens compared with the type.

Paraphanes Macl.	*Bolbophanes*, n.gen.
Form elongate, moderately convex, parallel.	Form short, very convex (*Paropsis*-like), ovate.
Antennæ long, penultimate joints little enlarged, 3 distinctly longer than 4, joints 3-10 gradually enlarging and obconic, 11 twice as long as 10, subcylindric.	*Antennæ* short, joints 8-10 abruptly enlarged and transverse, 3-7 short and slender, 11 large and ovoid.
Eyes quite free of prothorax, and very prominent.	*Eyes* (normally) partially covered by prothorax, not at all prominent.
Prothorax long; length to breadth as 2 : 3.	*Prothorax* short; length to breadth as 1 : 2.
Sides bisinuate, anterior angles sublobate; posterior dentate, produced outwards.	Sides widely rounded, arcuately narrowed from base to apex, posterior angles scarcely produced.
Elytra lineate-punctate.	*Elytra* irregularly, closely punctate.
Prosternum very long, sharply carinate.	*Prosternum* very short, coxæ almost touching front margin, a short wide carina.
Mesosternal cavity rounded.	*Mesosternal cavity* triangular.
Epipleuræ very narrow, incomplete.	*Epipleuræ* very wide, incomplete.

Femora with fringe of hair on lower surface.	*Femora* glabrous.
Front tarsi of ♂ little enlarged.	*Front tarsi of* ♂ considerably enlarged.
Hind tarsi with last joint as long as the rest combined.	*Hind tarsi* with basal and claw-joint subequal.

N.B.—The fringed femora are a noteworthy, distinguishing character of *P. nitida* Macl., not mentioned by its author.

From the above, it is evident that the two genera *Bolbophanes* and *Paraphanes* come under widely separated sections of the subfamily, the former standing next to *Hemicyclus*; while the latter approaches *Prophanes* in the structure of the antennæ, though standing alone in other respects.

Bolbophanes rugatus, n.sp.

Ovate, very convex and nitid; elytra dark greenish-bronze, head and pronotum metallic green; antennæ, legs, and tarsi blue; underside metallic green; abdomen sometimes reddish.

Head: eyes scarcely free of prothorax, and widely separated, epistoma rounded, canthus small and inconspicuous, rather coarsely punctate; antennæ short, joints 7-11 gradually enlarged, 9-10 transverse, 11 nearly round. *Prothorax* more than twice as wide as long, widely emarginate at apex; anterior angles advanced but obtuse, sides arcuately widening to base, the latter bisinuate; posterior angles subrectangular and not produced, sides a little explanate with narrow reflexed border, disc without regular impressions or central line, finely punctate on middle, more coarsely on margins. *Scutellum* triangular and punctate. *Elytra* of same width as prothorax at base, humeri obtuse, widest behind the middle, with narrow border continued to apex, with fine shallow punctures close and irregular, the surface (especially towards sides) longitudinally ridged, their interstices more or less wrinkled. Epipleuræ and episterna coarsely punctate; abdomen finely punctate; prosternum short, its process convex and rounded behind. Tarsi short. *Dimensions*, 9-13 x 6-8 mm.

Hab.—Blue Mountains, N.S.W.(Dr. E. W. Ferguson)—Tambourine Mountain, Queensland(R. Illidge, and the author).

Five specimens examined, show little sexual distinction, (in three of them, the front tarsi are wanting). A *Paropsis*-like insect, closely allied to *B. Dumbrelli* Lea, from which it differs in (1) the coarser punctures of upper surface, (2) its uneven surface of elytra, (3) its blue antennæ and legs, which in *B. Dumbrelli* are reddish.

BOLBOPHANES VARICOLOR, n.sp.

Shortly ovate, very convex, glabrous (except on head) and moderately nitid; colour various, in some specimens purple or cyaneous, in others dark green with purple reflections (the elytra generally concolorous); underside, legs, antennæ, and tarsi metallic blue-black or violaceous.

Head densely punctate, epistoma and labrum with short dark hair, the latter prominent, the former rounded in front, sinuate at the canthus, deeply impressed at the suture; eyes separated by a distance greater than the apparent transverse diameter of an eye; antennæ scarcely reaching the base of prothorax, joint 3 slightly longer than 4, joints 8-11 slightly enlarged, 9-10 nearly round, 11 largest and ovoid. *Prothorax* ($2\frac{1}{2} \times 5\frac{1}{2}$ mm.) widest at base, length measured in middle, apex and base bisinuate, in each case produced at the middle and at the angles; anterior angles acute but slightly rounded, sides arcuately widening to the base; posterior angles acute, sides and apex narrowly bordered, lateral margins explanate and sometimes finely corrugated, disc closely and uniformly finely punctate, a smooth middle line sometimes indicated, a small basal fovea on each side. *Scutellum* rounded behind and on sides, punctate. *Elytra* very convex, slightly gibbous at the shoulders, closely fitting and of same width as prothorax at base, then widening and oval, a little sinuously narrowed near the apex, very narrowly bordered throughout; disc uniformly closely, distinctly punctate, with a slight tendency to rugosity. Abdomen minutely rugose, the last segment closely punctate, with a circular depression; sternum sparsely, epimera closely punctate; prosternum carinate, received behind into a triangular cavity of the metasternum; intercoxal process wide, its apex truncate; three basal joints of front and intermediate tarsi considerably enlarged in the male, basal joint of hind tarsi as long as the claw-joint. *Dimensions*, 10-12 × 5-6½ mm.

Hab.—Kuranda (Dodd and Tillyard), Mackay and Stanthorpe (Illidge), North Queensland (Melbourne Museum).

Twelve specimens of this apparently common Queensland insect have been examined (4 males, 8 females), and these differ only in size, colour, and the sexual characters mentioned above. Six of them are more or less purple-bronze with cyaneous reflections on the head and prothorax; the others are chiefly dull green, with some purple or metallic reflections; the colour of the underside and legs also varies from being nearly black, to violet or blue. Types in the author's Coll.

HEMICYCLUS FLAVIPES, n.sp.

Widely ovate, convex, glabrous; head (especially clypeus) metallic, pronotum and elytra nitid bronze-brown, the former with slight coloured reflections; underside metallic bronze with green reflections, epipleuræ greenish, labrum, palpi, antennæ, and legs yellow.

Head: labrum very prominent, epistoma truncate and closely punctate, space between eyes wider than the apparent diameter of one eye (as seen from above), sparsely punctate, antennæ extending beyond base of prothorax, joints 7-11 enlarged, 8-11 oval, 11 longer and wider than 10. *Prothorax* 2½ × 5 mm., widely obliquely emarginate at apex, anterior angles obtuse, sides nearly straight and strongly widening to base, posterior angles acute but slightly rounded at extremity, base bisinuate, explanate margins corrugated and punctate, disc smooth. *Scutellum* triangular. *Elytra*: shoulders rounded, wider than prothorax at base, widest behind middle, finely margined, channel widest at shoulder, then gradually narrowing behind and, with the epipleuræ, abruptly ending before apex. Disc, under lens, seen to be closely set with shallow punctulate impressions, epipleuræ wrinkled and sparsely punctate, abdomen with last segment finely punctate; prosternum saddle-shaped, rounded behind, flanks of prosternum finely striolate. Posterior tarsi with joints 1 and 4 of about equal length. *Dimensions*, 12 × 10 mm.

Hab.—Dorrigo, New South Wales(Mr. J. H. Maiden).

A single female specimen, in the South Australian Museum, is easily separated from its congeners by its yellow appendages, *inter alia.*

CHARTOPTERYX PLANUS, n.sp.

Elongate-elliptic, glabrous, subnitid; chocolate-brown above and below, the margins of elytra with a pale band; legs, oral organs, antennæ, and tarsi reddish, tibiæ and tarsi with golden tomentum.

Head: labrum emarginate and ciliate, showing membranous hinge; epistoma broadly truncate, canthus raised and shortly rounded, suture arcuate and clearly defined; impunctate; eyes very large, just free from the prothorax, separated by a distance of one-half the width of one eye; antennæ long, slender (extending to the middle of the elytra), joint 3 nearly as long as 4 and 5 combined, 3-6 cylindric, 7-10 very slightly enlarged and successively shorter, 11 narrowly elongate-ovate. *Prothorax* depressed, 3 x 6 mm., (length measured in the middle), apex semicircular, its angles strongly projecting and acute (with their tips rounded), sides sinuate anteriorly, moderately widened behind the middle, again sinuate near the acute and slightly produced hind angles; narrowly produced throughout, the lateral and latero-anterior border slightly raised, nitid, and thicker than the rest, margins rather widely foliate and concave, and with the disc entirely impunctate; base strongly bisinuate, with wide central lobe; a small foveate impression within each posterior angle. *Scutellum* triangular with rounded sides, convex and impunctate. *Elytra* moderately convex in both directions, nowhere gibbous; elliptic, rather suddenly incurved towards apex, humeral angle subobsolete and obtuse; widest behind middle, each elytron separately rounded at apex; extreme border narrowly raised (discontinued towards apex), just perceptibly canaliculate within; disc with the suture and three obscurely raised lines smooth from base to apex, the intervals very minutely and irregularly punctate, a short scutellary row of small punctures visible (with a lens); whole underside smooth and impunctate with the exception of some minute punctures on the apical segment: prosternum compressed and subcarinate, its process little enlarged behind or produced in front; intercoxal process widely triangular (like a Gothic arch), legs and tarsi long, anterior tarsi with three basal joints strongly dilated, fourth joint very small; posterior tarsi with basal joint almost as long as the rest combined, joint 2 twice as long as 3, claw-joint as long as 2 and 3 combined. *Dimensions*, 15-18 x 7½-9 mm.

Hab. – Wollongbar, Richmond River(Mr. R. Helms); Acacia Creek(the author).

Two specimens in my collection, both male, and a specimen in the Queensland Museum, are the only specimens I have seen of this species, one of which was taken by the author by beating creepers in a dense scrub. It is very like *C. imperialis* Carter, in colour, form and sculpture; but is much smaller, less convex, with the greatest height at, or rather behind, the middle. Type in the author's Coll.

CHARTOPTERYX BLACKBURNI, n.sp.

Elongate, lightly obovate, and little convex; head metallic blue and green with purple reflections, pronotum brilliant green, elytra blue with suture and sides purplish, sternum iridescent green, legs darker, abdomen reddish with metallic reflections, upper surface sparsely clothed with long, black, upright hairs.

Head with epistoma rounded and coarsely punctate, forming nearly a right angle with the raised and prominent canthus, forehead wide between eyes, more sparsely and less coarsely punctate than the epistoma; antennæ very little enlarged apically, extending considerably beyond the base of thorax, joint 3 as long as 4 and 5 combined, 3-7 subcylindric, 8 much shorter than 7 and slightly wider, 2-10 oval, longer than wide, 11 elongate-ovate. *Prothorax* 3 x 5 mm., widest at base, length measured in middle, arcuate-emarginate at apex, anterior angles prominent and acute, sides rather abruptly widened at middle, posterior angles produced and acute, lateral border narrow, moderately channelled within, base bisinuate, the whole (including the border) sparsely clothed with setiferous punctures with four larger depressions, two near sides, two near base. *Elytra* wider than prothorax at base, and four times as long, shoulders rounded, sides gradually widening till near the apex, the latter unarmed; lateral border and channel very narrow but continuous to apex, epipleuræ continuous almost to apex, the whole surface evenly but not very closely dotted with small setiferous punctures, becoming smaller towards apex, a single lateral row of close large punctures. *Abdomen* with finer setiferous punctures than on elytra, the hairs arising therefrom adpressed and of a lighter colour; epipleuræ and episterna coarsely punctate, prosternum carinate and sharply produced behind, submentum transversely rugose. Hind tarsi with basal joint as long as the rest combined. *Dimensions*, 16 × 7½ mm.

Hab.—Australia.

A single female specimen in the South Australian Museum, labelled Australia, Blackburn Coll., is distinguished from its allies by the combination of brilliant colour, and depressed form, and the punctures of elytra evidently smaller than in *C. Mastersi* Macl., and *C. victoriensis* Blackb. A second specimen in the British Museum consignment to me, labelled S. Australia (F. Bates, 81, 19).

CYCLOPHANES, n.gen.

Between *Oremasis* and *Hemicyclus* in facies and characters. Widely ovate, very convex longitudinally, explanate and less convex transversely, especially on pronotum and apical half of elytra. Glabrous. Mentum trapezoidal, convex; labial palpi short, basal joint securiform; maxillary palpi long and robust, last joint large and securiform. Epistoma truncate in front, rounded at sides, canthus arcuate, raised and concave within, limiting suture clearly defined and arcuate. Eyes large, reniform, clear of prothorax, not approximate; antennæ long, extending considerably beyond the base of prothorax, joint 3 as long as 4-5 combined, cylindric, 4-7 subequal in length, successively wider at apex, obconic, 8-11 oval, successively wider and shorter, longer than wide, 11 wider and longer than 10, rounded at apex. *Prothorax* twice and one-half as wide at base as long in the middle, narrowly bordered at sides and apex, lateral margins widely explanate. *Elytra* of same width at base as prothorax, shoulders definitely angulate and obtuse, very convex, with highest point in front of middle, irregularly punctate, epipleuræ wide, horizontal, rather abruptly narrowed before apex; elytra narrowly bordered till near apex, the border then suddenly bent down and continuous (though not visible from above) to apex. Intercoxal process rather widely arched, prosternum compressed and saddle-shaped at apex, conical behind, not carinate; mesosternal cavity rounded; appendages yellow; tibiæ with small spine at apex, anterior tarsi of male with three basal joints much enlarged, posterior tarsi with basal and apical joints of equal length (excluding claws), the other two joints short. Penis short, attached to an arcuately widening lamella; female with a long protuberant ovipositor.

CYCLOPHANES VARIEGATUS, n.sp.

Widely ovate, moderately nitid above, very nitid beneath; head purple-green and gold, pronotum purple on margin, green and purple on disc; elytra mostly dark green, with suture, border, and shoulders coppery-purple; a purple band, wide at base, extending thence round the sides (but not reaching them) to apex, where it meets the sutural band; epipleuræ bright blue, variegated with purple; underside iridescent purple, blue and gold, the former colour predominant, the last on the epimera; antennæ, oral organs, legs, and tarsi yellow.

Head rather closely punctate on front, more sparsely and coarsely on epistoma, front widening behind, eyes separated by a distance equal to the transverse diameter of one eye. *Prothorax* $2\frac{3}{4} \times 7$ mm., sinuate-emarginate at apex, the middle very slightly advanced, the angles reaching to half the width of eyes, obtuse and rounded, sides evenly and arcuately widening to base, the latter bisinuate, central lobe wide, posterior angles rather widely acute, not at all produced, foliate margins wide, a little upturned, transversely wrinkled, separated from disc by a blue sulcus containing an irregular row of punctures, disc nearly flat, finely and closely punctate, a small basal fovea on each side of scutellum.

Scutellum triangular, sides rounded, finely punctate. *Elytra* ovate, very convex or humped in front of middle, thence evenly and rather flatly declivous to apex, the latter rather sharp, but unarmed: a small depression at extreme shoulders and on each side of scutellum, border narrowly canaliculate within, abruptly ending before apex, densely not coarsely punctate, with three obscure, sometimes raised lines on each elytron, less punctate than the rest, more evident on apical than basal half. Abdomen faintly striolate, the last segment punctate, sternum finely punctate at sides only and on epimera; epipleuræ slightly rugose and very finely punctate, submentum evidently punctate, legs slender, tibiæ straight. *Dimensions*, 14-15 × 9-10 mm.

Hab.—Dorrigo, New South Wales(R. J. Tillyard).

Three specimens of this beautiful insect were amongst Mr. Tillyard's captures, two males and one female. The anterior tarsi show more than the usual sexual enlargement. The colours are much more brilliant on the underside than above, but their definition is difficult to describe. Its form and combined characters do not fit it into any of the existing genera, though it is nearest *Oremasis*; while approaching *Hemicyclus* in its broadly ovate form, from which it is readily distinguished by its more explanate surface, longer (and yellow) legs, and antennæ. Types in the author's Coll.

CYCLOPHANES GLORIOSUS, n.sp.

Widely oblong-ovate; upper surface brilliant iridescent blue and green with purple reflections, the head rather densely clothed with golden pubescence, pronotum at the sides and epipleuræ of elytra purple; underside black; antennæ, palpi, legs, and tarsi bright yellow.

Head: labrum very prominent and rectangular, epistoma rounded in front, angular at its junction with canthus, the latter quite straight at the sides, angular in front, closely and not coarsely punctate, these sometimes concealed by dense short recumbent hairs; eyes large, reniform, separated by a distance equal to the transverse diameter of one eye (as seen from above); antennæ extending slightly beyond the base of prothorax, joints

7-11 moderately enlarged, 3 about half as long again as 4, 4-6 equal, subcylindric (very slightly obconic), 8-10 rather quadrate-ovate, not wider than long, shorter than 7, the last intermediate in form and length between 6 and 8; 11 oblong-ovate, as long as 9 and 10 combined. *Prothorax* $4\frac{1}{4} \times 7\frac{1}{2}$ mm., length measured in the middle, width at base, width across front angles 4 mm., apex with discal part straight (or sometimes produced forward in the middle), the anterior angles produced to half the width of the eyes, fairly widely rounded, sides arcuately widening to base; posterior angles dentate, acute and a little outwardly directed (overlapping the elytra), base strongly bisinuate, central lobe produced; apex, sides, and angles at base very narrowly bordered, margins wide, slightly concave and coarsely rugose-punctate, disc nearly smooth, with small punctures sparsely and irregularly placed, a more or less regular line of larger punctures at base and apex; without any indication of a middle line. *Scutellum* scutiform, impunctate, depressed at sides, convex in middle. *Elytra* very convex, gibbous at shoulders, humeral angle obtuse, soon widening considerably behind the shoulders, parallel for the middle portion, then rather abruptly incurved to the apex, the last unarmed and rounded; disc irregularly punctate, punctures coarser and more crowded in the humeral region, base and sides, more sparse and smaller near suture and quite evanescent on apical declivity, intervals minutely punctate on disc, rugose and vermiculate near shoulder and on epipleuræ. Abdomen minutely punctate (the last segment more coarsely and closely so, and truncate at apex); sides of metasternum and epimera rather finely punctate, prosternum short, saddle-shaped, its process scarcely produced forward, triangular with rounded sides behind, received into the correspondingly notched mesosternum. Legs long, finely pitted, tibiæ straight, with a line of short yellow hair on the inside, tarsi flavosetose, the anterior with three basal joints enlarged, posterior with basal and claw-joint of about equal length, the other two joints short. *Dimensions*, 17-20 × 10-11½ mm.

Hab.—Bellinger River (Mr. Jackson, per R. Helms), Dorrigo (R. J. Tillyard), Three specimens, all, I think, ♂, in my collection, in colour and general appearance resemble *Prophanes Mastersi* Pasc., but are without the spinose prothorax and elytra. The bright yellow appendages, more rounded form of both prothorax and elytra, the antennal and tarsal structure, the absence of the abdominal excavation, and its greatly enlarged anterior tarsi, together with the strongly sculptured margins of prothorax, mark this species as an ally of *Cyclophanes variegatus.* Type in the author's Coll.

CYCLOPHANES SPLENDENS, n.sp.

Widely ovate, glabrous, very nitid; head purple and gold, pronotum metallic purple on disc, bronze at sides, a line of blue on inside of margins, elytra metallic green with purple reflections at suture and sides, whole underside iridescent and variegated (purple, green, and blue), legs, tarsi, and antennæ yellow (femora greenish).

Head: labrum very prominent and rectangular, epistoma truncate, slightly rounded at sides, a depression within each corner, defining suture straight and deep; eyes large, separated by a distance equal to the apparent transverse diameter of an eye; closely, not coarsely punctate; antennæ extending beyond the base of prothorax, joint 3 about as long as 4-5 combined, 7-11 gradually enlarging, 8-10 ovate, not wider than long, 11 longer and wider than 10. *Prothorax* $2\frac{1}{2} \times 6$ mm., length measured in the middle, width at base, arcuate-emarginate at apex, anterior angles reaching the middle of the eye, moderately acute, sides arcuately and strongly widened to base, posterior angles acute but slightly blunted, base bisinuate, extreme border narrowly raised on sides and apex, explanate margins wide, concave, transversely wrinkled and punctate, separated from disc by a blue channel containing a row of punctures, disc nearly smooth, middle line vaguely suggested at base. *Scutellum* widely triangular, smooth. *Elytra* slightly wider than prothorax at base, ovate and convex, a little produced at apex, humeral angle distinct and obtuse, lateral border and channel narrow, the former abruptly bent down and ending before the apex; whole surface (except the apical declivity) finely, regularly and rather closely punctate, depressed on each side of scutellum and foveate within the humeri; abdomen finely striolate at sides, the last segment punctate, with large circular depression, epi- and parapleuræ nearly smooth, sternum finely rugose at sides, prosternal process not carinate, saddle-shaped in front, circular behind, closely fitting mesosternal cavity. Ovipositor extruded. *Dimensions*, 13 x 9 mm.

Hab.—Tambourine Mountain, South Queensland (H. Hacker).

A single female specimen, in the Queensland Museum, is a singularly beautiful insect, much more nitid than and without the longitudinal lines on the elytra of *C. variegatus*. There are two specimens in the Macleay Museum, from New South Wales.

PROPHANES DUCALIS, n.sp.

Oblong-ovate, glabrous, whole surface above and below a rich metallic purple bronze, very nitid, (borders of pronotum and parts of head tinged with green), legs blue, femora with violet reflections, apical joints of antennæ fuscous.

Head with labrum produced (showing membranous hinge), truncate and rectangular, epistoma straight in front, angulate at its junction with canthus, the latter raised and elongate, limiting suture straight and clearly impressed, front widely channelled, eyes large and separated by a distance considerably less than the transverse diameter of one eye; closely, irregularly punctate, the punctures larger on clypeal than on frontal area (in neither case so coarse as in *P. Mastersi* Pasc.). Antennæ extending considerably beyond the humeri, joints 7-11 enlarged, 3 about as long as 4 and 5 combined, 4-6 obconic, 7-10 pear-shaped, 8-10 shorter than 7, not wider than long, 11 elongate subcylindric, nearly as long as the preceding three combined. Prothorax 4 x 7 mm., length measured in the middle, width at base, widely emarginate at apex, anterior angles strongly produced into spines curved obliquely outwards, width between spines 5 mm.; sides slightly sinuate (widely in front, narrowly behind), otherwise nearly straight, base strongly bisinuate, central lobe produced and subtruncate, posterior angles produced (less so than the middle lobe) and acute, with narrow raised border throughout, except on central basal lobe; surface uneven, with six large foveate depressions, two forming (or rather including) the middle line, the anterior of these elongate, the basal round, two on each side (occupying a large portion of disc); surface rather closely punctate, the scarcely concave explanate margins with much larger punctures. *Scutellum* oval. *Elytra* ovate, subparallel at the middle, very convex (gibbous in humeral region), of same width as prothorax at base, humeri obtuse, widest at middle, strongly bispinose at apex, narrowly bordered, and, with the epipleuræ, closely irregularly foveate-punctate, intervals smooth, vermiculate, sometimes showing a longitudinal arrangement, foveæ sometimes confluent, with smaller bronze punctures within them; of varied size, but larger and more confluent towards sides. *Abdomen* nearly smooth, and with the sternum brilliantly metallic, the last segment with a large central depression, narrowed and curved at base, widened into a circular excavation at apex; intercoxal process moderately wide, sides of metasternum rugose-punctate, epimera with large round punctures, prosternum punctured on sides, its process saddle-shaped, not carinate, produced acutely forward, fitting into a widely triangular cavity of the mesosternum behind; legs long, tibiæ pitted, anterior tarsi enlarged, posterior tarsi with basal joint longer than 2 and 3 combined, claw-joint not as long as the rest combined, clothed with reddish tomentum. *Dimensions*, 20-21 × 10½-11 mm.

Hab.—North Queensland (F. P. Dodd), Upper Herbert River (per C. French, F.L.S.).

Two specimens, I believe ♀, of this fine species under examination. A specimen sent also from the British Museum; there is one in the Macleay Museum. The curious abdominal excavation, though unnoticed in other descriptions, occurs also in *P. Mastersi* Pasc., and in *P. cupricollis* Macl., and is possibly a sexual distinction, the obvious males having a less regular depression. It occurs as an irregular depression also in *Cyphaleus rugosus* Gray, *C. æreus* Waterh., *C. fulgidipennis* Boisd., and *C. insignitus* Pasc. *P. ducalis* is nearest to, though very distinct from, *P. Masteri* Pasc., and *P. aculeatus* Westw., (the latter only known to me by description). From the former, it is distinguished by the less closely punctate head, eyes larger and less separated, anterior angles of prothorax longer, posterior reflexed (in *C. Masteri* deflexed), elytra narrower, its spines longer, foveate punctures of elytra quite irregular and close, its intervals smooth, besides colour-differences. From *C. aculeatus* Westw., it differs in its metallic head, prothorax, and underside, and the sculpture of the elytra. Type in the author's Coll.

PROPHANES BREVISPINOSUS, n.sp.

Ovate, convex, glabrous; head green-bronze, pronotum purple-bronze, elytra obscure purple and blue, underside obscure green; antennæ, legs, and tarsi blue, the last clothed with reddish tomentum.

Head rather coarsely rugose-punctate, epistoma rounded in front, angulate at sides, canthus raised, prominent and rectangular in front, suture deeply impressed, arcuate, forehead canaliculate, eyes more distant than the obvious transverse diameter of one, and quite free of the prothorax; antennæ with joint 3 as long as 4-5 combined, 4-7 subcylindric and equal, 8 shorter and enlarged, 9-11 moderately enlarged, 9 and 10 shortly ovate, longer than wide, 11 more elongate than 10. *Prothorax* $3 \times 5\frac{1}{2}$ mm., length measured in middle, width at base, nearly flat, depressed behind apical borders, and within posterior angles, bisinuate at base and apex, the middle lobe and angles produced; anterior angles with a rather wide, short tooth directed outwards, sides scarcely sinuate in front, nearly straightly widened to base, posterior angle acute, obliquely directed outwards; sides and apex narrowly bordered, the former not foliate or furrowed; middle line indicated by a small depression at base, disc rather evenly, closely, not coarsely punctate. *Scutellum* scutiform, punctate, with a central depression. *Elytra* convex, ovate, humeri obtuse, with a slight depression at flanks, apex briefly dentate (scarcely spinose), narrowly bordered and channelled, the channel occupied by a line of large punctures; disc regularly, closely, and finely punctate, punctures evanescent at apex, epipleuræ coarsely punctate. Abdomen striolate-punctate, the last segment punctate only, its centre depressed, its apex circularly excised; intercoxal process widely rounded, sides of metasternum, and epimera with rather large, round punctures, prosternum more finely punctate, the process rather wide, not carinate; pointed in front and triangularly rounded behind. Legs long, three basal joints of anterior tarsi enlarged, posterior tarsi with claw-joint wanting, basal joint long. *Dimensions*, 16 x 8 mm.

Hab.—North Queensland.

A single male (I think from Mr. Dodd) is nearest *P. quadrispinosus* Waterh., which is, however, said to be "parce pubescens," "niger," with anterior angles "longe porrectis," and posterior angles "rectis," all of which characters sufficiently differentiate it from the above. The raised and subdentate canthus should assist in its identification. Type in the author's Coll.

MŒRODES KERSHAWI, n.sp.

Elongate, parallel; black, glabrous, moderately nitid, antennæ and tarsi reddish, apex of palpi testaceous.

Head densely punctate, epistoma truncate in front, widely rounded on sides, canthus raised, suture only defined by oblique lines at the sides, eyes separated by a distance less than the apparent transverse diameler of an eye (seen from above), antennæ not reaching base of prothorax, joint 3 little longer than 4, 7-11 successively widened and transverse, 9-11 widely ovate. *Prothorax* $3\frac{1}{2}$ x 7 mm., length measured in the middle, width near base, apex arcuate-emarginate; anterior angles strongly produced outwards into a sharp spine, sides rounded, sinuate behind front angles, narrowed behind, base bisinuate; posterior angles acute, lateral margins subhorizontal, widening at the anterior angles and narrowly produced on apex as far as the eyes; disc regularly, closely punctate, with some irregular depressions near base. *Scutellum* scutiform and concave. *Elytra* wider than prothorax at base, shoulders rounded, sides parallel for the greater part, lateral border narrowly channelled within, continuous to the apical spine, the latter short and stout, not placed at suture, but about 2 mm. apart; disc with about fourteen rows of large punctures, uneven in size and position (in general *close*), rows 8-9 and 12-13 somewhat commingled, the punctures continuous to the apex, but smaller in this region; intervals and epipleuræ smooth. Abdomen finely punctate-striolate; sides of metasternum and epimera strongly pustulose, prosternum rugose, its process carinate, produced anteriorly and received into a triangular cavity behind; intercoxal process widely arched. *Dimensions*, 20 × 10 mm.

Hab.—Queensland.

Two specimens, both probably male, are amongst some Cyphaleinæ sent for examination, from the Melbourne Museum, by Mr. J. Kershaw, the courteous Curator, to whom I dedicate the species. A specimen also in the Adelaide Museum. It is readily distinguished from *M. Westwoodi* Macl., by the following: (1) wider and differently shaped prothorax, especially wider at apex through its strongly divergent spines, which are narrower and more forwardly directed in *M. Westwoodi*. (2) Punctate-striate elytra (quite irregular sculpture in *M. Westwoodi*). (3) The apical spines placed farther from the sutural extremity. (4) Stouter and more parallel form. Type in National Museum, Melbourne.

The Australian Cnodaloninæ.

This subfamily occupies a position between Cyphaleinæ and Helopinæ. They are differentiated from the former by the following characters. Head not largely enclosed in prothorax, the latter not strongly emarginate, prosternum little or not at all compressed, its process less produced behind, and the corresponding mesosternal notch less enlarged, the epipleural fold continuous to the apex, tarsi shorter. From the Helopinæ, they are differentiated by the depressed joints of their antennæ, and their brilliant metallic colours. Widely distributed in the East Indies, South America, Madagascar, so far only four genera have been recorded from Australia; and these may be distinguished by the following table.

1(3) Prothorax and elytra more or less cylindric.
2. Elytra coarsely and irregularly punctate.................... ..*Titæna* Erichs.
3. Elytra finely striate-punctate . ...*Thesilea* Haag.
4. Body oval, prothorax explanate, tarsi thin.................*Chariotheca* Pasc.
5. Form more depressed, tarsi short and stout........... ... .*Espites* Pasc.

Pascoe differentiates *Espites* from *Chariotheca* by its sloping mesosternum, short stout tarsi, and narrow clypeus.

The genus *Cholipus* Pasc., originally placed with the Cnodaloninæ, is now considered identical with *Encyalesthus* (Tenebrioninæ). *Tetraphyllus* is apparently confined to Madagascar, the two species under that name in Gemminger and Harold, and Masters' Catalogue, are evidently wrongly placed, and are almost certainly synonymous as follows.

Hemicyclus grandis Westw. = *Hemicyclus (Tetraphyllus) Reaumuri* Casteln. *Espites basalis* Pasc. = *Espites (Tetraphyllus) sumptuosus*(?) Hope. Hope's type has apparently been lost, and the description is very scanty, so that it would be desirable to retain Pascoe's name.

TITÆNA Erichs.

1(7)Pilose.
2(4)Colour variegated; size large, 15 mm. long.
3. Prothorax more cylindric, punctures coarser............*columbina* Erichs.
4. Prothorax more explanate, punctures finer..................*tyrrhena*, n.sp.
5(7)Colour blue, size smaller.
6. Feebly pilose, rugose-punctate; 8-9 mm. long........ .. *alcyonea* Erichs.
7. Strongly pilose, not at all rugose; 6 mm. long. ....*minor*, n.sp.
8(10)Glabrous.
9. Size large, colour variegated............. . ...*varicolor* Haag.
10. Size smaller, colour dark metallic (black with age)....*tasmanica* Champ.

THESILEA Haag.

Of this genus, two species are recorded from Australia.

T. cuprina Fairm., from Wallis Island. I have identified two specimens sent by Mr. F. Dodd, of Kuranda.

T. planicollis Fairm. = *T. oblonga* Blanch., (*Olisthæna*) = (?) *Chariotheca cupripennis* Pasc.

The former synonymy is contained in the Gemminger and Harold's Catalogue; the latter is my own conclusion from the descriptions and figure(Voy. Pôle Sud, 1853). I have specimens of *C cupripennis* Pasc., that I compared with the type, from Kuranda.

CHARIOTHECA Pasc.

1(3)Form oval.
2. Pronotum black ....*amaroides* Pasc.
3. Pronotum blue............. .... *Besti* Blackb.
4(6)Form elongate and parallel.

5. Size larger and wider($8\text{-}11 \times 3\frac{1}{2}\text{-}4$ mm.). ....*striato-punctata* Macl.; *viridipennis* Macl.
6. Size smaller($7\text{-}8 \times 2\text{-}2\frac{1}{2}$ mm.). ....*cupripennis* Pasc.

Having examined the types of *Decialma striato-punctata* Macl., and of *D. viridipennis* Macl., I am convinced, (1) that there is nothing but a slight colour-distinction between the two specimens; and (2) that both are congeneric with *C. cupripennis* Pasc., from which it is chiefly distinguished by difference of size. I have already pointed out the strong probability of the synonymy of *C. cupripennis* Pasc., with *Thesilea planicollis* Fairm., which only a comparison of the types will definitely prove.

ESPITES Pasc.

E. basalis Pasc., = (?) *E.* (*Tetraphyllus*) *sumptuosus* Hope.

I have already recorded this species from Cape York; originally described from New Guinea (These Proceedings, 1910, p.134).

TITÆNA TYRRHENA, n.sp.

Head and prothorax bright purple, with blue reflections, elytra with the suture greenish, shoulders and margins cyaneous, the rest purple with some metallic reflections, underside and legs variegated with blue and purple, underside of femora reddish, tarsi and antennæ castaneous.

Head coarsely and densely rugose-punctate, eyes smaller and more prominent than in *T. varicolor* Haag-Rut. *Prothorax* very convex anteriorly, produced and gibbous at the middle of apex, anterior angles acute and prominent, the sides more rounded and more narrowed behind than in *T. varicolor* Haag-Rut., posterior angles widely obtuse, bisinuate and lobate at base, lateral margins narrow and partially evident from above, sparsely pilose with short whitish hair, and coarsely dotted with large round punctures, the interstices (especially near base) subvermiculate and sometimes wider than the punctures. *Scutellum* semicircular, punctate. *Elytra* very little wider than prothorax, striate-punctate, the striæ shallow, the intervals containing irregular lines of punctures of the same size as those in the striæ, otherwise smooth, elytra more sparsely and shortly pilose than the prothorax. Sternum and abdomen strongly punctate, the punctures smaller and more distant than on the elytra. *Dimensions*, 11-11·5 × 3·5 mm.

Hab.—Ebor and Guyra (New England district), New South Wales (R. J. Tillyard and the author).

Three specimens under examination, without evident sexual distinction. A beautiful variegated species, nearest to *T. varicolor* Haag-Rut., but differing in its narrower form, the colours differently arranged, and having much coarser punctures on the prothorax and elytra. *C. varicolor* is, moreover, glabrous or nearly so. Compared with *T. columbina* Erichs., the colour is much more brilliant and various, the prothorax is less cylindric (more explanate on hinder half), the punctures on prothorax are smaller and less crowded, while those on the elytra are distinctly smaller, especially towards the apex. Its distinctions from the other described species are obvious. One specimen has the elytra greenish, with the suture coppery-purple, otherwise identical with the other two. Type in the author's Coll.

TITÆNA MINOR, n.sp.

Upper surface dark peacock-blue, pilose, suture of elytra brassy; underside, legs, antennæ and oral organs red.

Head and *prothorax* densely and (compared with other species) finely punctate, the latter thickly clad with long upright whitish hairs; very gibbous anteriorly, the lateral margins only evident near base from above, sides rather widely rounded, all angles obtuse, the posterior very wide and subobsolete. *Elytra* evidently wider than the prothorax at base, and shortly cylindric, striate-punctate, the striæ shallow, the punctures moderately large (though smaller and closer than in any described species), the intervals with smaller punctures sometimes irregular (near the suture), sometimes in rows, pilose (with more sparse clothing than the prothorax), segments of abdomen longitudinally striate and finely punctate, mesosternum coarsely punctate. *Dimensions*, 6 × 2 mm.

Hab.—Tambourine Mountain, South Queensland (the author)

Several specimens taken by Mr. A. M. Lea, and the author, at night, on fences, in January, 1912, of which four are under examination. The smallest (except *T. tasmanica* Champ.), and the most finely sculptured species in the genus. From Champion's species, it differs in colour, clothing, and sculpture, the punctures everywhere finer and nowhere variolose. The prothorax has a reddish tinge, when viewed from the side, in some cases. Types in the author's Coll.

EXPLANATION OF PLATES VI.-VII.

Plate vi.

Fig.1.—*Platyphanes Clarki.*
Fig.2.—*P. chalcopteroides.*
Fig.3 —*P. Frenchi.*
Fig.4.—*P. ellipticus.*
Fig.5.—*P. parallelus.*
Fig.6.—*P. minor.*
Fig.7.—*P. quadrifoveatus*, var. *subangulatus*,
Fig.8.—*P. quadrifoveatus.*
Fig.9.—*Bolbophanes Dumbrelli* Lea.
Fig.10.—*B. rugatus.*
Fig.11.—*B. varicolor.*
Fig.12.—*Toreuma cupreum.*
Fig.13.—*Chlorophanes punctipennis.*
Fig.14.—*Mitrephorus convexicollis.*

Plate vii.

Fig.1—*Prophanes brevispinosus.*
Fig.2.—*P. ducalis.*
Fig.3.—*Trisilus femoralis* Haag (at first, misdetermined by the author as a new species).
Fig.4.—*Cyclophanes gloriosus.*
Fig.5.—*C. variegatus.*
Fig.6.—*C. splendens.*
Fig.7.—*Chartopteryx imperialis.*
Fig.8.—*C. planus.*
Fig.9.—*Mœrodes Kershawi.*

Some loss of antennæ and tarsi is due to the breaking loose of a specimen in the box sent to Mr. MacIntosh, who kindly took the original photographs.

ORDINARY MONTHLY MEETING.

April 30th, 1913.

Mr. W. S. Dun, President, in the Chair.

Mr. Berkeley Harrison, Burringbar, N.S.W.; Mr. Gerald F. Hill, Darwin, N.T.; Professor A. A. Lawson, University of Sydney; and Mr. Alex. H. Turnbull, Wellington, N.Z., were elected Ordinary Members of the Society.

The President announced that, under the provisions of Rule xxvi., the Council had elected Messrs. A. H. S. Lucas, M.A., B.Sc., J. R. Garland, M.A., C. Hedley, F.L.S., and W. W. Froggatt, F.L.S., to be Vice-Presidents; and Mr. J. H. Campbell [Royal Mint, Macquarie Street] to be Hon. Treasurer, for the Session 1912-13.

The Donations and Exchanges received since the previous Monthly Meeting (26th March, 1913), amounting to 10 Vols., 69 P art or Nos., 8 Bulletins, and 3 Reports, received from 53 Societies, &c., were laid upon the table.

NOTES AND EXHIBITS.

Mr. D. G. Stead reported that the heavy easterly and south-easterly seas experienced during the early part of the month, had caused considerable destruction of the fauna along the ocean littoral. This, however, was not so great as on the occasion previously recorded (These Proceedings, 1912, p.390). At Port Macquarie, numbers of Flat-tail Mullet(*Mugil peronii*), Silver Mullet(*Mugil georgii*), and Sand Mullet(*Myxus elongatus*), and a few Blackfish(*Girella tricuspidata*) were washed ashore on the south side of the breakwater. At Stockton Beach, Newcastle, during the height of the storm, many Sea Mullet(*Mugil dobula*), Freshwater Mullet(*Trachystoma petardi*), Black Bream(*Chrysophrys australis*), Sand Whiting(*Sillago ciliata*), Blackfish, and Jewfish(*Sciæna antarctica*), and a Dart (*Trachinotus baillonii*), were washed up. One of the Jewfish weighed 60lbs., and another 24lbs., while many of the Mullet measured from 10 to 16 inches; and this will indicate the severity of the storm. The Freshwater Mullet were brought out of the Hunter River by a heavy freshet then running. At Tuggerah Lakes, many Black Bream were enabled to enter the Lakes over the sandspit separating the latter from the sea, the waves washing right over. At Lake Illawarra (the entrance to which is also closed), through the same cause, many Eels(*Anguilla reinhardtii*) and Black Bream were enabled to reach the ocean from the Lake. At Manly Beach, a large Albatross(*Diomedea*) was washed ashore. The invertebrate fauna and the flora of the reefs and bumboras had also suffered considerably. At Cronulla, on the 29th March, after several days of strong south-west winds, a Little Penguin(*Eudyptula minor*) was found standing on the rocks, near Glaisher Point, in an almost exhausted condition.

Mr. T. Steel exhibited shells of the common snail, *Helix aspersa*, eaten by the common brown rat at Petersham. In each case the apex of the shell was nibbled away so as to permit of the ready extraction of the mollusc. He also mentioned that Mr. Arthur Yates, seedsman, had reported to him that a stray rat which got into one of his firm's orchid-houses at Exeter, had practically exterminated the snails, which were previously somewhat of a pest.

Mr. Fred Turner exhibited and offered observations on: (1) *Echinopogon ovatus* Beauv., the "Rough Bearded Grass." This species was forwarded by Mr. C. J. Campbell, Rangers' Valley, Dundee, New England, to Messrs. Anderson and Company, Seedsmen and Plant Merchants, Sydney, who sent it to Mr. Turner for identification and report. Mr. Campbell writes: "This grass has appeared in the district of late years, and has the effect of giving young cattle and sheep the 'staggers,' which in many cases cause death. If you can give me any information regarding the above, I shall be obliged." *E. ovatus*, in one form or another, is fairly common in the coast-districts of all the States of the Commonwealth, and is recorded in Turner's botanical survey of New

England, where it was first discovered by Mr. C. Stuart; also in Dr. James Norton's "Vegetation of Springwood, Blue Mountains." The leaves of this grass are very scabrous, the asperities being erect on the upper surface, and reversed on the underside of the laminæ and on the sheaths. The spike-like bearded panicle is also very rough to the touch. It is probably owing to these circumstances, that the grass caused irritation in the alimentary canal of stock that had eaten of it, and brought on the symptoms referred to. *E. ovatus* was figured and described by Mr. Turner, in the Government "Agricultural Gazette," (Vol. iii., p.388).—(2)*Panicum capillare* Linn. This species is indigenous to Europe, Asia, and North America, and is now apparently acclimatised in Australia. It was found near the Botany Sewage Farm by the exhibitor. Although a highly ornamental grass, it is only of annual duration. In America, this species is popularly called "Old Witch Grass," or "Fool Hay," and is reported to be common in several of the States, and growing principally on sandy soils.—(3)A fasciated growth of *Cassia candolleana* Vogel,(= *Cassia bicapsularis* Linn.). Although Mr. Turner had cultivated this profusely flowering South American shrub for many years, he had never hitherto seen it in the condition exhibited.

Mr. W. W. Froggatt showed a number of flowers of the Oleander(*Nerium Oleander* Linn.), received from Mr. G. Ryder, Quanda Station, Gulargambone, N.S.W., containing specimens of Diptera, Hymenoptera, and Lepidoptera, caught and held by their probosces, in the manner described and figured by Mr. E. Jarvis in a recent number of the Queensland Agricultural Journal (xxx., p.263, April, 1913). Five species of flies were represented, including two specimens of *Lucilia cæsar*, three of *Calliphora oceaniæ*, one of *Helophilus bengalensis*, together with an undetermined Syrphid and Muscid. The other victims comprised a noctuid moth and a hive-bee.

Mr. L. Harrison exhibited two specimens of an undetermined Hippoboscid fly, forwarded by Mr. R. Blacket, and taken upon a Grey Magpie(*Strepera versicolor* Lath.), one specimen showing, attached to the hairs of the dorsal surface of the abdomen, fourteen individuals of an undescribed species of *Degeeriella* (*Mallophaga*); also a Hippoboscid forwarded by Mr. A. S. Le Souëf, taken upon a Regent Bird(*Sericulus chrysocephalus* Lewin), from the Nambucca River, with a single individual of *Degeeriella hectica* Nitzsch, attached to the hairs on the right side of the abdomen. Sharp(Proc. Ent. Soc. Lond. 1890, p.30) records the capture of several specimens of a mallophagous insect from an *Ornithomyia* taken on the wing. Mjöberg (Arkiv för Zoologi, Band vi., 1910, p.10) records taking specimens of *Philopterus leontodon* Nitzsch, attached to Hippoboscids from a Starling (*Sturnus vulgarus* Linn.). Both these authors have suggested the possibility of Mallophaga habitually making use of dipterous parasites to effect transfer from a dying, or dead, to a new, host. The additional examples now brought forward, would appear to strengthen this possibility. But *Degeeriella* and *Philopterus* are genera, the individuals of which die a few hours – at most, two days —after the death of their host, first attaching themselves, by their mandibles, to some part of the feathers. Death appears to be due simply to the fall in temperature, following upon the death of the host. There is thus another possibility, namely, that the mallophagous insects which find a Hippoboscid upon the body of a dead host, fasten upon it, as its body temperature is above that of the defunct bird, without any intent, conscious or otherwise, of seeking transport to a new host. This would seem the more reasonable view to take, and it still allows the possibility of infection of a new host by parasites carried by a Hippoboscid.

Dr. Dodd reported the deaths of some animals tethered near a garden plant of the South African *Acokanthera spectabilis* Benth., [N.O. *Apocynaceæ*] which showed symptoms of poisoning; and he asked for information as to the toxic properties of this plant.

Mr. Lucas showed a beautiful series of marine algæ, collected and mounted by himself.

Mr. Maiden exhibited photographs of (*a*) a female cone of *Macrozamia Moorei* F.v.M., from Springsure, Q., rather more than 2 ft. long; (*b*) illustrating syncarpy (3 fruits) in *M. Perowskiana* Miq., in a plant in the Botanic Gardens, Sydney; (*c*) a hybrid from *Acacia Baileyana* ♂ and *A. decurrens* var. *mollis* ♀; Mr. H. L. White, of Belltrees, Scone, found this form in his garden, under a tree of the latter; the hybrid exhibits characters almost strictly intermediate between the two species.

Dr. D'Ombrain showed portion of a plank of Oregon Pine showing the ravages caused by a molluscan marine Wood-borer (*Nausitoria saulii* Wright) during immersion in the waters of Sydney Harbour.

Mr. McCulloch exhibited a freshwater turtle taken in the salt water of the Parramatta River during dry weather, when the ponds had dried up; on being restored to fresh water, the animal seemed indifferent to the change.

Mr. A. A. Hamilton showed specimens of two introduced plants from the National Herbarium, which, he believed, had not previously been recorded from New South Wales, nor the first from Australia—*Paronychia chilensis* DC., (near Melbourne, H. B. Williamson; Randwick, Sydney, A. A. Hamilton); and *Caucalis nodosa* Scop.,(Inverell, E. S. Thomas). Also a specimen of *Leucopogon appressus* R.Br., a rare plant in New South Wales (Cheltenham, Ryde-Hornsby; E. Cheel).

Mr. E. Cheel exhibited an interesting series of specimens of species of *Eragrostis* represented in the National Herbarium collection, and invited special attention to the remarkable similarity of the morphological characters, which causes considerable difficulty in determining the various species, as will be seen from observations offered in connection with the respective species. *Eragrostis pilosa* Beauv.: Waterworks, Brisbane, Q. (J. L. Boorman). These are the only Australian specimens represented in the collection. There are, however, several sheets of specimens from New Caledonia, India, and South Africa, which are identical with the Queensland specimen quoted above, as will be seen by comparing the specimens with *E. pilosa* from Natal, S. Africa, distributed by J. Medley Wood, No.6058. This seems to be chiefly confined to the warmer regions, and is everywhere regarded as a common weed, and of no value as a fodder-grass. It is interesting to note, that the Queensland specimen shows the hairs at the base of the branches of the panicle, which originally gave rise to the specific name. The following series of specimens, included under *E. pilosa*, appear specifically distinct from that species, and exactly agree with Robert Brown's description of *Poa pellucida*(Prodromus, p.181, 1810), which is included as a synonym under *E. pilosa* by Bentham(Fl. Aust., vii., p.645). New South Wales: Greenridge, near Casino(D. J. McAuliffe); Narromine(R. Helms); Zara, viâ Hay(Miss E. Officer); Merrygoen, viâ Mudgee(F. H. Brown); Euabalong, Tabulam, and George's Creek (J. L. Boorman); Narrabri (J. H. Maiden); Inverell (E. Thomas); Tongo Station, Wilcannia(W. J. Hourigan); Yandama, Waverley Downs and west of the Paroo River(A. W. Mueller); Bourke(D. W. F. Hatton); New England(C. Stuart). There are also cultivated specimens from Hawkesbury Agricultural College, Richmond, Bathurst, Yanco, Wollongbar, and Botanic Gardens, Sydney. A specimen in the herbarium of the late Rev. Dr. W. Woolls is from Richmond, and one from Sydney, collected by E. Betche. Queensland: Darling River(Dallachy); Jericho and Rockhampton(E. Simmons); Warwick(J. L. Boorman). N. W. Australia: (A. W. Crawford). On the various farms, this is referred to as the "irrigation pilosa," and it is regarded as a very valuable fodder-grass, in contradistinction to the "cultivation paddock pilosa," which is spoken of as a useless weed. The transparent glumes, with almost obsolete lateral nerves, and more numerous flowers in the spikelets, together with the absence of hairs in the axils of the branches of the inflorescence, and the thickened base of the panicle-branches, as well as the more robust growth, readily separate this form from the true *E. pilosa* Beauv. The figure in "The Agricultural Gazette of New South Wales" (iii., 1904, 149), by Mr. F. Turner, together with a specimen from the "Interior" labelled *E. pilosa*, in Mr. Turner's handwriting, also belong to this series. I would suggest that it be called *E. pilosa* var. *pellucida*.—*E. Purshii* Schrad.: Government Domain(J. H. Camfield); Hyde Park(E. Cheel); Botanic Gardens (W. F. Blakely); Centennial Park, cultivated from seeds collected at Blackheath by the late W. Forsyth(A. A. Hamilton); Wollongbar and Wagga Experimental Farms(E. Breakwell); Hawkesbury College(C. T. Musson and W. M. Carne). This species is frequently confused, and has been mixed up with *E. pilosa;* and, like that species, is chiefly found in plantations and cultivation-paddocks, and is useless as a fodder-plant.—*E. interrupta* Beauv., var. *tenuissima* Stapf,(Syn. *E. tenella* Benth., Fl. Aust., vii., 643; not Beauv.). SOUTH AUSTRALIA: Oodnadatta(without collector's name). WEST AUSTRALIA: King George's Sound (W. W. Froggatt); McArthur River(A. G. Martin and W. V. Fitzgerald); King River, Lennard River, Barnett River, Fitzroy River, Denham River(W. V. Fitzgerald); Murchison District(C. Walter). N. W. AUSTRALIA (A. Crawford). QUEENSLAND (E. Palmer). This was figured by Bailey, under the name of *E. tenella*, but afterwards corrected (in his Queensland Flora, vi., p.1903), and mentioned as "a fine sheep pasture grass of the western districts of Queensland." E. Palmer calls it "Swamp-Grass, Flinders and Mitchell, poor fodder-grass."—*E. plumosa* Link,(Syn., *E. tenella* Beauv.). There are specimens of this species from Funafuti(Mrs. David and C. E. Finckh); Apia, Samoa(Dr. B. Funk); Jaluit, Marshall Islands(E. Betche, and Dr. Schee); Fiji(F. Wernham); and from Cook or "Tarawa" Island, Gilbert Group(F. R. Best), but no specimen from Australia.—*E. Dielsii* Pilger, in Engler's Bot. Jahrb., xxxv., 1907, p.76. This includes *E. falcata* of Bentham(Fl. Aust., vii., 649, but not of Gaud.). It is also pointed out by Pilger(*loc. cit.*) that *E. falcata* Gaud., includes *E. lacunaria* F.v.M. in Benth., Fl. Aust.—*E. trachycarpa* Domin, in Fedde's Repert., 1912,(Syn., *E. nigra* Nees, var. *trachycarpa* Benth.). Additional localities to those recorded in these Proceedings(xxvi., 1901, p.89) are Jillamalong Mountain, near Braidwood(J. L. Boorman); Deepwater(J. L. Boorman); Moona Plains (A. R. Crawford); and Bulga Ranges, Singleton District(Sylvester Browne).—Mr. Cheel showed, also, the fruit of the "Snake Gourd" (*Trichosanthes anguina* Linn.), cultivated in the Botanic Gardens, Sydney; and examples of a creeping species of *Xanthium*, probably *X. catharticum* H.B. & K., forwarded from Jerilderie, by Mr. J. T. Mackie, through the Chief Inspector of Stock; a weed which is capable of becoming perhaps a worse pest than the "Bathurst Burr." Also a hybrid Callistemon seedling raised from seed of *C. acuminatus* Cheel, crossed with pollen of *C. lanceolatus* DC.; the leaves of the hybrid show the characteristic prominent venation of *C. acuminatus*, but are not quite so acuminate.

Mr. J. G. Hunter showed specimens of an enormous Antarctic Pycnogonid, dredged in 25 fathoms off the coast of Adélie Land.

Mr. Fletcher showed four fruits, up to 8½ inches long, three in one cluster, of the North American *Tecoma radicans* Juss., a common plant in Sydney gardens, but which rarely fruits. The flowers are freely visited by honeyeaters; but these invariably get at the nectar by pecking holes in the corolla near the base, the tubular flowers being too deep for them.

Mr. J. E. Carne, F.G.S., showed a most interesting series of lantern views, illustrating a geologist's visit to New Guinea and Java.

STRATIGRAPHICAL GEOLOGY OF THE PERMO-CARBONIFEROUS SYSTEM IN THE MAITLAND-BRANXTON DISTRICT,

WITH SOME NOTES ON THE PERMO-CARBONIFEROUS PALÆOGEOGRAPHY IN NEW SOUTH WALES.

BY A. B. WALKOM, B.Sc., LINNEAN MACLEAY FELLOW OF THE SOCIETY IN GEOLOGY.

(Plates viii.-xiii., and ten text-figures.)

This paper is the result of about four months' fieldwork in the Hunter River District, the area examined during that period being bounded on the north by the Hunter River, and on the other three sides roughly by a line drawn through West Maitland, Mt. Vincent, Mt. View, and Belford, and also a small area north of the Hunter River, between West Maitland and Paterson.

The most important work done on this area is Professor David's memoir on "The Geology of the Hunter River Coal-Measures of New South Wales."* In that work, the coal-measures are worked out in detail, but the Lower Marine Series and the Upper Marine Series are not treated in as great detail as the coal-bearing series. It was with the object of obtaining a more detailed knowledge of these two marine series, that this work was done. One portion of the outcrop of the Greta Coal-Measures, namely, that extending south from Branxton, was not very well-known at the time Pro-

* Mem. Geol. Survey N. S. Wales, Geology No.4, 1907.

fessor David's work was published; but since then, a good deal of prospecting has been done along this part of the outcrop, and fresh information was obtainable, and is included in this paper.

To make the lists of fossils as complete as possible, fairly large collections were made, and these have been supplemented by records of localities of fossils, from the publications of the Geological Survey of New South Wales, and from the "Catalogue of Australian Fossils," by R. Etheridge, Jr. In many cases, however, the record of the locality of fossils is not definite enough to permit of their horizon being determined. Only cases where the locality is sufficiently definitely stated, have been used in completing these lists. The map which accompanies the paper (Plate ix.) is part of Professor David's Map of the Hunter River Coal-Measures, published by the Geological Survey of New South Wales, in 1907, with additions which have resulted from my field-work.

Lower Marine Series.

The development of the Lower Marine Series varies considerably in different parts of the district; vertical sections have been obtained in three places, and are shown in Figs. 1-3. In Fig. 1 (p. 116), which gives the most typical section, and that in which the series is most completely represented, the series attains a thickness of nearly 4,800 feet. This section is taken from the occurrences in the area between Farley, Greta, and Cessnock. Fig. 2 (p. 117) gives the succession near the Carboniferous inlier of Mt. Bright, where there is a considerable overlap of the lower beds. Fig. 3 (p. 118) is taken along the Eelah Road, where there is also a considerable overlap.

The group of hills about one mile south-east of Lochinvar Township, of which Winder's Hill is the most prominent, is composed of a varied series of rocks of Carboniferous age. They include a variety of volcanic rocks, both acid and intermediate; and also sedimentary rocks, such as conglomerate, sandstone, and yellowish cherty tuff. These sedimentary rocks, in places, contain abundant plant-remains, such as *Rhacopteris,* which indicate that they are of Upper Carboniferous age.

Skirting the southern end of these Carboniferous rocks are the lowest beds of the Permo-Carboniferous System that occur in the Hunter River District, namely, the Lochinvar glacial beds. These can be traced, almost continuously, from a point just west of the village of Gosforth round to a point about half a mile south of the Hunter River, on the road from Lochinvar to Windermere, a total

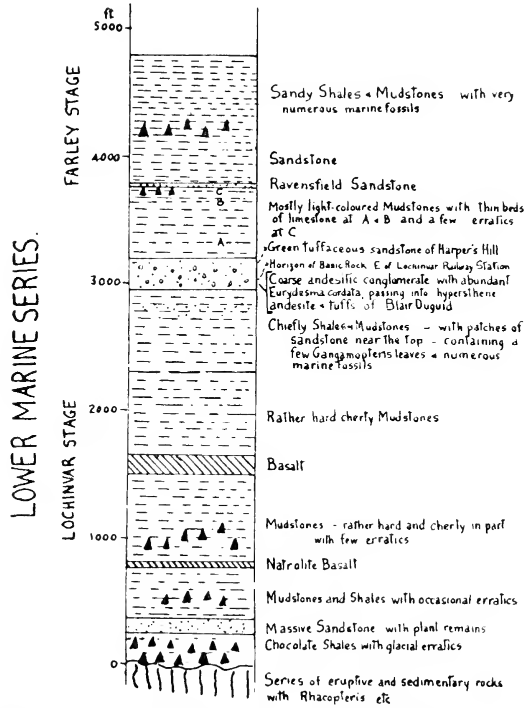


Fig. 1.—Vertical Section of Lower Marine Series in the Farley-Greta District.

distance of about five miles. In places, they are distinctly unconformable with the underlying beds. In portions 5 and 6, Parish of Gosforth, the Carboniferous rocks strike 225°, and dip to the south-east at high angles (58°-64°); and the strike of the glacial beds varies between 195° and 170°, and they dip at low angles (15° to 8°). They have been described by Professor David,* and consist of fine-grained, reddish-brown to chocolate-coloured shales, containing numerous boulders up to about 2 feet in diameter. Very many of these boulders are waterworn, but some are undoubtedly striated and faceted as a result of ice-action. Their thickness varies, a section near the north-west corner of portion 13, Parish of Gosforth, gives their thickness as about 150 feet, but further south, on Windella Estate, they are quite 250 feet thick. There is a good outcrop on the road from Lochinvar to Windermere, but the lower limit there is hidden under recent alluvial, so that the thickness is not determinable. No marine fossils have ever been found in these shales. The glacial beds are not found on the northern side of the Hunter River. At the eastern end of the Carboniferous rocks, near Eelah, they are overlapped by higher members of the Lower Marine Series: while, at the western end of the Carboniferous complex, the Elderslee fault has thrown the Upper Coal-Measures down against the Carboniferous.

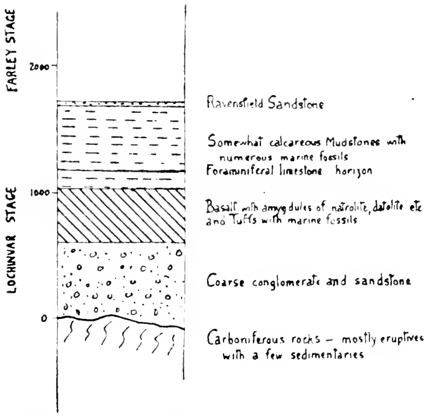


Fig. 2.—Vertical Section in the vicinity of Pokolbin and Mt. View.

Immediately overlying the chocolate shales, is a massive sandstone, about 100 feet thick; and no marine fossils have yet been reported from this. Careful search was made, at several points, in this sandstone for marine fossils, but without success. It contains, however, numerous plant-remains. There is a possibility, then, that this lowest part of the Lower Marine Series is of freshwater

* Journ. Proc. Royal Soc. N. S. Wales, 1899, xxxiii., pp. 154-159.

origin. As a new and extensive occurrence of the glacial beds has recently been described from the Kempsey District,* it would perhaps be as well to leave any further discussion of them until that area has been more fully worked out.

This stage is followed by an enormous development of marine sandstones and mudstones, with which are associated a number of contemporaneous lava-flows. There are, first, about 400 feet of gritty, ferruginous mudstone, followed by a flow of basalt, 50 feet thick, in which numerous small steamholes have become filled with secondary minerals, such as analcite, natrolite, calcite, etc.

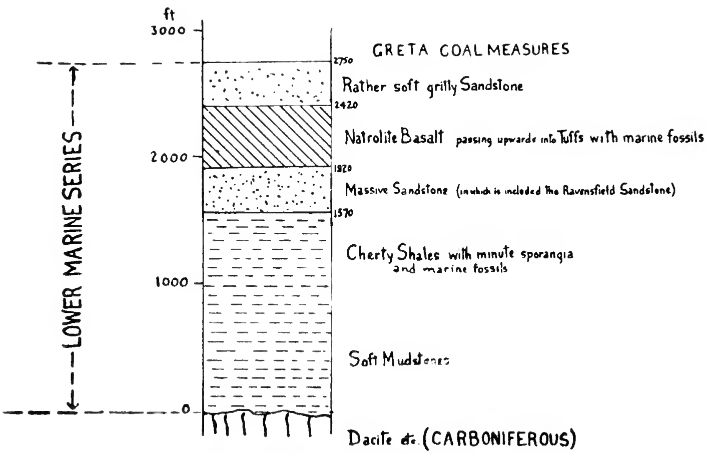


Fig.3.—Vertical Section obtained along Eelah Road.

Then come 700 feet of rather hard shales and mudstones, which contain a few erratics, followed by a basalt-flow, 150 feet thick. This is followed by 1,300 feet of shales and mudstones, which also contain a few erratics, and near the top of which, there are numerous small patches of calcareous sandstone. About 100 feet above the basalt, the shales are somewhat cherty, and contain veins filled with a red secondary material, probably chalcedony.

* W. G. Woolnough, Journ. Proc. Royal Soc. N. S. Wales, 1911, xlv. pp. 159-168.

It is in these beds that the lowest horizon for marine fossils in the series is found. About halfway up the series, and about 2,000 feet from the base of the marine series,* there is a zone in which *Ptycomphalina trifilata, P. nuda,* and *Gangamopteris* are found, the first-named being particularly abundant. This zone is exposed in a small quarry on the road, about half a mile north of Lochinvar Railway Station.

A little higher up in the mudstones, fossils become much more abundant, and the following have been found:—

Tribrachiocrinus sp	*Merismopteria*, sp.nov.
Indeterminate crinoid.	*Aviculopecten sprenti.*
Crinoid stems.	*A. tenuicollis.*
Fenestell (?) *internata.*	*A. englehardti.*
F.(?) *fossula.*	*A.* sp.
Stenopora tasmaniensis.	*Deltopecten subquinquelineatus.*
Spirifer duodecimcostata.	*D. farleyensis.*
S. stokesi.	*Mæonia* sp.
S. avicula.	*Pleurophorus.*
Martiniopsis subradiata.	*Notomya*(?).
var. *morrisii.*	*Pachydomus.*
cf. *morrisii.*	*Mourlonia.*
Productus cora var. *farleyensis.*	*Ptycomphalina trifilata.*
Strophalosia jukesi.	*Platyschisma.*
Chonetes sp.	*Conularia.*
Edmondia(?) *nobilissima.*	

In the sandstone patches, near the top of these mudstones, fossils are abundant, and comprise the following:—

Spirifer vespertilio.	*Pleurophorus* sp.
S. tasmaniensis.	*Pachydomus.*
Martiniopsis subradiata.	*Mourlonia rotundatum.*
Chænomya sp.	*Keeneia* (juv.).

* On p.322 of Professor David's Memoir, this is stated as 3,000 feet; it is probably a misprint, as on the vertical section accompanying that work, it is shown as about 2,000 feet.

Edmondia(?) nobilissima. *Conularia lævigata.*
Deltopecten subquinquelineatus. Plant-stems.
Mæonia, 3 spp.

One hundred and fifty feet below the top of these mudstones, (or 2,450 feet above the base of the marine beds), in a band of dark-coloured, sandy, calcareous mudstone, numerous specimens of the pseudomorph Glendonite were obtained. Further details of this are embodied in a separate note.

Following the mudstones, there is a development of a coarse conglomerate with large waterworn pebbles, chiefly composed of andesite, followed by a rather soft gritty sandstone, and then a rather coarse, greenish, tuffaceous sandstone. These together form a thickness of strata of about 250 feet. The conglomerate is known as the Allandale Conglomerate, and contains an abundance of large molluscs with thick shells, such as *Eurydesma cordata, Platyschisma oculus, Keeneia platyschismoides,* etc. The greenish, tuffaceous sandstone is the Harper's Hill Sandstone. These beds are only developed locally in the neighbourhood of Allandale. Towards the south-east, they seem to give place to a development of tuffs associated with the hypersthene-andesite of Blair Duguid Hill. This hypersthene-andesite mass is contemporaneous in the Lower Marine Series; the mudstones can be seen dipping under it at a gentle angle (9½°-10°) on its northern side, and they have practically the same dip at its western end, so that they, apparently, have not been disturbed by the volcanic rock. The centre of eruption must have been somewhere in the vicinity of Blair Duguid Hill, and the activity here was doubtless responsible for some of the blocks of andesite in the Allandale Conglomerate, as well as for the tuffaecous nature of the Harper's Hill Sandstone. The hypersthene-andesite contains a great number of steamholes filled with secondary material, and beautiful specimens of agate, chalcedony, etc., can be obtained. At the eastern end of the mass, near the junction of two creeks in portion 152, Parish of Allandale, masses of chert, up to about 18 inches in diameter, have been floated up in the lava. This chert resembles very much that in which Carboniferous fossils are found near Winder's Hill, and has probably been brought up from some considerable depth, as there would be nearly 3,000 feet of Permo-Carboniferous strata between this horizon and the underlying Carboniferous rocks.

Some distance to the east of Lochinvar Railway Station, there is a large mass of basic rock, which is on a horizon about 2,700 feet above the base of the marine beds; this, then, probably belongs to the same series as the volcanic rocks round Blair Duguid. In the opposite direction, to the north-west, the conglomerate seems to die out quickly, and give place to a thicker development of the Harper's Hill Sandstone, for there is no outcrop of the conglomerate on the main road to Singleton, going up Harper's Hill. Fossils are very numerous in these beds; in the railway-cutting, just over half a mile east of Allandale, there is a bed about 2 to 3 feet thick, composed mostly of the remains of thick shells like *Eurydesma cordata* and *Platyschisma*. The following is a list of fossils from these beds:—

Crinoid stems.	*Aviculopecten tenuicollis.*
Stenopora tasmaniensis.	*A. squamuliferus.*
S. aff. *tasmaniensis.*	*A. mitchelli.*
S. ovata.	*A. sprenti.*
Fenestella(?) fossula.	*A.* sp.ind.
Polypora.	*Deltopecten illawarrensis.*
Dielasma hastata.	*D. fittoni.*
D. sacculus.	*D. limaeformis.*
Martiniopsis subradiata.	*Eurydesma cordata.*
var. *morrisii.*	*Aphanaia* sp.ind.
cf. *morrisii.*	*Modiola crassissima.*
Spirifer vespertilio.	*Pleurophorus* sp.ind.
S. stokesi.	*Orthonota* sp.
S. tasmaniensis.	*Notomya* sp.
S. clarkei.	*N. cuneata.*
S. sp.ind.	*Pachydomus antiquatus.*
Solenopsis sp.	*P. laevis.*
Chaenomya etheridgei.	*P. ovalis.*
C. sp.	*Orthonychia altum.*
Allorisma curvatum.	*Platyceras,* n.sp.

Edmondia(?) *nobilissima.*
Palæarca subarguta.
Merismopteria macroptera.
M. n.sp.
M. sp.ind.
Avicula intumescens.
Ptycomphalina trifilata.
P. morrissiana(?).
Keeneia platyschismoides.
Platyschisma oculus.
P. depressa.
Conularia inornata.
C. lævigata.

Following the Harper's Hill beds, there are 560 feet of light-coloured mudstones, with two horizons of limestone-bands. The mudstones are somewhat calcareous, but, in the outcrops from which this section was obtained, they contain few fossils. Further south, however, near Pokolbin, there are numerous fossils in them (see later p.125). At about 130 feet above the base of the mudstones, there occur in several localities (marked *a* on the map) limestone-bands containing marine fossils, amongst which Fenestellidæ are abundant. The following fossils occur on this horizon :—

Stenopora.
Fenestella(?) *fossula.*
F.(?) *internata.*
Spirifer.
Aviculopecten squamuliferus.
Platyschisma.
Euomphalus(?).
Ptycomphalina.

In the cuttings, along the road from Allandale Railway Station to the main northern road, a number of small faults can be seen, which, however, cannot be traced on the surface. They appear to be a series of step-faults, with small throws to the north-east.

At 420 feet from the base of the same mudstones, there is another series of limestone-concretions at several places (marked β on the map), but these contain only very few fossils.

Almost at the top of these beds, just below the Ravensfield Sandstone, in portions 46 and 47, Parish of Heddon, there are a number of large granitic erratics.

The mudstones are the topmost beds of the Lochinvar Stage, and are followed by the Ravensfield Sandstone, the lowest beds of the Farley Stage.

The Farley Stage commences with the well-known Ravensfield Sandstone. This sandstone forms a very persistent horizon, and is from 12-20 feet thick. In the vicinity of Farley Railway Station, there is a considerable development of massive sandstone, reaching perhaps 200 feet in thickness, part of which is the Ravensfield Sandstone. The part which corresponds to the Ravensfield Sandstone, and which has been quarried for building-stone, is about the middle of this massive sandstone. It is difficult, however, to make a division-line in this sandstone, and the whole of it has here been included with the Farley Stage. A similar occurrence is met with on the Eelah Road, and will be described later(p.126). There are numerous conglomerate patches in the Ravensfield Sandstone, and they contain a varied and abundant marine fauna, amongst which are the following:—

Lasiocladia.
Palæaster clarkei
P. stutchburii.
P. giganteus.
Fenestella(?) fossula.
F.(?) sp.
Dielasma cymbæformis.
D. biundata.
D. sp.
Spirifer tasmaniensis.
S. duodecimcostata.
S. sp.
Cyrtina(?).
Martiniopsis subradiata.
var. *morrisii.*
Solenopsis sp.
Cardiomorpha(?).
Chænomya mitchelli.
C. etheridgei.
C. n.sp.
Edmondia(?) nobilissima.
Aviculopecten squamuliferus.
A. profundus.
Aviculopecten tenuicollis.
A. sprenti.
A. mitchelli(juv.).
Deltopecten limæformis.
D. subquinquelineatus.
D. farleyensis.
D. fittoni.
Eurydesma cordata.
var. *ovale.*
Mæonia carinata.
Pleurophorus.
Pachydomus.
Astartila corpulenta.
Lamellibranch (new genus).
Platyceras altum.
Platyschisma.
Ptycomphalina trifilata.
Conularia tenuistriata.
C. inornata.
Hyolithes lanceolatus.
Goniatites micromphalus.
Orthoceras, 2 spp.

Perhaps the best outcrop of this is to be seen at Browne's Ravensfield Quarry, about three miles south-west from Farley Railway Station, where good collections can be obtained.

These sandstones are followed by a series of sandy shales and mudstones, and the whole stage attains a thickness of from 800 to 1,000 feet. The mudstones are, in general, light-coloured, but some bands are much impregnated with iron, and have become stained quite red. Fossils are very numerous, and good collections can be obtained from both the road and railway-cuttings near Farley Railway Station. The following is a list of fossils from the Farley beds:—

Dielasma sacculus.
D. cymbæformis.
D. biundata.
D. amygdala.
D. inversa.
D. hastata.
Spirifer duodecimcostata.
S. stokesi.
S. tasmaniensis.
Martiniopsis subradiata.
var. *morrisii.*
var. *koninchi.*
Productus cora var. *farleyensis.*
P. fragilis.
Rhynchonella.
Chonetes.
Cardiomorpha gryphioides.
Edmondia(?) nobilissima.
Aviculopecten squamuliferus.
A. tenuicollis.
A. sprenti.
A. englehardti.
Aphanaia sp
Mytilus bigsbyi.
Modiolopsis.
Maonia.
Pleurophorus sp.
P. gregarius.
Stutchburia farleyensis.
Pachydomus.
Platyschisma oculus.
P. rotundatum.
Conularia inornata.
Goniatites micromphalus.

In the upper 200 feet of these beds, *Nuculana waterhousei*, which does not appear in the lower part, is of fairly frequent occurrence.

An interesting and somewhat different vertical section is obtained in the vicinity of Pokolbin and Mt. View (Fig.2). More than 2,000 feet of the Lochinvar Stage have been overlapped in this part. The lowest member of the stage here is a coarse conglomerate and sandstone, at least 600 feet thick, which is on about the same horizon as the Harper's Hill beds further north. Their thickness is rather difficult to estimate at all accurately on account of some doubtful faulting which occurs just north-east of Mt. View, but it is quite 600 feet, possibly more. This conglomerate was evidently deposited close to the old Carboniferous islands, the rocks of which have been described elsewhere.* The conglomerate is here followed by a development of basalt and tuffs, attaining a thickness of about 440 feet. The basalt contains numerous steamholes filled with such minerals as natrolite, datolite,† analcite, etc. The tuffs overlie the basalt, for the most part, and contain marine fossils. The position of the centre from which these basalts and tuffs were poured out, is doubtful. A couple of small patches of olivine basalt have been observed, quite isolated and in the midst of the acid volcanic rocks of the Carboniferous inlier of Mt. Bright. The most reasonable explanation of these occurrences seems to be, that they are old volcanic necks, and they may represent the old pipes from which this series was erupted. The tuffs are followed by 650 feet of calcareous mudstones. One hundred and fifty feet above the base of these mudstones, there is a well-marked development of limestone containing numerous well-preserved Foraminifera, which have been described by Messrs. Chapman and Howchin.‡

This bed of limestone is on the same horizon as those mentioned above(p.122). Ostracods are found in these beds, as well as numerous marine fossils, *e.g.*

Crinoid stems.
Stenopora tasmaniensis.
Fenestella(?), 2 or 3 species.
Protoretepora.
Spirifer tasmaniensis.
S. duodecimcostata
Martiniopsis subradiata.
Aviculopecten mitchelli.
Aviculopecten tenuicollis.
A. sprenti.
A. squamuliferus.
Deltopecten farleyensis.
Mæonia carinata.
Pachydomus, 3 or 4 species.
Ptycomphalina(?).

* Journ. Proc. Royal Soc. N. S. Wales, 1911, xlv., pp.379-408.
† C. Anderson, Rec. Austr. Museum, 1904, v., pp.127-130.
‡ Mem. Geol. Survey N. S. Wales Palæontology, No.14, 1905.

The other section of the Lower Marine Series to be described, is that obtained along the Eelah Road(Fig.3). Here, resting directly on Carboniferous rocks, there is a large development of mudstones and cherty shales. These attain a thickness of about 1,570 feet, and there has been an overlapping of more than 2,000 feet of strata below them. The mudstones are in the lower portion, and have been more easily eroded than the cherts, and so the former show few outcrops. The cherty shales, however, give good outcrops, and, near the top, a few marine fossils have been found. These include

Crinoid stems.	*Eurydesma cordata.*
Spirifer tasmaniensis.	*Pachydomus.*
S. vespertilio.	*Platyschisma.*

These shales are followed by about 350 feet of massive sandstone. This contains the equivalent of the Ravensfield Sandstone, which has been quarried extensively at Comerford's Quarry. This thick development of sandstones is similar to that mentioned near Farley Railway Station, and, as in that case, it has been included with the Farley Stage.

Above the sandstone, there is a thick series of basalt and tuffs. The basalt contains steamholes which have become filled with secondary minerals, such as calcite, natrolite, etc. The tuffs contain numerous fossils, amongst which are

Fenestella(?) fossula.	*Aviculopecten mitchelli.*
Stenopora.	*A. tenuicollis.*
Spirifer tasmaniensis.	*Mæonia carinata.*
Martiniopsis subradiata.	*Platyschisma oculus.*
Eurydesma cordata.	

In the areas previously described, the development of basalt and tuffs has been confined to the Lochinvar Stage, but here there seems to be no doubt but that the volcanic activity took place during the deposition of the rocks of the Farley Stage. This area must have been close to the shoreline at this time, as indicated, by the abundance, in the tuffs, of thick-shelled molluscs, which inhabit shallow, turbulent waters. These tuffs are overlain by a series of a little over 300 feet of brownish sandstones, which are followed by the Greta Coal-Measures.

The Greta Coal-Measures.

Professor David mapped the outcrop of these Measures, and gave numerous detailed sections of the coal-seams developed at many points along the outcrop. At the time of publication of his work,* however, very little information was obtainable about the development between Branxton and Pokolbin.† Since that time, a new colliery (the Rothbury Colliery) has been opened, and the coal prospected at three other points along the outcrop on Rothbury Estate. To the manager of this colliery, Mr. Richard Thomas, Jr., I am indebted for most of the information contained in this section. The four separate points at which sections of the seams have been measured are :

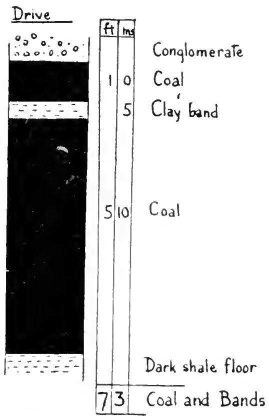


Fig.4 Section of Upper Seam at Rothbury Collieries

(1.) Rothbury Colliery (on portion 26, Parish of Branxton).

(2.) Where the outcrop crosses Black Creek.

(3.) In portion 17, Parish of Rothbury.

(4.) Where the outcrop crosses Rothbury Creek.

(1.) Rothbury Colliery.—As seen from Plate viii., the most complete section has been obtained at this point. Underneath a solid conglomerate-roof, there is a 7 feet 3 inches seam (see Fig.4).

* Mem. Geol. Survey N. S. Wales, Geology, No.4, 1907.

† *Op. cit.*, pp.138-140.

Exposure to the atmosphere gives a yellowish tinge to the surface of the coal from this seam, and a small amount of sulphur is deposited in the cracks. Although no crystalline pyrites has been observed, there is probably a small percentage of it in the coal; and this sulphur has been set free during the oxidation of the pyrites to iron sulphate ($FeSO_4$). This seam has a floor of dark shale, and then, for a thickness of about 60 feet, the strata are chiefly sandstones and a massive conglomerate. Then follows the best seam of this locality. Within a very short distance (only a few yards) of the outcrop, the seam is 12 feet 6 inches thick; and, at 170 yards in, along the tunnel, the seam has thickened to 14 feet $4\frac{1}{2}$ inches, including bands (see Fig.5).

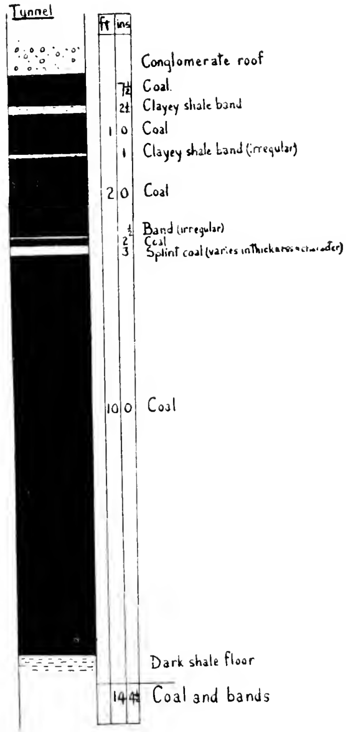


Fig 5 Section of coal seam at Rothbury Collieries

The lower ten feet of this seam is being worked at the Rothbury Colliery. The seam dips N.55° W. at $18\frac{1}{2}$°, and consists of hard, semibituminous coal.

Analyses of some Coals from the Lower Split of the Main Greta Seam.

	i.	ii.	iii.	iv.	v.	vi.
Hygroscopic moisture	2·35	1·87	1·54	2·38	2·10	1·58
Volatile hydrocarbons	40·74	40·63	42·05	41·01	41·45	42·72
Fixed carbon	51·11	50·52	49·29	51·70	49·74	50·30
Ash...	5·80	6·98	7·12	4·91	6·71	5·40
Sulphur	0·694	0·766	0·862	1·159	0·947	0·873
Sp.Gr.	1·290	1·303	1·304	1·282	1·251	1·272
Coke	56·91	57·50	56·41	56·61	56·45	55·70
Lbs. of H_2O converted to steam by 1lb. coal	13·5	13·5	12·9	13·3	13·0	13·5

i. Rothbury Colleries* (No.1 sample). Coke fairly swollen, firm and lustrous. Ash, grey in colour; semigranular.

ii. Rothbury Colleries* (No.2 sample). Coke fairly swollen, firm and lustrous. Ash grey; semigranular.

iii. Ebbw Main, Greta.† Bands picked out; coke fairly swollen, firm and lustrous. Ash buff-coloured; semigranular.

iv. Stanford Merthyr.‡ Coke slightly swollen, firm and lustrous. Ash buff-coloured; semigranular.

v. Pelaw Main.§ Coke well swollen, firm and lustrous. Ash light reddish tinge; semigranular.

vi. Hebburn.‖ Coke fairly swollen, firm and lustrous. Ash pink; semigranular.

The above table gives analyses of two samples of coal from the Rothbury Collieries; and analyses, for comparison, from the same seam in four other collieries. The Rothbury coal is very suitable for gasmaking and steaming, and also makes a good coal for household purposes. It gives only a small percentage of small coal, and is a good coal for shipment, as it stands handling well.

This seam has a floor of dark shale, and the sandstone and conglomerate have been proved for about 20 to 24 feet below. Then there is a gap of approximately 20 feet, in which the strata

* Analyses kindly supplied by Mr. Richard Thomas, Jr., Manager.

† E. F. Pittman, "The Coal Resources of New South Wales." Geological Survey of N. S. Wales, 1912, p.68.

‡ *Idem*, p.75. § *Idem*, p.73. ‖ *Idem*, p.69.

have not been touched by prospecting shafts, but there is little doubt that this portion is composed of sandstone and conglomerate. Below this, the section is given in a shaft some 185 feet east of the main tunnel mouth. The section of this shaft is(Fig.6):

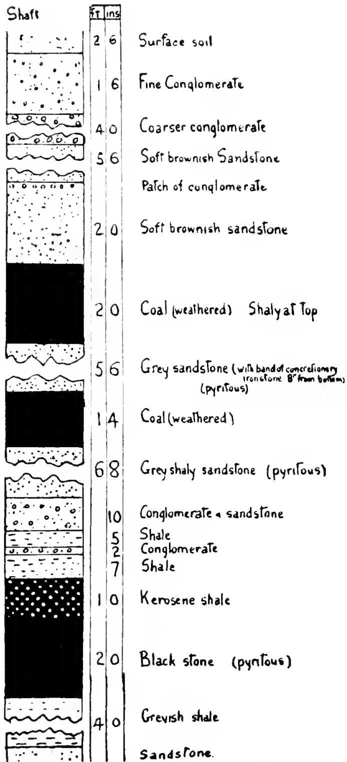


Fig 6 Section of Bottom Seams at Rothbury Colliery

It shows a couple of weathered seams of coal, and a band of about one foot of kerosene-shale. In this lower part of the section, there is a sprinkling of small crystals of pyrites through the shale and sandstone, and also through the two feet of "Blackstone" at the bottom. The coal shown by the shaft is very weathered, and of no use; but it is, of course, possible that, further in from the outcrop, it may lose its weathered character. The greyish, shaly sandstone, between the seams, contains fairly abundant plant-remains, amongst which *Glossopteris* is the most prominent; some of the stems of these plants are replaced by pyrites.

(2.)Black Creek.—At Black Creek, about one mile south of the Rothbury Collieries, two seams can be seen, corresponding to the two upper ones at the first locality. The top one of these two seams has not been prospected, but a tunnel in the lower one revealed the following section(Fig.7, p.131).

It was near the position of this tunnel that Professor David had a shaft put down some years ago,* and obtained 9 feet, 9

* *Op. cit.*, p.139.

inches of coal and bands. The newer section gives a greater thickness of coal and bands (11 feet, 0½ inch), thus bearing out Professor David's opinion that the seam, being somewhat perished in his shaft, would probably be found to have a greater thickness.* There is a small band of white clay just below the top seam. The two seams at this point are about 40 feet apart, and their dip is N.47°W. at 24°.

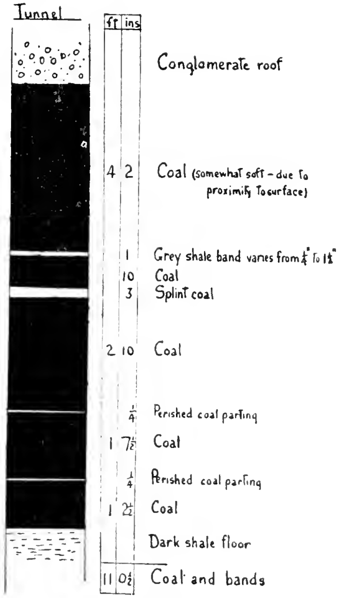


Fig 7 Section of Seam at Black Creek

(3.) Portion 17, Parish of Rothbury. – A small tunnel has been driven in portion 17, Parish of Rothbury, (about 1¾ miles south of the Black Creek tunnel), and a seam (with band) of 6 feet, 2 inches struck, giving the following section (Fig.8): —

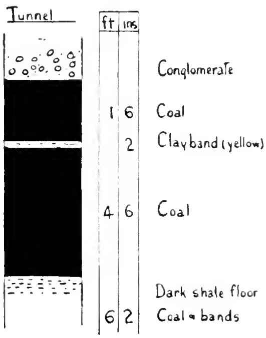


Fig 8 Section of Upper Seam on Portion 17 Par Rothbury

This seam is the equivalent of the top seam further north at the Rothbury Colliery. It does not quite attain the thickness of that seam, but, when exposed to the weather, the same yellow stain and sulphur-deposit are noted as at the Colliery. There is also a slight smell of H_2S in

* *Op. cit.*, p 140.

this old tunnel. These phenomena denote the presence of a small amount of pyrites in the coal.

(4.) Rothbury Creek.—Three-quarters of a mile further south, the outcrop crosses the Rothbury Creek. Here Professor David noted the outcrop of a coal-seam in the creek.‡ When I visited the spot, the outcrop in the creek was under water, but a shaft has been sunk for 39 feet, on the bank a few yards away, of which the following is a section(Fig.9):—

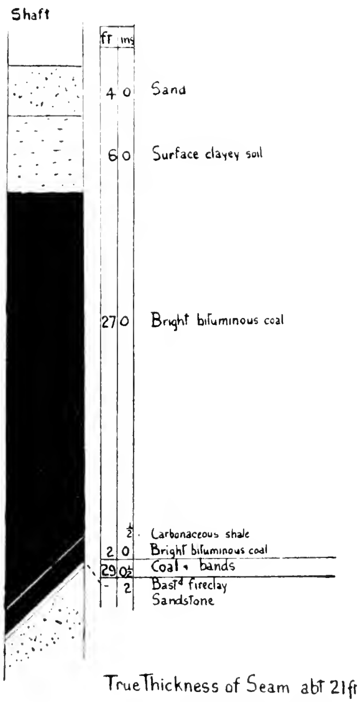


Fig 9 Section of Seam on bank of Rothbury Ck

It will be noted that the top boundary of the seam is horizontal, instead of dipping parallel to the bottom-edge. This indicates that the seam has been eroded somewhat. That this is so, is further indicated by the fact that, in the creek, there is a solid conglomerate dipping conformably just above the seam; while, in the shaft, there is no trace of the solid conglomerate, but only surface-sand and clayey soil. The seam dips N.60° W. at 45°, and has a thickness of at least 21 feet, and as the surface has been somewhat eroded, the thickness is probably somewhat more. It is a bright, bituminous coal of good quality, and

‡ *Op. cit.*, p.140.

apparently does not deteriorate readily on exposure, as the shaft had been made over two years at the time of my visit, and the coal, which had been lying about for that time, showed only a slight amount of surface-discolouration; and when broken open, was as bright and hard as coal freshly taken out. About 75 yards up the creek, there is an outcrop of another seam, but the water was too high for me to see it. However, Mr. R. Thomas, Jr., informed me that he had got specimens of coal *in situ* at that point, when the creek had been drier. At the point in the creek where this outcrop occurs, the boulders in the creek-bed are all coated black, and there is a very strong smell of H_2S.

Plate viii. is a series of comparative vertical sections of the various seams just described. On comparison with section No. x,* accompanying Professor David's Memoir, there seems little doubt but that the top seam, in each case, represents the upper split in the main Greta seam. This is further confirmed by the presence of pyrites, which is indicated in these seams. The lower split of the main Greta seam appears to have become further split between Rothbury Creek and Black Creek, and a bed of conglomerate and sandstone, some 60 feet thick, is developed between the two parts. The 14 feet, 4½ inches seam at the Rothbury Colliery, and the 11 feet, 0½ inch seam at Black Creek, represent the top part of this lower split; and the lowest seams at Rothbury Colliery represent minor splits of the bottom-part of the lower split. The 21 feet seam at Rothbury Creek probably represents the whole of the lower split of the main Greta seam.

Summary of Greta Coal-Measures in this district.

The main Greta seam, or part of it, has been prospected in four places, and the seam is split as at other localities.

In each of the four localities, the upper split of the main Greta seam has been struck.

The lower split seems to be entire at Rothbury Creek, but splits further to the north.

---

* Section No. x is a comparative series of vertical sections of the Greta coal-seams.

The upper split contains a small amount of pyrites; in the top part of the lower split, no trace of this mineral has been observed; in the sandstone and "black-stone" associated with the bottom part of the lower split, there is a small percentage of pyrites.

The dips are in directions N.47°W. to N.60°W., and increase in amount as they get further south, *i.e.*, as they approach nearer to the eastern branch of the Elderslee fault. The band of conglomerate, between the two splits, appears to thicken very considerably towards the south.

The amount of perishing of the seams near the surface does not appear to be so great here as in the eastern and southern portions of the Greta Coal-Measures outcrop.

Upper Marine Series.

The Upper Marine Series, in the Hunter River District, occupies a much larger and more widely scattered area than the Lower Marine Series, and, for that reason, could not be studied in as much detail as the latter, in a comparatively short time. Examination of a number of the most typical exposures, however, enables one to form a fairly accurate estimate of the succession.

Whereas sedimentation in Lower Marine time was interrupted at frequent intervals by outbreaks of volcanic activity, in the Upper Marine of this district there were no such volcanic outbursts, and the sedimentation was uninterrupted. It must be remembered, however, that this is not true for other areas of Upper Marine sedimentation, *e.g.* in the South Coast District, there is abundant evidence of volcanic activity in Upper Marine time.*

The Upper Marine Series has been divided into three stages, namely, the Branxton, Muree, and Crinoidal Stages, by Professor David.†

* Jaquet, Card and Harper, Rec. Geol. Surv. N. S. Wales, 1905, viii., Pt.1.—Card and Jaquet, Rec. Geol. Surv. N. S. Wales, 1903, vii., Pt.3.

† *Op. cit.*, p.319.

The lowest (Branxton) stage is from 3,000 to 3,200 feet thick, and follows immediately on the Greta Coal-Measures. This stage might be divided into two parts, (1) *lower*, with a thickness of about 1,400 feet; and (2) *upper*, 1,600 to 1,800 feet thick. The lower part consists of hard, massive, white to brown sandstone, often passing into conglomerate. In the lower 900 ft, the sandstone is often considerably iron-stained, and contains occasional bands of ironstone. At 900 feet from the base, there is a bed about 100 feet thick, of bluish-grey to brown mudstone, in which *Mytilus* and *Aphanaia* are common. Above this, there is a very hard, white sandstone, which forms a prominent outcrop near Black Creek, south of the railway line just west of Branxton. This particular bed is about 200 feet thick, and its outcrop is shown on the map. It contains a few marine fossils (e.g., *Spirifer*, *Martiniopsis*, and *Aviculopecten*), and numerous remains of plant-stems.

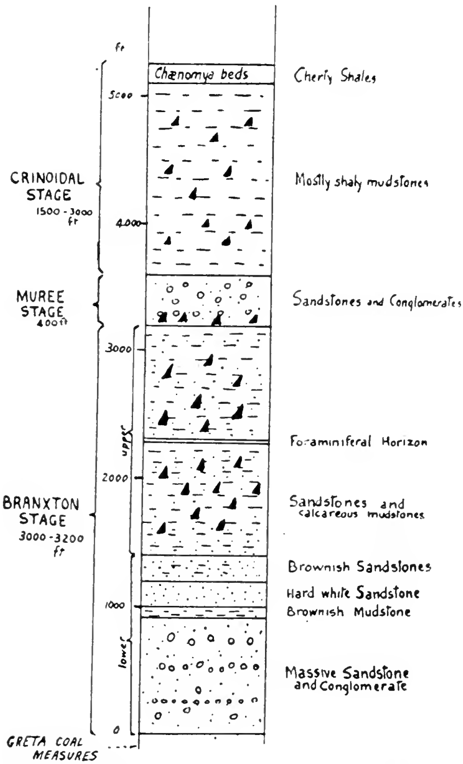


Fig 10.—Vertical Section of the Upper Marine Series.

The remainder of this substage consists of more brownish sandstones. Marine fossils occur abundantly in this lower part of the Branxton Stage, and, where conditions were favourable, they approach to within a few feet of the top seam of the Greta Coal-Measures. The following is a list of the fossils from this substage:—

Zaphrentis robusta.	*Strophalosia jukesi.*
Palæaster clarkei.	*Chænomya etheridgei.*
Protoretepora ampla.	*C. undata.*
Fenestella(?) fossula.	*Aviculopecten englehardti.*
Dielasma inversa.	*A. ponderosus.*
D. biundata.	*A. tenuicollis.*
D. hastata.	*A.* sp.
Spirifer convoluta.	*Deltopecten farleyensis.*
S. vespertilio.	*D. leniusculus.*
S. avicula.	*D.* sp. (juv.).
S. tasmaniensis.	*Seminula*(?).
S. duodecimcostata.	*Mæonia carinata.*
S. strzeleckii.	*M. valida.*
Martiniopsis oviformis	*Stutchburia costata.*
M. subradiata.	*Astartila polita.*
var. *transversa.*	*Leptodomus duplicicosta.*
var. *morrisii.*	*Platyschisma oculus.*
Productus brachythærus.	*Goniatites micromphalus.*

The upper half of the Branxton Stage is composed of sandstones and calcareous mudstones, with frequent shaly bands. They contain numerous glacial erratics, which sometimes attain a very large size, some of them being over two tons in weight. These beds are exceedingly rich in marine fossils, perhaps the most abundant being members of the Fenestellidæ(?). In them, at about 2,300 feet from the base of the Branxton Stage, occurs a limestone-horizon which contains numerous well-preserved Foraminifera.* This upper part is also characterised by an abundance of *Trachypora wilkinsoni*, which is only found sparingly on any other horizon of the Upper Marine, and is extremely scarce in the Lower Marine. Good outcrops of the

---

* Chapman and Howchin, "Monograph of the Foraminifera of the Permo-Carboniferous limestones of N. S. Wales." Mem. Geol. Surv. N. S. Wales, Pal., No. 14, 1905.

Branxton Stage can be seen almost anywhere, where it is shown on the map. A good occurrence of glacial beds has been exposed by the new road-cutting on the Branxton to Elderslee road, just before it reaches the Elderslee Bridge over the Hunter River. The following is a list of the fossils from this upper part of the Branxton Stage :—

Zaphrentis robusta
Crinoid stems.
Trachypora wilkinsoni.
Stenopora.
Protoretepora ampla.
P. konincki.
Fenestella(?) internata.
F. fossula.
F. plicatula.
Spirifer convoluta.
S. strzeleckii.
S. vespertilio.
S. stokesi.
S. tasmaniensis.
S. duodecimcostata.
S. sp.
Martiniopsis oviformis.
M. subradiata.
var. *konincki.*
Productus brachythærus.
Strophalosia jukesi.
S. gerardi.
S. clarkei.
Chænomya etheridgei.
Merismopteria.
Conocardium australe.
Aviculopecten tenuicollis.
Deltopecten ittoni.
D. leniusculus.
Aphanaia gigantea.
Mæonia carinata.
Pleurophorus morrisii.
Stutchburia costata.
S. compressa.
Platyschisma rotundatum.
Conularia.
Hyolithes lanceolatus.
Goniatites micromphalus.

The upper limit of the Branxton Stage is well-defined by the Bolwarra Conglomerate (" Muree Rock "), which forms the base of the Muree Stage. This is a massive conglomerate, on which very little grass or vegetation of any kind will grow, and which forms a bold, bare outcrop, very useful indeed for purposes of geological mapping. This conglomerate passes upwards to a hard, massive, somewhat calcareous sandstone, and the whole Stage attains a thickness of about 400 feet. Both the conglomerate and the succeeding sandstone contain numerous marine fossils, there being a most remarkable abundance, in places, of the small brachiopod, *Strophalosia*. The following is a list of fossils from the Muree Stage :—

Zaphrentis phymatoides.
Phialocrinus princeps.
Archæocidaris.
Stenopora crin ta.
Protoretepora.
Dielasma biundata.
D. amygdala.
D. cymbæformis.
D. hastata.
Productus brachythærus.
Spirifer convoluta.
S. clarkei.
Spirifer stutchburii.
S. duodecimcostata.
Martiniopsis cyrtiformis.
M. oviformis.
Strophalosia clarkei.
S. gerardi.
Conocardium australe.
Deltopecten leniusculus.
Mæonia fragilis.
M. carinata.
Entomis jonesi.

One of the best exposures of this Stage is in the vicinity of Mt. Vincent, just east of Mr. Charles Wyndham's residence at Wollong, at the place known as "Bow Wow." Here the Muree Beds weather into large caves or rock-shelters, where numerous fossils can easily be obtained.

Above the Muree Stage comes the Crinoidal Stage. This varies very considerably in thickness in places, having a minimum of about 1,500 feet, and a maximum of from 3,000 to 4,000 feet. For the most part, it consists of fairly soft shales and mudstones. These weather fairly readily, and in this lies the reason for the development of some of the extensive alluvial flats, *e.g.*, along the course of the Mulbring or Wallis Creek. For the same reason, good outcrops are not of as frequent occurrence as they are in the more resistant beds. They can be seen outcropping, however, near Mt. Vincent, and in the railway-cuttings and creeks to the west and south of Belford. In places, they contain small and large erratics; *e.g.*, where the old line of northern road crosses a small creek in portion 61, Parish of Rothbury, there are numerous, small erratics of such rocks as aplite, quartz-porphyry, quartzite, and fine-grained, black, basaltic rocks. A little further east, where the same road crosses Jump Up Creek, there are a number of large erratics, an aplitic one reaching quite three feet in diameter, and one about the same size, of coarse granite, containing grains up to nearly an inch long. These erratics are imbedded in brownish, calcareous mudstones, which also contain marine fossils. In this district, in the Crinoidal Shales there are two horizons, on which numerous specimens of the pseudomorph Glendonite occur, namely, (1) about 200 feet above the base (outcrop at Glendon), and (2) about 700 to 1,000 feet above the base (outcrops at Mt. Vincent and Singleton Railway Bridge). This stage terminates upwards in a series of hard, cherty shales, which have been quarried for road-metal, known as the Chænomya beds. These, as may be surmised from the name, contain large numbers of the fossil *Chænomya*: they also contain obscure casts of radiolaria. These Chænomya beds attain a thickness of 150 to 200 feet. The following is a list of fossils from the Crinoidal Stage :—

Zaphrentis phymatoides.
Archæocidaris, sp.ind.
Tribrachiocrinus corrugatus.
Stenopora crinita.
Protoretepora.
Fenestella(?).
Spirifer convoluta.
S. duodecimcostata.
Martiniopsis subradiata. var. *morrisii.*
Strophalosia.
Chænomya etheridgei.
C. audax.
C. mitchelli.
C. sp.
Deltopecten fittoni.
Eurydesma hobartense.
Maeonia carinata.
Goniatites micromphalus.

Notes on the Permo-Carboniferous Palæogeography in New South Wales.

During almost a year's study of the Permo-Carboniferous rocks of Eastern Australia in general, and New South Wales in particular, some facts with regard to the palæogeography have become apparent, which are contrary to the ideas generally held. This is especially so with the distribution of land and sea in New South Wales. It has generally been held that, in Permo-Carboniferous time, New England and north-eastern New South Wales were cut off from the main continental mass, and that there was a water-connection with Queensland, to the west of New England. Professor David expressed this view recently in his Presidential Address to the Royal Society of New South Wales, thus: "At this time [Permo-Carboniferous], Eastern Australia was probably, from New England to Townsville, isolated from the portion lying further to the west, first by the Permo-Carboniferous sea, and later by the lakes and swamps of that period."*

The following notes attempt to show the distribution of land and sea in New South Wales in Permo-Carboniferous time, as suggested by the results obtained by recent workers in the North-eastern portion of the State, particularly Mr. J. E. Carne, Professor Woolnough, and Mr. E. C. Andrews.

The ideas put forward are by no means to be regarded as final solutions of the problems, my chief reason for bringing them forward here being that they may serve as something tangible, to be modified as further information is brought to light. A very important area in connection with this subject, and one which is not well known at present, is that between the Manning and Clarence Rivers. When the various Palæozoic formations in this area have been determined and mapped correctly, it is probable that a number of modifications will have to be made in the maps presented here.

The results of recent work in Northern New England mostly show that the extensive series of shales and slates there, are of Permo-Carboniferous age,† and that the great granitic masses have intruded the Lower Marine rocks, and are thus of late Permo-Carboniferous or even Mesozoic age. These two results point to the fact, that the greater part of what is now northern New England, was under water in Lower Marine time. Other

---

* Journ. Proc. Royal Soc. N. S. Wales, 1911, p.54.

† With regard to the slates in the neighbourhood of Tingha, two recent workers do not agree. Mr. L. A. Cotton[8] regards them as being older than Permo-Carboniferous, and similar to the Ordovician slates of Berridale and Tallong. Mr. J. E. Carne[7] puts them down as Permo-Carboniferous, evidently on account of their lithologic similarity to occurrences further north, in which he found Permo-Carboniferous fossils. Which of these views may be correct, however, does not affect these notes to any great extent, as it would only mean a small alteration in the position of the western limit of the Lower Marine Sea.

authors have noted deposits of Lower Marine age at a number of localities in that part of New South Wales east of New England, and north of the Hunter River. These localities are Rivertree[3], Drake[3], Joagla Falls (twenty miles east of Hillgrove)[1], near Kempsey[16], Wauchope, Kendall[6], and between Taree and Wingham[16]. These are all the known occurrences of undoubted Lower Marine rocks in New South Wales, outside those in the Maitland district[11], and near Mount Tangorin[11, 17]. Lower Marine fossils have also been found just over the Queensland border, six or seven miles west of Warwick. The distribution of these occurrences is shown on the map (Plate x.), and they seem to indicate that most of the north-eastern part of New South Wales was covered by the sea in Lower Marine time. The probable western limit of this sea has been drawn on the map. The faunas which exist at these occurrences, and the type of rocks developed, mostly indicate a relatively shallow sea, and also that the deposits were laid down not far from land. The faunas include typically such genera as *Spirifer*, *Martiniopsis*, *Eurydesma*, *Aviculopecten*, *Deltopecten*, *Pachydomus*, *Platyschisma*, etc. Sandstones and sandy mudstones are the most frequent and characteristic types of deposit; conglomerates are often developed, while limestones are comparatively scarce except in the Kempsey district. In the most northern part, the rocks have been altered subsequently, and now consist chiefly of slates.

The thickness of the strata which were deposited, shows that there must have been considerable high land not far away. One of the most prominent features of the land was a high range running approximately N.N.W., in the present Tamworth district, composed of rocks of Devonian and Carboniferous age. This range is probably responsible for the eastward bulge in the old coast-line towards Kempsey.

Parts of the district between the Macleay and Clarence Rivers, as well as the extreme north-east corner of New South Wales, are composed of old rocks, which are generally believed to be older than Permo-Carboniferous, but no fossils have been found in them. It seems more than probable, however, that this view is correct, and, therefore, a good deal of this area was probably a land-area during Permo-Carboniferous time. This leaves us with two alternatives as to the position of the Lower Marine Sea, and only detailed mapping of the areas mentioned can finally decide which is the correct view. These alternatives are, (1) that a land-mass constituted the north-eastern corner of New South Wales, and this was cut off from the mainland by a long narrow sea, the western coast of which was probably that shown on the map(Plate x.); or (2), that there was a long narrow peninsula, probably joined to the mainland somewhere between the Macleay River and Inverell, running in a general north-easterly direction to the Tweed River district, and that the Lower Marine rocks of northern New England and Drake were deposited in a large bay connected with the ocean on its northern side. Of these two alternative views, the former seems, to me, to be the more probable.

Towards the close of Lower Marine time, a slow pushing force began to make itself felt from a direction about E. by N. This may perhaps have been the first expression of the great movements which culminated eventually in the extensive granitic intrusions into the Permo-Carboniferous strata of New England. The result of this movement, pushing against the mainland to the west, was to elevate a belt roughly parallel to the old coast-line, and to depress somewhat the belt in between this elevated belt and the mainland.* The effect of this was the production of a land-zone extending in an approximately S. by E. direction from northern New England, and the depression of a zone between this and the mainland. The amount of depression, however, was not sufficient to submerge the old N.N.W. mountain range of Devonian and Carboniferous rocks near Tamworth, and this divided the submerged zone in two. Thus, there were produced relatively long and narrow inland depressions, in which the Greta Coal-Measures were deposited(Plate xi.). The presence

* This is somewhat the same effect produced by placing a sheet of paper flat on a table, with one end against a fixed object, and pushing the other end towards the fixed object. The first part of the paper to be elevated is a belt somewhere about the middle of the sheet, and parallel to the edge which is against the fixed object.

of the N.N.W. mountain range just mentioned, accounts for the absence of the Greta Coal-Measures between Wingen and Ashford.

In the Drake district, some of the marine deposits have a fauna which consists of a mixture of Lower Marine and Upper Marine types, and it seems almost certain that, during the time of deposition of the Greta Coal-Measures in the inland basins, marine sedimentation was going on in this area. This means that there was continuous marine sedimentation from Lower Marine into Upper Marine time in the Drake area.

After the deposition of the Greta Coal-Measures, the sea broke through the eastern land-barrier in its southern part, and submerged an area extending some distance north of Gunnedah, bounded on the west by the older rocks (Devonian, Silurian, and Ordovician) that we see at Marulan, Mt. Lambie, Bathurst, Wellington, etc. The northern shore of this arm of the sea was probably somewhere in the neighbourhood of the Peel Range and the Manning River, and the land for some distance north of the Manning seems to have extended further to the east than the present coastline. The Drake district was also submerged at this time, and the coastline appears to have been something like that suggested on the map (Plate xii.).

At the close of Upper Marine time, the pushing force once more made itself felt, and the result was that once again a land-barrier was raised, and another series of inland depressions formed. In New South Wales, the great inland basin in which the Upper Coal-Measures were laid down, was approximately as shown in Plate xiii., and it is probable that here, for the first time, there was direct water-communication from the Hunter River Basin to Queensland west of New England.

The land, at this time, to the east of the central part of the present coastline, was not far away, and must have been of some considerable height, as proved by the coarse conglomerates with diagonal bedding, dipping strongly inland, which Professor David has described at New Lambton and Red Head.*

* Mem. Geol. Surv. N. S. Wales, Geology, No.4, pp.20 and 41.

The Permo-Carboniferous was closed by the great granitic intrusions of New England and the great earth-movements which resulted in the production of the great Lochinvar Dome, the central part of which was raised through at least 6,000 feet.†

In conclusion, I wish to express my gratitude to Professor David for the interest he has always taken in this work, and for his willingness at all times to advise and help me in any way possible; also to Mr. W. S. Dun, by whose advice and assistance my work was often rendered easier than would otherwise have been the case, I wish to tender my most sincere thanks.

BIBLIOGRAPHY FOR PALÆOGEOGRAPHY.

1. ANDERSON, W.—Ann. Rept. Dept. Mines N. S. Wales, 1888, p. 190.

2. ANDREWS, E. C.—"The Geology of the New England Plateau," Part ii. Rec. Geol. Surv. N. S. Wales, viii., 1905, p. 108.

3. ———— "Report on Drake Gold and Copper Field." Dept. Mines and Agriculture N. S. Wales, Mineral Resources No. 12, 1908.

4. BENSON, W. N.—A preliminary Account of the Geology of the Nundle District, near Tamworth. Report Aust. Assocn. Advancement of Science, 1911, p. 100.

5. CARNE, J. E.—"Kerosene Shale Deposits of N. S. Wales." Mem. Geol. Surv. N. S. Wales, Geology, No. 3, 1903.

6. ———— "The Lithgow or Western Coalfield." Mem. Geol. Surv. N. S. Wales, Geology, No. 6, 1907.

7. ———— "The Tin-mining Industry of N. S. Wales." Dept. of Mines N.S.W., Mineral Resources, No. 14, 1911.

8. COTTON, L. A.—Proc. Linn. Soc. N. S. Wales, xxxiv., 1909, p. 738.

9. DAVID, T. W. E.—"Geology of the Vegetable Creek Tin-mining Field." Mem. Geol. Surv. N. S. Wales, Geology, No. 1, 1887.

10. ———— Presidential Address, Proc. Linn. Soc. N. S. Wales, 1893.

11. ———— "Geology of the Hunter River Coal Measures, N. S. Wales." Mem. Geol. Surv. N. S. Wales, Geology, No. 4, 1907.

12. ———— "Notes on some of the chief Tectonic Lines of Australia." Journ. Proc. Royal Soc. N. S. Wales, xlv. (1911).

13. DUN, W. S.—"Stratigraphical Notes: Permo-Carboniferous Beds in the Kempsey District." Rec. Geol. Surv. N. S. Wales, v., p. 180.

---

† *Op. cit.* p. 339.

14. JENSEN, H. I.—"The Building of Eastern Australia." Proc. Royal Soc. Queensland, xxiii., 1912, p.149.

15. PITTMAN, E. F.—Rec. Geol. Surv. N. S. Wales, v.,(1896-1898), pp.26-30.

16. WOOLNOUGH, W. G.—"Preliminary Note on the Geology of the Kempsey District." Journ. Proc. Royal Soc. N. S. Wales, xlv., (1911), p.159.

17. WALKOM, A. B.—"Geology of the Permo-Carboniferous System the in Glendonbrook District near Singleton." Proc. Linn. Soc. N. S. Wales, 1913, p.146.

EXPLANATION OF PLATES VIII.-XIII.

Plate viii.

Comparative Series of Sections of Greta Coal-Seams south of Branxton.

Plate ix.

Geological Map of Part of the Hunter River District, taken from the Map accompanying Memoir of the Geological Survey of New South Wales, No.4; with Additions by A. B. Walkom, B.Sc.

Plate x.

Map showing approximately the Western Limit of the Lower Marine Sea in New South Wales.

Plate xi.

Map showing approximately the Distribution of the land and sea during the deposition of the Greta Coal-Measures in New South Wales.

Plate xii.

Map showing approximately the extent of the Upper Marine Sea in New South Wales.

Plate xiii.

Map showing approximately the extent of the inland sea, in which were deposited the Upper Coal-Measures.

THE GEOLOGY OF THE PERMO-CARBONIFEROUS SYSTEM IN THE GLENDONBROOK DISTRICT, NEAR SINGLETON, N.S.W.

By A. B. Walkom, B.Sc., Linnean Macleay Fellow of the Society in Geology.

(Plate xiv., and four text-figures.)

The district treated of in this paper, lies from 5 to 15 miles E. by N. from Singleton. It contains two units of Permo-Carboniferous rocks, namely, a small basin about 2 miles N.E. of Mt. Tangorin, with a diameter of approximately 3 miles; and the northward extension, from the Hunter River District, of the Upper Coal-Measures and Upper Marine Series along Glendon Brook and Westbrook Creek.

Previous Literature.—In his memoir on "The Geology of the Hunter River Coal Measures," Professor David* has described the outcrop of rocks belonging to the Lower Marine Series and Greta Coal-Measures in Parishes of Tangorin and Stanhope, and has indicated some of the outcrops on a sketch-map.

* Mem. Geol. Surv. N. S. Wales, Geology, No.4, 1907, pp.188-189.

The Coal-Measures at Westbrook Creek were reported on by the late C. S. Wilkinson,* and also have been examined by Professor David.†

The ironstone at Westbrook Creek has also been mentioned in J. B. Jaquet's memoir on "The Iron-Ore Deposits of New South Wales."‡

Physiography, etc.—The knot of hills round Mt. Tangorin is composed of hard resistant rocks, mostly eruptive, of Carboniferous age. Similar rocks are also responsible for the range which trends about E.N.E. from Tangorin, although they do not form the summit of the range at all points. A part of the top of the range, for a distance of about 2 miles E.N.E., from portion 96, Parish of Stanhope, is made up of massive conglomerates and sandstones of Upper Marine age. These sandstones and conglomerates extend northwards nearly to the southern boundary of portion 90, Parish of Tangorin, and form a number of flat-topped hills. Less resistant rocks (of Lower Marine age) intervene between these conglomerates and sandstones and the Carboniferous rocks, and the denudation of these is responsible for the gap in the range at Cranky Corner. To the west of Brook's Mountain, the country becomes undulating. The rocks in this part belong to the Upper Coal-Measures and Upper Marine Series, which have been let down to the level of the Carboniferous rocks by heavy faulting.

A point worthy of note is the salinity of the creek-waters in the neighbourhood of the Tangorin Range. This is brought to one's notice, during dry weather, by the fact that the gravels and creek-beds are often covered with a white saliferous deposit, when there has been a good deal of evaporation.

General Geology.—Stratigraphically, the rocks represent two systems, (A) Carboniferous, and (B) Permo-Carboniferous.

(A) Carboniferous.—There are two distinct divisions of the Carboniferous rocks, separated from one another by the Webber's Creek fault, which extends in a general E.-W. direction for about 10 miles, and throws to the south.

* Ann. Report Dept. Mines N. S. Wales, 1884, p.151.

† *Op. cit.*, pp.274-277.

‡ Mem. Geol. Survey N. S. Wales, Geology, No.2, 1901, p.111.

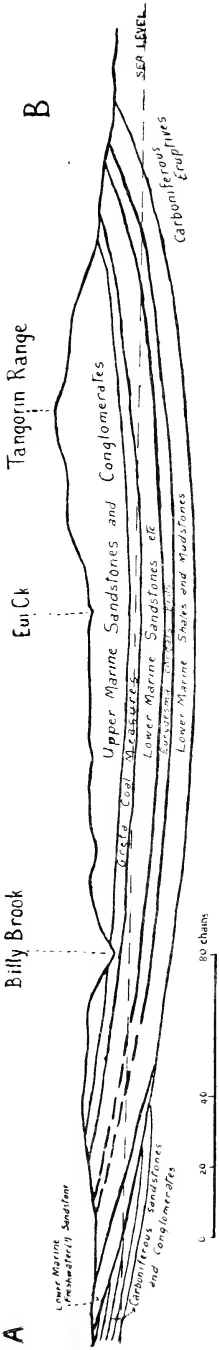


Fig. 1.—Section along AB.

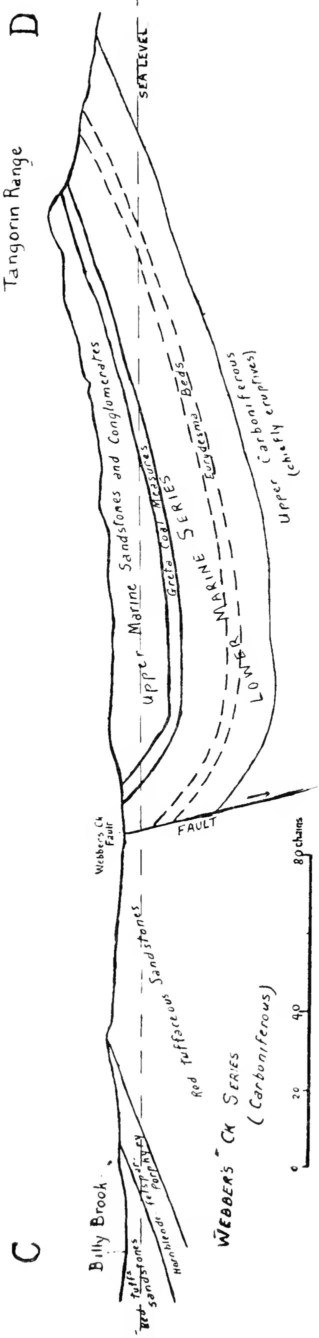


Fig. 2.—Section along CD.

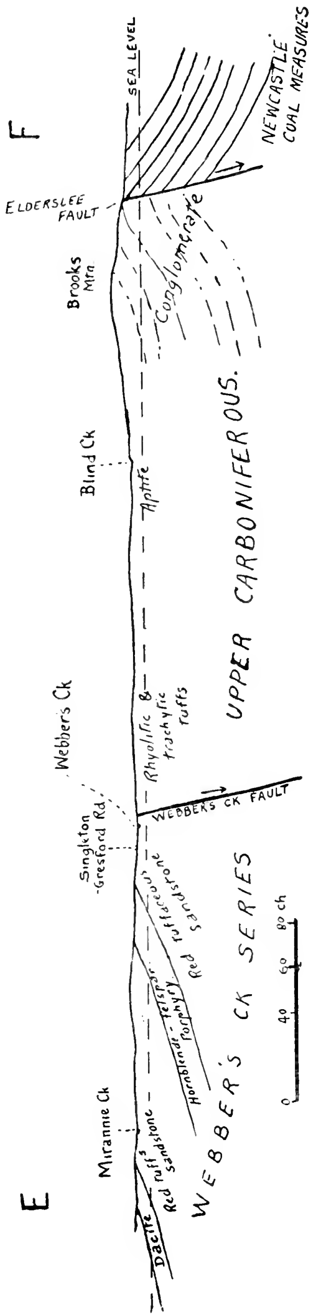


Fig.3.—Section along EF.

The older of these two divisions, that on the northern side of the fault, I have called here the Webber's Creek Series. This series has been examined, at intervals, for about a distance of 10 miles in an E.-W. direction, and extends for quite 5 miles north from the fault, which forms its southern boundary. The series consists of sandstones and shales, with contemporaneous lava-flows. The sandstones are more of the nature of arkoses, being composed mostly of grains of orthoclase with a smaller amount of quartz, hornblende, and biotite. In places, in these arkose sandstones, there are small bands of chocolate shale. The sandstones are conglomeratic in places, and, where this is the case, they contain pebbles of such rocks as banded rhyolite, andesite, aplitic granite, porphyrite, quartzite, etc. The lava-flows associated with this series consist of dacite and hornblende-felspar porphyry. There does not seem to be any doubt but that these flows are contemporaneous and not intrusive, although no very definite evidence is forthcoming on that point. They form long, comparatively narrow outcrops, roughly parallel to the strike of the arkose sandstones, and, being harder than the latter, they form lines of hills running in a general E.-W. direction. These hills have a relatively steep slope on the southern side, and slope more gently away to the north, showing that they dip to the north in the same way as the sedimentaries do.

This series of rocks appears to be similar to part of the Upper Carboniferous Series described, some distance further to the east, by Mr. J. B. Jaquet. Part of his description of the latter series is: "The formation comprises sandstones, claystones, limestones, tuffs, cherty shales, and intercalated lava-beds. The sedimentary rocks are in part marine, and in part freshwater. *The great bulk of the rocks consist of coarse-grained tuffaceous sandstones, which do not contain recognisable organic remains; so that one is unable to determine whether they are marine or freshwater.*"*

The latter part of this description might be applied equally well to the series under consideration here. I have not seen specimens of the Clarencetown Series, but in discussing the subject with Professor David, he pointed out the great similarity, lithologically, between specimens of the Webber's Creek Series and the Upper Carboniferous rocks near Clarencetown.

Another point which emphasises the resemblance to the Clarencetown Series is the fact, mentioned to me by Mr. Frank Drinan, of Glendon Brook, that, in the creeks in the north-eastern part of the area shown on the accompanying map, the sands which accumulate in the beds of the creeks often contain a notable percentage of ironstone.

No fossils have been found in this series, so that it is uncertain whether they are marine or freshwater. If, however, as seems to be the case, they belong to the same series as the Clarencetown rocks, they are probably freshwater.

The other series of Carboniferous rocks is developed to the south of the Webber's Creek fault, and is called here the Tangorin Series, on account of the bold outcrop at Tangorin Trig. Station. They are bounded on the west by the northward extension of the fault named, by Professor David, the Elderslee Fault. They extend as far east as the district has been examined, and no doubt are con-

* *Op. cit.*, p.64.

tinuous with the Carboniferous series at Hudson's Peak. They surround, almost completely, the isolated basin of Permo-Carboniferous rocks at Cranky Corner. They consist of a varied series of eruptives—rhyolite, trachyte, dacite, andesite, pitchstone, etc., and also rhyolitic and trachytic tuffs, tuffaceous sandstones and conglomerates. Professor David has found an abundance of *Rhacopteris* in some of the tuffs on the road just south of Cranky Corner, so that there is no doubt that they belong to the same series (Upper Carboniferous) as those Carboniferous rocks occurring further south, at Winder's Hill and Pokolbin.*

No boundaries of these Carboniferous rocks have been surveyed, except where they are in contact with rocks of different age, but field-names have been placed on the map at points where they have been observed.

(B) PERMO-CARBONIFEROUS.—There are two separate occurrences of Permo-Carboniferous rocks in the district, namely, (*a*) the Cranky Corner Basin, (*b*) the series west of the Elderslee fault.

(*a*) *The Cranky Corner Basin.*—In this area, there is a development of some 1,850 feet of Permo-Carboniferous strata, made up approximately of 900 feet of Lower Marine Series, 150 feet of Greta Coal-Measures, and 800 feet of Upper Marine Series. An examination of the dips at once shows that these strata form a somewhat triangular-shaped basin. They are surrounded, for the greater part, by the Tangorin Series, except on a portion of their northern side, where they have been brought into contact with the Webber's Creek Series by the Webber's Creek fault. They are unconformable above the Carboniferous System, there being differences generally of 30° to 40° in the directions of strike, where Carboniferous and Permo-Carboniferous sedimentary rocks occur close together. Near portions 14 and 11, Parish of Stanhope, the Carboniferous conglomerates strike about N.-S., and dip easterly; while the Permo-Carboniferous rocks strike 327°, and dip at 14° in direction 57°. Near Tamby Creek, about portion 98, Parish of Tangorin, the Carboniferous conglomerate strikes 140°, dipping

* Journ. Proc. Royal Soc. N. S. Wales, xlv., 1911, pp.379-408.

south-westerly, and the Permo-Carboniferous rocks strike 100° dipping southerly.

(i.) Lower Marine Series.—In portions 35 and 98, Parish of Tangorin, just opposite portion 81, there is a small outcrop of rather coarse sandstone containing remains of plant-stems. This is resting unconformably on Carboniferous conglomerates, and is the lowest member of the Permo-Carboniferous System found in the district. The outcrop, however, is only of limited extent, being cut off by the Webber's Creek fault to the west, and thinning out between the Carboniferous conglomerates, and the overlying mudstones towards the south-east. From its lithological character, and from the presence in it of plant-stems, and also since it is the lowest member of the Lower Marine Series developed here, it seems very probable that it is to be correlated with the sandstone which is immediately above the glacial beds in the Lochinvar District. It attains a thickness of about 100 to 150 feet.

Next above this sandstone, there is a thickness of some 300 feet of bluish shaly mudstones. These can be traced, almost continuously, nearly right round the basin. About half-way up in these mudstones, there is an horizon of hard limestone-concretions containing fossils. These are chiefly *Fenestella* (?) sp., and a small brachiopod shell (? *Dielasma*). This bed with Fenestellidæ can be seen at three localities in the Parish of Stanhope, namely, (1) on the W.-E. road in portion 66, (2) in portion 46, and (3) in the creek in portion 50. The mudstones are fossiliferous, but most of the fossils appear to be in the upper part, *i.e.*, above the limestone-concretion horizon. Some of the fossils from these mudstones are:—

Spirifer duodecimcostata.	*Aviculopecten tenuicollis.*
S. tasmaniensis.	*A. englehardti.*
S. stokesi.	*Pachydomus.*
Martiniopsis subradiata.	*Ptycomphalina trifilata.*
Chænomya sp.	*Hyolithes lanceolatus.*

The best locality for collecting these, is in portion 10, Parish of Stanhope, on the western slope of the hill, between the creek and the eastern boundary of the portion.

In portion 91, Parish of Stanhope, there is a development of basalt and breccia in this series. This may represent a centre of volcanic activity, which was responsible for the tuffaceous nature of the sandstones next to be described.

Following the mudstones, there is a thickness of about 120 feet of rather coarse tuffaceous sandstone. Good outcrops occur, the best being those in portions 8, 96, 78, 76, and 74, Parish of Stanhope. It is thus seen that this sandstone occurs continuously on the western and south-eastern sides of the basin, but has not been observed to outcrop on the northern side. This absence on the northern side is due to the presence of the Webber's Creek fault. The sandstone contains numerous marine fossils, there being, in places, regular banks of such thick-shelled molluscs as *Eurydesma cordata, Platyschisma,* etc., indicating turbulent, shallow-water conditions during the deposition of the beds. The fossils present in this sandstone include—

Spirifer duodecimcostata.	*Pachydomus.*
S. tasmaniensis.	*Scaldia*(?).
Martiniopsis subradiata.	*Platyschisma oculus.*
Aviculopecten mitchelli.	*Mourlonia.*
A. tenuicollis.	*Ptycomphalina.*
Eurydesma cordata.	*Hyolithes lanceolatus.*

In appearance, this sandstone is sometimes very similar to that of Harper's Hill, and the similarity is increased by the occasional presence of andesitic boulders, with numerous amygdules of secondary silica, calcite, etc.

The remainder of the Lower Marine Series consists of about 330 feet of mudstones, sandstones, and conglomerates, in which fossils appear to be very scarce. At Eui Creek and Billy Brook, these are somewhat hardened and jointed, probably as a result of their proximity to the Webber's Creek fault.

(ii.) Greta Coal-Measures.—Above the Lower Marine Series, the Greta Coal-Measures are developed. They consist mostly of the sandstones and conglomerates typical of these measures, and there are also developed some beds of a brownish shale, as well as at least one coal-seam. The outcrop can be traced continuously round its northern part, from portion 41 to portion 29, Parish of Stanhope, but the remainder is somewhat less certain. However, in portions 70 and 96, Parish of Stanhope, there is a conglomerate not unlike the Greta conglomerate, associated with a soft brownish and yellowish sandstone containing indeterminate plant-remains, and it is not unreasonable to put these down as belonging to these measures, more especially as they occur at localities where one would expect to find the Greta Measures. In portion 42, Parish of Stanhope, there are some shaly beds which contain plant-leaves. Along the northern part of the outcrop, and where it is close to the Weber's Creek fault, the dips are considerably higher than they are a short distance to the east or west, where they are not so close to the fault-line.

Coal is developed in these measures, and actual outcrops can be seen in Kangaroo Creek, on portion 90, Parish of Tangorin, and also in Billy Brook, on portion 26, Parish of Stanhope.

At the Kangaroo Creek outcrop, Professor David has measured a section of the seam as follows* :—

Roof.	Conglomerate containing pebbles up to 3 or 4 inches in diameter.
0ft. 6in.	Hard bituminous coal.
1ft. 8in.	Clay shale.
0ft. 8in.	Carbonaceous sandstone.
0ft. 9in.	Hard bituminous coal.
0ft. 2in.	Band of pebbly sandstone.
1ft. 3in.	Hard bituminous coal.
0ft. 6in. to 1ft. 0in.	Band of fine conglomerate and sandstone, carbonaceous in places and clayey.
4ft. 0in.	Hard bituminous coal with pitchy lustre on freshly fractured surfaces. This coal approaches a cannel coal in composition.
0ft. 6in.	Coaly shale.
10ft. 0in.	Coal and bands.

Mr. Frank Drinan, of Glendon Brook, very kindly piloted me to the outcrop in Billy Brook. The position of this outcrop has been fixed fairly closely. It is in the bed of the creek, and the bearing

* *Op. cit.*, p.188.

from it to the western corner of portions 27 and 28, Parish of Stanhope, is 120½°. The coal is uncovered there, in the creek, for about six feet, and Mr. Drinan assured me that the seam used to outcrop at a position he pointed out to me, but which is now covered with débris; this point is some 10 to 15 yards further downstream. As the seam is dipping about south at 16°, this would indicate (if the two points represent outcrops of the same seam) a thickness of approximately 11 to 13 feet of coal and bands. This thickness corresponds very well with that mentioned above, and the two outcrops (Kangaroo Creek and Billy Brook) are probably of the same seam. As this outcrop (Billy Brook) was under water at the time of my visit, it was not possible to obtain specimens suitable for analysis, but from the pieces which could be got, the coal appears to be a hard, bright, bituminous coal of good quality. The position and extent of the actual outcrops depend on weather-conditions a good deal. Between my two visits to Kangaroo Creek (about three months apart), there was considerable rain, and much of the outcrop, as first seen, was covered with soil washed down the creek-bank.

At a number of other points in the neighbourhood, pieces of coal have been observed, washed into the creeks after heavy rains, *e.g.*, in Eui Creek above Mr. Peter's house, in portion 42, and in Billy Brook about portion 40, Parish of Stanhope. That these come from the same measures, there is no doubt, but the outcrops are probably covered over by surface-soil. The outcrop in Billy Brook is due to the creek having cut down through the overlying sandstone, isolating a part of it, and exposing the Greta Coal-Measures along the creek-bed. (See Section, Fig. 1, p. 148).

(iii.) The Upper Marine Series.—Above the Greta Coal-Measures, there is a series of massive sandstones and conglomerates. Marine fossils are very scarce in them, but, in the lower part, fragments of a Conularia (*C. inornata*) were found. These sandstones are, then, probably the equivalents of the lower part of the Branxton beds of the Upper Marine Series. The following is a vertical section of the Permo-Carboniferous rocks, as developed in this area (Fig. 4, p. 156).

(*b*) *Permo-Carboniferous Rocks west of the Elderslee Fault.*— The Elderslee fault, with a throw of nearly 6,000 feet to the west, brings the Upper Coal-Measures down against the Carboniferous rocks, just to the west of Brook's Mountain. In these Upper Coal-Measures, there are a number of coal-seams, which outcrop at intervals along Glendon Brook and Westbrook Creek. The series there consists chiefly of interbedded sandstones and conglomerates, with which there are also coal-seams, bands of ironstone, and occasional dolomitic bands. The ironstone is concretionary, and the bands vary from 1 inch to 15 inches in thickness. At the centre of the concretions, there is often a cavity in which quartz-crystals have grown. From the outcrops of the strata, Professor David* has calculated a descending vertical section, in which there are eighteen coal-seams varying from 3 to 27 feet in thickness. The measures in this part (Westbrook Creek), dip to the east, at angles up to about 70°, the very high angles of dip being at the extreme west of the occurrence of the series. The reason for these steep easterly dips is explained by their occurrence close to the Greta fault, which has a throw, at this point, of some 1,500 feet to the east, and forms the western boundary of these Upper Coal-Measures. Thus the Upper Coal-Measures here occupy an area of subsidence between two heavy faults, *i.e.*, it is a senkungsfeld-area. They do not extend any dis-

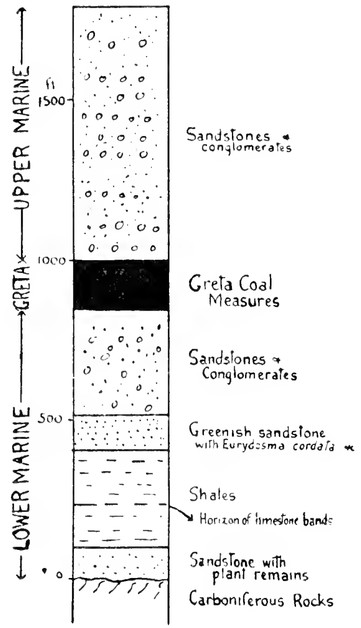


Fig. 4.—Vertical Section of the Permo-Carboniferous rocks.

* *Op. cit.*, pp. 275-276.

tance to the north, the northern boundary being formed by the Webber's Creek fault. This is shown by the fact, that the great majority of the boulders in the gravels brought down by Westbrook Creek and its tributaries, consist of eruptive rocks (chiefly porphyries, and dark-coloured, fine-grained rocks) and tuffs. On the west of the Greta fault, the Upper Marine Series are found, and they extend away westwards, past Singleton, until they disappear under the Rix's Creek Coal-Measures.

Immediately next the fault, there are shaly and sandy mudstones, with numerous erratics. These dip towards the east, and belong to the Crinoidal Beds, being part of the eastern arm of the Belford anticline. Some of the erratics are quartzites containing fossils. To the north, these beds extend some considerable distance. I followed them along the Dyrring Road, to a point about 4 miles north of the village of Sedgefield.

Faulting.—In this area, there are three very heavy faults. Two of them are northward continuations of faults described by Professor David in the Hunter River District,* namely, the Greta and Elderslee faults, and, in each case, the throw has increased towards the northern end of the fault. The third has a roughly east-west trend, and throws to the south. It has been called here the Webber's Creek fault. The Greta fault has swung round from having a S.E.-N.W. trend to almost N.-S., and here has a throw of about 1,500 feet to the east, bringing the Upper Coal-Measures down into contact with the lower part of the Crinoidal Shales of the Upper Marine Series. The Elderslee fault strikes a little to the west of north, and has a throw of nearly 6,000 feet. The Carboniferous rocks, near the fault, are conglomerates, and rhyolitic and trachytic tuffs of Upper Carboniferous age, while, on the downthrow side, are rocks of the Upper Coal-Measures. At this point, then, all the rocks of the Lower Marine Series, Greta Coal-Measures, and Upper Marine Series that have been developed in the district, are faulted out of sight. That both the Lower Marine Series and Greta Coal-Measures were developed to some extent, is indicated by their presence at Cranky Corner, with a thickness

* *Op. cit.* pp.302-304.

of about 1,000 feet; the Upper Marine Series have practically their full development (4,800 feet) not far away, so it seems not unreasonable to put the throw of the fault somewhere in the neighbourhood of 5,800 feet. The Webber's Creek fault trends roughly E.-W. in its western extension, and swings round to a S.W.-N.E. trend towards its eastern end. It extends, on the map, from near Westbrook to near "The Gap," on the road from Singleton to Gresford. It is an extensive fault, and its existence is indicated mainly by the following points:—

(*a*) The southern boundary of the Webber's Creek Series is a fairly regular line, and that Series is in contact with beds of different ages at different points, namely, Upper Carboniferous at Tamby Creek, Permo-Carboniferous from Tamby Creek to One-Tree Hill, Carboniferous again from there to the Elderslee fault, and then Upper Coal-Measures at Westbrook Creek. The fact that all these different series are cut off on their northern side, in a fairly regular line, favours the existence of a fault.

(*b*) Where the Permo-Carboniferous rocks approach close to the Webber's Creek Series (at One-Tree Hill), they have very high dips to the south, while a short distance to the west, where they are not so close, the dip is much less.

(*c*) Also where the Permo-Carboniferous shales are nearest the Webber's Creek Series, there is a slight amount of metamorphism of the shales, which might easily have been the result of faulting.

(*d*) No tuffaceous sandstones, similar to the Webber's Creek Series, are found associated with the Carboniferous rocks, south of the line of junction of that series with the other series.

The Webber's Creek Series seems to be of the same age as similar rocks near Clarencetown, which Jaquet* has determined as Upper Carboniferous. The throw of the Webber's Creek fault is about equal to the amount of strata between these rocks and the top of the Carboniferous strata, but, as the exact position of these rocks in the Upper Carboniferous has not been determined, it is not possible, at present, to say what is the amount of the throw of this fault.

---

* *Op. cit.*, p.62.

Summary.—Representatives of two Systems—Carboniferous and Permo-Carboniferous—occur in the district described. The Carboniferous rocks all belong to the Upper Carboniferous, some being of the same age as the Clarencetown tuffaceous sandstones, etc., and others of the same series as the rhyolites, etc., at Mount Bright, near Pokolbin. The boundary between the two Carboniferous series is formed by an extensive E.-W. fault (the Webber's Creek fault), throwing to the south.

The Permo-Carboniferous rocks occur in two separate areas. Just north-east of Mount Tangorin, there is a small, triangular-shaped basin made up of representatives of the Lower Marine Series, Greta Coal-Measures and Upper Marine Series. The most important point, economically, here is the occurrence of the Greta Coal-Measures. Previously it was thought that this was just the southern end of an extensive occurrence of the Coal-Measures, but the discovery that it is a small isolated basin, shows that there is probably no Greta coal anywhere to the north-east of the district, and on the north-west, the next occurrence is somewhere not far south-east of Muswellbrook. The small extent of the Cranky Corner basin, and its inaccessible position, make it improbable that it will ever be of any considerable economic value. The other area of Permo-Carboniferous rocks is just west of Brook's Mountain. Here the Upper Coal-Measures are developed, enclosed on three sides by heavy faults. Upper Marine Series (Crinoidal Beds) occur farther to the west, on the western side of the Greta fault.

My thanks are due to many of the residents of the district, who were always willing to assist me as far as possible, and, in particular, to Mr Frank Drinan, of Glendon Brook, and Mr. J. Graham, of Westbrook. I also wish to express my gratitude to Professor David and Mr. W. S. Dun for the interest they have taken in my work, and for the help they have rendered me, in discussing and criticising this work in preparation.

EXPLANATION OF PLATE XIV.

Geological Map of the Glendonbrook District.

NOTES ON SOME RECENTLY DISCOVERED OCCURRENCES OF THE PSEUDOMORPH, GLENDONITE.

By A. B. Walkom, B.Sc., Linnean Macleay Fellow of the Society in Geology.

(Six text-figs.)

While examining the Lower Marine Series along the main northern road, in the vicinity of Harper's Hill (Allandale), I observed a number of specimens of the pseudomorph, Glendonite, in two large boulders by the roadside. These were thought, at the time, to have been carried there from some other locality, but inquiries, made of some of the residents, showed that they had come from the road-cutting close by. Further search was then made, and specimens were soon found *in situ*. This discovery was of considerable interest, for, although glendonite had been recorded from a number of localities previously, all the occurrences were in

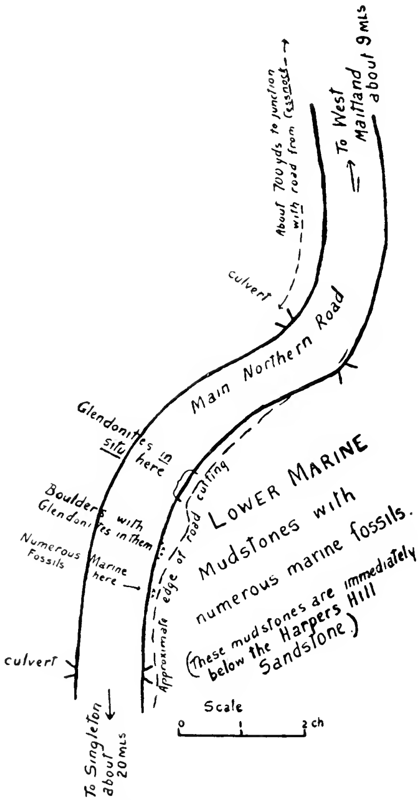


Fig. 1.—Sketch showing locality where Glendonites were found in the Lower Marine Series.

the Upper Marine Series, and it had never been found in the Lower Marine Series. A number of specimens were collected, and examined to see whether they presented any differences from those previously described. Mr. W. S. Dun kindly exhibited specimens of these crystals for me, at the meeting of this Society held in August, last year.

In a paper on "The Occurrence of the Pseudomorph Glendonite in New South Wales," by Professor David, Dr. Woolnough, and Messrs. Taylor and Foxall,* a complete review of previous literature was given; and for a bibliography, the reader is referred to that paper. They described the occurrence of glendonite at four localities, representing four separate horizons in the Upper Marine Series, as follows†:—

(a) Glendon, 5 miles E.S.E. from Singleton. Horizon approximately 200 feet above the Muree Beds. The glendonites here occur singly or in groups, and are from 3 to 12 inches in length.

(*b*) Left bank of Hunter River, at Railway Bridge, Singleton. Horizon about 1,000 feet above the Muree Beds. One glendonite recorded from here, is composed entirely of ferruginous gypsum.

(*c*) Mount Vincent, 14 miles south of East Maitland. Horizon 700 feet above the Muree Beds. The glendonites here frequently take the form of hollow casts in the centre of an oval or elliptical concretion. They occur singly or in aggregates.

(*d*) Huskisson, Jervis Bay. Horizon about 200 feet below the Nowra Grit, which is the equivalent of the Muree Beds.

The size varies from an inch to over fourteen inches in length.

In 1908, Mr. J. E. Carne‡ discovered glendonites on another horizon, in the Upper Marine Series, namely, about 350 feet above the top seam of the Greta Coal-Measures at Muswellbrook. These glendonites are of the large type, measuring up to 9 inches and

* Records Geol. Surv. N. S. Wales, 1905, viii., pp.161-179.

† The following details of these four horizons are taken from the paper mentioned above, pp.166-169.

‡ Ann. Report Dept. of Mines N. S. Wales, 1908, p.166. (The plan and sections accompanying this report, were printed in the Annual Report for 1910, facing p.176).

more in length, and 2 to 3 inches in diameter. Both simple and compound types occur, the latter being apparently haphazard intergrowths of two or more individuals.

In 1910, Dr. W. G. Woolnough* discovered a zone of glendonite pseudomorphs in an argillaceous limestone, on the road from Singleton to Dyrring, near the southern branch of Wattle Ponds Creek. This horizon is about 1,480 feet below the base of the Muree Beds. The crystals there are of the small, composite type.

During 1912, Professor Woolnough† found glendonites associated with *Chænomya* in the topmost part of the Upper Marine Series at Wollongong. These were in the form of hollow moulds in the centre of concretions, similar to those which are found at Mt. Vincent. The base in which these concretions occur, is a tuffaceous sandstone.

In his report on "The Tasmanite Shale-Fields of the Mersey District," Mr. W. H. Twelvetrees‡ has recorded the occurrence of glendonite in the mudstones above the Tasmanite Shale-deposit. The Shale is considered, by him, to be on the same horizon as the Greta Coal-Measures in New South Wales, so that the horizion of the glendonite-occurrence in Tasmania, corresponds to the lower part of the Upper Marine Series in New South Wales. In the only specimen that I have seen from the Tasmanian locality, the glendonites are of the smaller type, and are bunched together in complex aggregates.

The occurrence which forms the main subject of this note, is on the main northern road, nearly half a mile beyond the junction of that road with the road from Allandale Railway Station. (See sketch, Fig. 1, p.160).

The horizon of these beds is 2,800 feet above the base of the Lower Marine Series, and is nearly 2,600 feet below the lowest recorded horizon. It is about 150 feet below the well-known Harper's Hill, green, tuffaceous sandstone.

* Journ. Proc. Royal Soc. N. S. Wales, 1910, xliv., pp.557-559.

† Professor Woolnough very kindly gave me this information of his discovery at Wollongong.

‡ Dept. of Mines, Tas., Geol. Survey Bulletin, No. 11, 1912, p.54.

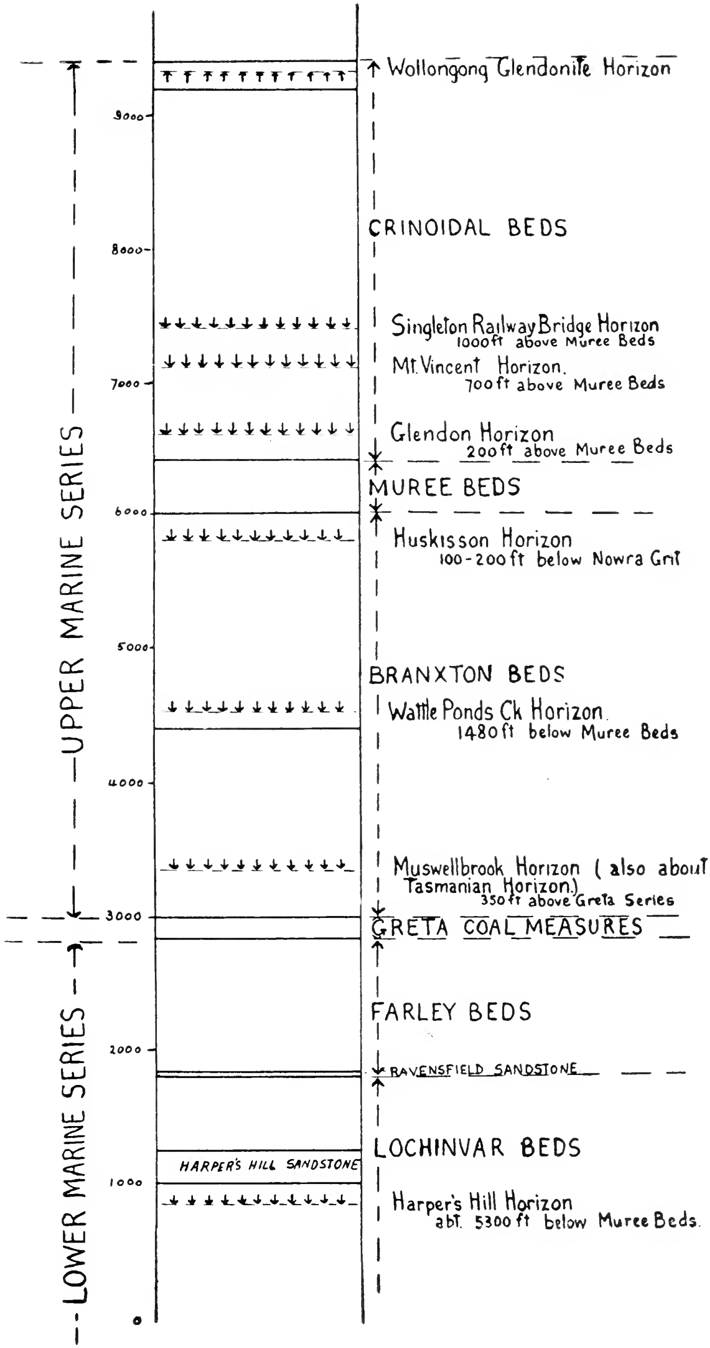


Fig. 2.—Vertical Section of part of the Permo-Carboniferous System, showing glendonite-horizons.

The glendonites here are imbedded in a light-coloured, micaceous mudstone, which is rather calcareous, and contains numerous marine fossils, *e.g.*,

Plant-st em.	*Mœonia*, 3 spp.
Spirifer vespertilio G. Sby.	*Pleurophorus* sp.
S. tasmaniensis Morris.	*Pachydomus* sp.
Martiniopsis subradiata Sby.	*Mourlonia rotundata*(?).
Chœnomya sp.	*Keeneia*(juv.).
Edmondia(?) *nobilissima* de Kon.	*Conularia lævigata* Morris.
Deltopecten subquinquelineatus McCoy; two vars.	

Fig. 2 (p. 163) is a vertical section of part of the Permo-Carboniferous system, showing the position of the various glendonite-horizons.

Chemical.—The substance of these pseudomorphs was found to be almost entirely soluble in hydrochloric acid; and qualitative analysis showed that they consist almost wholly of calcium carbonate, and also that there is an absence of both sulphates, and barium. The composition, then, is no doubt very similar to those analyses by Mr. B. V. Barton, B.E., quoted in the paper mentioned above,* and a quantitative analysis was not considered necessary in this case.

Crystallographic.—The crystals are all of similar type to those described from Singleton and Glendon, but are somewhat smaller, averaging from 2 to 2·5 inches in length and 0·75 inch in diameter. They a re mostly simple crystals, but a number are of the composite type. Of those which are not simple, the majority are like that figured(Fig.4), *i.e.*, an intergrowth of two individuals, while a few are much more complex, there being as many as eight individuals bunched together. The frequent occurrence of the first of these two types, namely, intergrowths of two individuals, suggested the possibility of twinning. That they are not twinned, however,

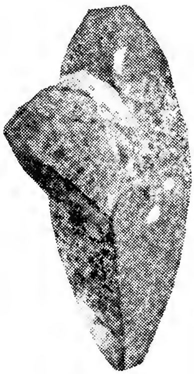


Fig.4—Photo of simply twinned glendonite crystal (about nat. size).

* Rec. Geol. Survey N. S. Wales, viii., pp.170-172.

seems to be shown by the fact, that an examination of three different specimens of this type, showed the relative orientation of the two individuals to be different in each case.

The crystals all show distinct curving of some of the faces; the prism-faces are generally plane, and give straight edges, but the pyramid- and dome-faces are decidedly curved. In measuring the curved faces, the method used by Anderson and Jevons,* in measuring opal-pseudomorphs from White Cliffs, N.S.W., was followed, namely, "making the goniometer-arms tangent to the part of the faces close to the edges."

Glauberite has been suggested as the probable original mineral for these pseudomorphs, and all the measurements of these crystals, from the Lower Marine Series, tend to confirm that suggestion.

The habit is monoclinic, and measurement shows that there are three forms present, the angles between homologous faces of which are, 94°, 63·3°, and 67°. These three forms correspond fairly well with with *m*(110), *s*(111), and *f*(023)of glauberite. Two of these forms were described on the crystals from Huskisson,† but on these crystals, the clino-dome present was *g*(021), while on the crystals now being discussed, the clino-dome is *f*(023). The following table shows the measurement of interfacial angles, compared with those of glauberite:—

Normal Angles.	No. of readings.	Limits.	Mean.	Average.	Angles for Glauberite
$(1\bar{1}0)\wedge(110)$	9	91°-97°	95°	94°	96° 58′
$(\bar{1}10)\wedge(\bar{1}\bar{1}0)$	8	90°-94½°	92·3°		
$(111)\wedge(1\bar{1}1)$	8	59½°-67°	63·6°	63·3°	63° 42′
$(\bar{1}\bar{1}\bar{1})\wedge(\bar{1}1\bar{1})$	9	60½°-66½°	63·1°		
$(023)\wedge(0\bar{2}3)$	9	63°-68½°	66·3°	67°	64° 46½°
$(0\bar{2}\bar{3})\wedge(02\bar{3})$	9	64°-70°	67·7°		

* Rec. Austr. Museum, vi., 1905, p.33.

† *Op. cit.*, p 175.

The measurement of the angles between *s* and *f*, and *s* and *m* was too unsatisfactory, on account of rough and curved surfaces. Fig. 3 is an ideal stereographic projection of one end of a crystal with the three forms developed.

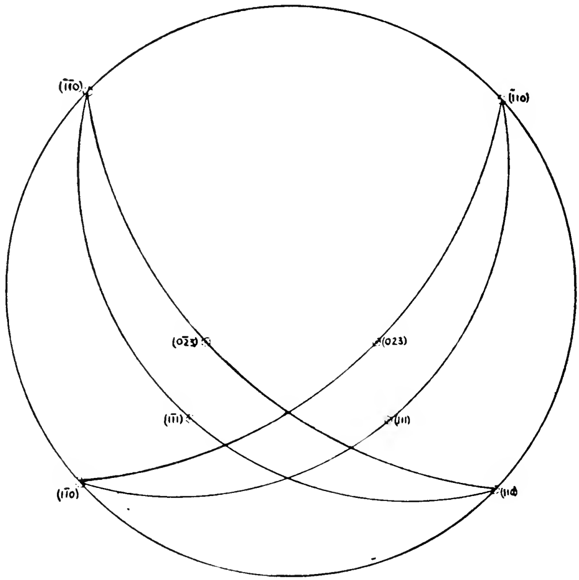


Fig. 3.—Stereographic projection of one end of a glendonite-crystal.

A number of the crystals show a series of parallel striations, representing the trace of a cleavage (Figs. 5-6). In some cases, these striations persist along the whole length of the crystal, over forms which are not in one zone, and so cannot represent oscillatory combinations. The angle between the plane of these striations and the edge (110) ($1\bar{1}0$), was easily calculated, and proved to be approximately 66°. If the original mineral were glauberite, the cleavage is perfect, parallel to (001), so that the angle just measured, would represent β. In glauberite, β is 67° 49′ 7″, so that the angle obtained for these glendonites, is quite as close as could be expected from contact goniometer-measurements.

Petrology.—Only one crystal was sectioned for the microscope. It consisted almost completely of granular calcite. A small proportion of the calcite-grains are clear and colourless, but most of them are of a cloudy-brown colour. A few small fragments of quartz were observed.

Summary and Conclusions.—All the observations made on these glendonites from the Lower Marine Series, confirm the conclusion

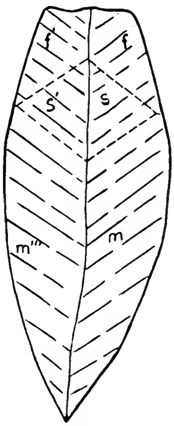


Fig.5.—Freehand drawing of glendonite crystal, showing direction of striations (front view : about nat. size).

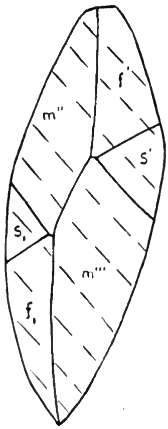


Fig.6.—Same as Fig.5 (side view : about nat. size).

arrived at by Professor David, Dr. Woolnough, and Messrs. Taylor and Foxall, that the original mineral, of which they are replacements, was glauberite.* Nothing has been observed which conflicts with their conclusions, excepting numbers (v.) and (vi.).†

With regard to (v.), which is as follows, "The presence of numerous erratics indicates that these waters were occasionally chilled by floating ice," it may be stated, that three, of the four newly-discovered occurrences of glendonite, are on horizons which

* *Op. cit.*, p.179. † *Op. cit.*, p.178.

are not considered to have been formed under glacial conditions. The newly-discovered occurrences also do not agree with the statement in conclusion No. (vi.) that "The horizons of the glendonites are not far below, in some cases close to, the top of the highest beds of a Marine Series, etc."

Glendonite has now been recorded from seven horizons in New South Wales, and one in Tasmania. These horizons are scattered at intervals, through a thickness of strata amounting to about 7,000 feet. This shows that the conditions, which governed the crystallisation of glauberite (for it is almost certain that this was the original mineral), must have been of fairly frequent occurrence in the Permo-Carboniferous seas; and it also shows that the occurrence of the pseudomorphs is of no value as an indicator of any particular stratigraphical horizon.

Glacial conditions were of frequent occurrence during Permo-Carboniferous time, and Professor Woolnough has suggested, in conversation about these pseudomorphs, that these conditions may have played an important part in the production of conditions suitable for the formation of glauberite; and that if this could be established, then the occurrence of glendonite, pseudomorphic after glauberite, might be taken as an indication of glacial conditions. This suggestion, taken with the fact that the glendonites always occur in a calcareous mudstone, opens up an interesting field of research in the artificial preparation of glauberite,(which, as far as could be ascertained, has not yet been prepared artificially in the wet way), by attempting to grow the crystals in calcareous mud, under temperature-conditions approximating to those which would be prevalent in waters subject to chilling by glaciers.

I wish to express my thanks to Dr. C. Anderson, of the Australian Museum, for the advice he most willingly gave me in connection with the crystallographic part of this note; and to Professor Woolnough for kindly volunteering part of the information contained in the paper, and for suggestions made in discussing the subject with me.

ORDINARY MONTHLY MEETING.

May 28th, 1913.

Mr. W. S. Dun, President, in the Chair.

Mr. Dene Fry, Sydney; and Mr. Leslie J. W. Newman, Perth, W.A., were elected Ordinary Members of the Society.

The Donations and Exchanges received since the previous Monthly Meeting (30th April, 1913), amounting to 33 Vols., 100 Parts or Nos., 34 Bulletins, 3 Reports, and 18 Pamphlets, received from 72 Societies and one Individual, were laid upon the table.

NOTES AND EXHIBITS.

Mr. D. G. Stead exhibited the tail-barb or spine of a Stingray (*Dasyatis*), which had been taken from the back of an example of the same kind, into which it was buried to the depth of 55mm. The protruding butt-end (about 60mm.), was encased in a growth of sessile barnacles, which, by their size, showed that the barb had been buried in the Ray for some time. The wound caused by the entry of the weapon had apparently healed.

Mr. Fred Turner exhibited and contributed notes on:—(1) *Andropogon intermedius* R.Br., from Warren, New South Wales, a locality two hundred miles further west than the exhibitor had hitherto known it to be found.—(2) *Panicum melananthum* F.v.M., from near Lake Bathurst, New South Wales, not hitherto collected in that locality by exhibitor. It is the only known Australian species of *Panicum* with black spikelets, and on that account is a most interesting grass. Both the above species are figured and described in Turner's "Australian Grasses," Vol. i., pp.5 and 40.—(3) An abnormal growth of *Atriplex campanulata* Benth., from Mildura, Victoria. Both the leaves and the fruiting perianths showed remarkable variation from the normal type. It was the first time Mr. Turner had seen this species in the condition exhibited.

Dr. H. G. Chapman showed some damaged specimens of *Spirula spirula* Linn.,(syn. *S. peronii* Lam.), taken by his wife at Narooma, New South Wales, in January last. After a heavy gale, the beaches were strewn with fragments of these cephalopods. There are several specimens in the Macleay Museum collected by the late Mr. George Masters at Bondi Beach. These were unknown to Pelseneer at the time of his monograph with Huxley in the Challenger Report, 1895.

Dr. Chapman also communicated some results on the freezing points of blood-sera as follows: sera of the ox, – 0·65°C, – 0·58°C – 0·645°C and – 0·655°C; sera of the sheep, – 0·60°C and – 0·61°C; serum of the dog, – 0·595°C; and human serum, – 0·66°C.

Mr. Maiden exhibited buds, flowers, and fruits of one of the rarest and most showy of Eucalypts, *E. erythrocorys*, from Dongarra, Western Australia.

Mr. A. A. Hamilton exhibited specimens of two introduced plants, unrecorded for New South Wales, from the National Herbarium Collection—*Papaver dubium* Linn., collected at Narrabri(J. H. Maiden; November, 1899); and *Ranunculus sceleratus* Linn., a species poisonous to cattle, flourishing in a ditch at Waterloo(A. A. Hamilton; December, 1912). A specimen of *Boerhaavia diffusa* Linn., from Penrith, was also shown(A. A. Hamilton; December, 1912); this is a western species which has now become well established in the district.

Mr. E. Cheel showed a fine series of specimens of a fungus, in various stages of development, collected at Hill Top, in March last, which produces sclerotia, very closely resembling those of *Polyporus mylittæ* Cke. & Mass. One sclerotium had a well developed mass of whitish mycelium, together with the sporophore or pileus *in situ*. The sclerotia are smaller than those of *P. mylittæ*, and the pileus is about 2 in., in diameter, brownish-coloured on the upper side, and the spores are white. The specimens somewhat resemble *P. sacer*, a South African species, and *P. rhinocertis*, a native of Malay and Ceylon; and should be carefully compared with these two species. A compacted mass of earth and mycelium, together with an undeveloped sporophore, was also exhibited; this was collected at Penshurst, in February, 1911. It is probably *P. tumulosus* Cke.[see Grevillea, xvii., 1889, p.55]. Specimens of a "Stone-making Fungus," probably *Lacco-cephalum basilapiloides* McAlp. and Tepp., were exhibited, collected at Rappville, in December, 1910, by Mr. A. Spedding; and at Mona Vale, Manly, by Mr. T. G. Wilson. A few interest, ing Rusts and Smuts were also shown, including: (1) *Uromyces trifolii*(Alb. & Schw.) Wint., Clover-Rust, on leaves of *Trifolium pratense-perenne*; collected at Hilltop, in December, 1912. This species has been recorded from this State and Victoria, on *Trifolium repens* L., and *T. glomeratum* L., but not on *T. pratense* so far as is ascertainable, except for Europe. (2) *Phragmidium Barnardi* Plowr. & Wint., on leaves of *Rubus parvifolius* L., from Nattai River, viâ Hill Top, N.S.W.; and Tynong, Victoria. This Rust has not previously been recorded for this State;* and Tynong, Victoria, is a locality additional to those mentioned in McAlpine's "Rusts of Australia," (p.186). (3) *P. longissimum* Thuem., on leaves of *Rubus moluccanus* L.; Hill Top. Previously recorded only for Queensland. (4) *P. subcorticium* (Schrank) Wint., on leaves of Garden Rose(*Rosa centifolia*); Randwick (R. Nichol; December, 1912). (5) *Tilletia striæformis*(Westd.) Oud., on leaves and leaf-sheaths of *Agrostis vulgaris* With.; Botanic Gardens, Sydney; an additional host, and new for this State.

Mr. North sent, for exhibition, skins of four birds, *Vini kuhli*, *Acrocephalus pistor*, *Procelsterna cærulea*, and *Gygis candida*, which, together with *Anous stolidus*, *Micranous leucocapillus*, *Numenius tahitiensis*, and *Sula piscatrix*, had been collected by the late Dr. Phillip Henry Metcalfe on Fanning Island in the North Pacific, while doing relief-duty for the resident medical officer of the Pacific Cables Station. Dr. Metcalfe's long residence on Norfolk Island afforded him exceptional opportunities for carrying out ornithological work, in which he was keenly

---

* Except for a record, without locality, in the Report of the Government Bureau of Microbiology, 1909, p.57.

interested; and his kindness and courtesy in supplying collections, and affording information, have been of great service to ornithologists.

Discussion.—Mr. Tillyard gave a short explanation of his proposed method for the "Study of Zoo-geographical Distribution by means of Specific Contours." In this method, instead of attempting to subdivide the recognised zoogeographical regions into distinctly marked off sub-regions and lower divisions, it is proposed to study the various groups of plants or animals occurring over the whole region, by constructing "specific contours" by the following rules. (1) The group selected must be a *natural* group, *i.e.*, a genus, tribe, or family which forms a homogeneous whole, and not merely a group separated off for convenience of classification. (2) The records available must be sufficiently numerous to give the *general form of the contour*, but absolute accuracy is neither attainable (without infinite labour) nor necessary. (3) Each species of the selected group is reckoned as a unit. On the map of the region under study, against each locality which has been "worked," the number of units occurring there is to be put down. Then contour lines, in the form of free curves, are to be drawn so that *all localities having an equal number of units shall be between any two successive contour-lines.* Clearly, the higher the number, the smaller the area enclosed by the contour, and *vice versâ.* The first contour line is the outer boundary of distribution for the group. The *n*th. or highest contour encloses an area termed the "*Zoo-centre,*" or, if elongated in form, the "*Zoo-centric Axis.*" By examination and classification of the different forms of contour obtainable over any given region Z, it will be evident that there are three main divisions:—

A. Entogenic Contours with the Zoocentres lying within Z and their lower contours spreading out around it. Groups of this kind furnish the *characteristic* fauna or flora of the region.

B. Ectogenic Contours with their Zoocentres lying quite outside or near the boundary of Z., and having lower contours spreading more or less into Z. Groups of this kind are outgrowths from the entogenic groups of other regions, and may profoundly modify the character of the fauna or flora of special parts of Z.

C. Archipelagic or Archaic Contours consisting of one or more generally small and isolated "island" contours of no definite distribution. These are the contours of archaic groups, and represent the mountain-tops, as it were, of a once much larger and more continuous area of distribution.

Mr. Tillyard exhibited maps showing the occurrence of different types of A, B, and C in the Australian Region, constructed for various groups of *Odonata*. He suggested that the separate types should receive suitable names.

Discussion postponed to next Meeting.

STUDIES IN AUSTRALIAN MICROLEPIDOPTERA.

By A. Jefferis Turner, M.D., F.E.S.

This paper is intended to be a supplement to Mr. Meyrick's paper on the Australian *Plutellidæ* in these Proceedings (1907, p.47). It describes new species, and gives further localities. Mr. Meyrick has since divided this group into several families, which I prefer to regard as subfamilies. But the *Adelinæ* have no near relationship to the other subfamilies, and are included here for convenience, as they have been recently monographed by Mr. Meyrick in the "Genera Insectorum."

Subfam. Gracilarianæ.

In his monograph in the "Genera Insectorum," Mr. Meyrick has substituted older names for two of his genera, and has added a few new species. These will be referred to below.

Gen. Epicephala.

This is an Australian genus of some extent, also represented in India and South Africa. I have already nine species. They are mostly closely allied, and difficult to discriminate. The larval habits are interesting. Dr. T. Bancroft first called my attention to those of the species *E. frugicola*. To open a green fruit-capsule, and to find inside a perfect moth fully fledged, was a novel and startling experience. The blackish markings on the hindwings of the male only, in two species, are an unusual character, and very helpful to the recognition of the species.

Epicephala albistriatella.

Gracilaria albistriatella Turn., Trans. R. Soc. S. Australia, 1894, p.129.

Correctly referred to this genus; the frontal tuft is easily abraded.

Q.: Brisbane, in March and April; Caloundra, in August; Nambour, in April; Stanthorpe, in February.

Epicephala colymbetella.

Brisbane, also in June.

Epicephala trigonophora.

Q.: Brisbane, in April; Bunya Mountains, in December.

Epicephala acrobaphes.

The blackish suffusion of the apical half of the hindwings is present only in the male, of which I have now two examples.

Q.: Stradbroke Island, also in April.

Epicephala australis.

Q.: Brisbane, from May to November.

Epicephala eugonia, n.sp. [εὐγωνιος, well-angled.]

♀. 6 mm. Head and palpi snow-white. Antennæ grey. Thorax and abdomen grey. Legs white. Forewings grey; markings snow-white; a rather broad streak along whole of dorsum; a slender streak from $\frac{1}{4}$ costa obliquely outwards, joining dorsal streak at $\frac{3}{4}$; a second streak from costa at $\frac{3}{5}$, very obliquely outwards; a third short streak from $\frac{4}{5}$ costa; two streaks from dorsum just before tornus, very oblique, nearly touching second dorsal streak in disc; an outwardly curved silvery streak from costa before apex to midtermen; a dark fuscous dot in disc just beyond this; cilia white, apices grey, on dorsum wholly grey. Hindwings and cilia grey.

Near *E. trigonophora*, but more neatly marked, the costal streaks narrower, and the first of them joining dorsal streak. There seems to be no fuscous line around apex and termen, but as to the colour of the thorax, I cannot be certain, as it has been discoloured by grease, though the type is otherwise in good condition. Type in Coll. Turner.

Q.: Brisbane, in December; one specimen.

Epicephala frugicola, n.sp. [Frugicolus, inhabiting fruit].

♂♀. 8-9 mm. Head white. Palpi white; external surface of labial palpi grey, except at base and apex. Antennæ ochreous-grey. Thorax and abdomen ochreous-grey; the former with a white spot in centre; tuft whitish. Legs grey, with whitish annulations. Forewings ochreous-grey, with white streaks; a rather ill-defined dorsal streak, incised near base, broad towards base, towards tornus narrow or interrupted; three short oblique costal streaks from $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$; three oblique dorsal streaks, first from mid-dorsum, sometimes meeting first costal streak, second obscurely double from $\frac{3}{4}$, third from near tornus; a silvery transverse streak from costa slightly beyond third streak to tornus; a short blackish longitudinal line in apical part of disc; a white spot on tornus; a dark fuscous line around apical portion of costa and termen; cilia white, apices fuscous opposite apex, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Brisbane, in December and February, bred abundantly from the seed-capsules of *Phyllanthus Ferdinandi.* The larvæ feed on the seeds, and the imagines are found in the ripe capsules, many days before they are liberated by the dehiscence of the fruit. They are victimised by two species of hymenoptera, one reddish and the other blackish, and these do not wait for dehiscence, but escape by boring their way through the capsules.

EPICEPHALA LOMATOGRAPHA, n.sp. [λωματογραφος, marginally inscribed].

♂♀. 9-10 mm. Head and palpi white; external surface of labial palpi grey. Antennæ grey. Thorax grey, with a large central white spot. Abdomen grey. Legs white annulated with grey. Forewings ochreous-grey, with white markings; a streak along dorsum, broad at base, becoming very narrow towards tornus, its upper edge irregularly excavated; costal streaks very short, dot-like, at $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{2}{3}$; a double oblique streak from costa at $\frac{5}{6}$ to termen; followed by a suffused fuscous spot; a white spot on tornus; a dark fuscous line around apical portion of costa and termen; cilia white, apices fuscous, on dorsum grey. Hindwings grey; in ♂ with narrow dark fuscous streaks on costa to middle and on dorsum to $\frac{1}{3}$.

Distinguished by the very short costal streaks, the absence of the first dorsal streak, and especially by the dark fuscous streaks on hindwing of ♂. Type in Coll. Turner.

N.Q.: Mourilyan Harbour, near Innisfail, in June.—Q.: Stradbroke Island, commonly taken in November and April.

EPICEPHALA NEPHELODES, n.sp. [νεφελωδης, cloudy].

♂. 9-10 mm. Head whitish-ochreous; face and palpi white; outer surface of labial palpi whitish-grey. Thorax and abdomen grey. Legs white, with blackish annulations. Forewings grey without ochreous tinge; markings white, rather indistinct; an irregularly outlined streak along dorsum; short oblique costal streaks at $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{2}{3}$; a double outwardly oblique streak from tornus; a transverse silvery line from $\frac{5}{6}$ costa to tornus; followed by a round blackish dot; a white spot on tornus; a dark fuscous line around apical part of costa and termen; cilia white, apices fuscous opposite apex, on dorsum grey. Hindwings and cilia grey.

Distinguished by the ochreous-tinged crown, the absence of ochreous tinge in forewings, the blackish annulations on the legs, and the absence of dark markings on hindwings of ♂. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in June and September; three specimens.

Gen. ACROCERCOPS.

Acrocercops Wallengren, Ent. Tidskr., ii., p.95(1881).
Conopomorpha Meyr., Trans. N.Z. Inst., 1885, p.183.
A large genus universally distributed.

ACROCERCOPS MENDOSA.

Meyr., Gen. Insect., Gracilariadæ, p.16.
N.Q.: Kuranda, near Cairns; in October(Dodd).

ACROCERCOPS HIEROCOSMA.

Meyr., Gen. Insect., Gracilariadæ, p.18.
N.A.: Port Darwin(Dodd).

ACROCERCOPS ORDINATELLA.

N.Q.: Kuranda, near Cairns.—Q.: Gympie, in April; Nambour, in November; Mt. Tambourine, in November and February; Burpengary, near Brisbane, in May. A number bred from larvæ mining the leaves of *Litsea dealbata*.

Acrocercops irrorata.

Q.: Brisbane, in December, January, March, and May.

Acrocercops tricuneatella.

Q.: Brisbane, from December to February.

Acrocercops autadelpha.

Q.: Mt. Tambourine, in February; from larvæ on *Banksia.*

Acrocercops zaplaca.

Q.: Caloundra, in August.

Acrocercops hoplocala.

Q.: Mt. Tambourine, in October and November.

Acrocercops calicella.

Q.: Brisbane, from June to September.

Acrocercops euchlamyda.

Q.: Brisbane, in August, September, and March.

Acrocercops obscurella.

O.: Brisbane, in September and April; Toowoomba, in September.

Acrocercops eupetala.

Q.: Nambour, in October and March; Brisbane, in August and November.

Acrocercops eumetalla.

Q.: Toowoomba, in September; Warwick, in October.

Acrocercops heliopla.

Q.: Brisbane, in August.

Acrocercops alysidota.

Q. Brisbane, in August.

Acrocercops tristaniæ.

Q.: Brisbane, also in April.

Acrocercops parallela.

N.Q.: Kuranda, near Cairns, in October.—Q.: Nambour, in December; Brisbane, from July to November; Caloundra, in August.

ACROCERCOPS NEREIS.

Q.: Brisbane, in August and September; Toowoomba, in September.

ACROCERCOPS LACINIELLA.

Q.: Brisbane, in August and September; Mt. Tambourine, in October.

ACROCERCOPS OPHIODES.

Q.: Brisbane, in August and September; Warwick, in October.

ACROCERCOPS PYRIGENES.

Q.: Brisbane, in November, March, and April; Nambour, in November, December, and March.

ACROCERCOPS PLEBEIA.

Q.: Brisbane, in November, January, and April; Warwick, in October.

ACROCERCOPS UNILINEATA.

Q.: Brisbane; Coolangatta, in May.

ACROCERCOPS SYMPHYLETES, n.sp.[συμφυλετης, of the same tribe].

♂ 7-8 mm. Head snow-white. Palpi white; apex of second joint dark fuscous. Antennæ grey; basal joint white. Thorax white, anterior edge grey. Abdomen pale grey. Legs dark fuscous, with white annulations. Forewings grey, with three white transverse fasciæ, edged with a few dark fuscous scales, first at $\frac{1}{4}$, broad, gradually increasing in breadth from costa to dorsum; second at middle, similar to first; third at $\frac{3}{4}$, similar but rather less broad; a minute white dot on costa before apex, a second on mid-termen, and a third, rather larger, on extreme apex; cilia grey, on apex white. Hindwings and cilia grey.

Extremely like *A. autadelpha*, but with the thorax grey anteriorly, and base of forewings not white. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; two specimens received from Mr. F. P. Dodd.

Acrocercops leucotoma, n.sp. [λευκοτομος, divided by white].

♀. 6 mm. Head grey; face and palpi white. Antennæ grey. Thorax grey, with a transverse median white line. Abdomen fuscous; beneath white, barred with fuscous. Legs fuscous, with white annulations. Forewings dark grey, with white markings edged with darker scales; a transverse fascia at $\frac{1}{4}$, broadening towards dorsum; a second fascia just beyond middle, also broadening towards dorsum; a minute dot on costa at $\frac{3}{4}$; a larger spot on costa midway between this and apex; and another, also larger, on costa just before apex; cilia grey, on subapical spot white. Hindwings and cilia grey.

Belonging to the *autadelpha*-group, distinguished by having two fasciæ, and three spots, but no spot on dorsum. Type in Coll. Turner.

Q.: Brisbane, in March; one specimen.

Acrocercops apoblepta, n.sp.[ἀποβλεπτος, admired].

♀. 7 mm. Head and palpi white. Antennæ grey, towards base white. Thorax pale ochreous-brown, with a posterior white dot. Abdomen grey. Legs white, annulated with fuscous. Forewings pale ochreous-brown; five white transverse fasciæ partially edged with fuscous scales; first narrow, basal; the others broad, nearly equal on costa and dorsum, with straight edges; second at $\frac{1}{4}$, third at middle, fourth before $\frac{3}{4}$, and fifth apical; fourth fascia traversed by four longitudinal dark fuscous streaks; a white costal dot between second and third fasciæ; cilia white, apices dark fuscous, on dorsum grey. Hindwings and cilia grey.

Of the *autadelpha*-group, immediately distinguished by the curiously striated fourth fascia. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; two specimens, received from Mr. F. P. Dodd.

Acrocercops tetrachorda, n.sp. [τετραχορδος, four-stringed].

♂. 6 mm. Head white. Palpi white; outer surface of second joint fuscous. Antennæ grey; basal joint white. Thorax and abdomen grey. Legs dark fuscous, annulated with white. Forewings grey; four broad white parallel-sided fasciæ, partly edged with dark fuscous scales; first basal, second at $\frac{1}{3}$, third at $\frac{3}{5}$, fourth apical; a fuscous dot on extreme apex; cilia white, apices fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner

N.Q.: Kuranda, near Cairns; one specimen received from Mr. F. P. Dodd.

ACROCERCOPS MACARIA, n.sp. [μακαριος happy].

♂. 6 mm. Head and palpi snow-white. Antennæ dark grey; basal joint white. Thorax white. Abdomen grey. Legs white, with dark fuscous annulations. Forewings rather dark ochreous-brown; four transverse snow-white fasciæ neatly edged with blackish; first at $\frac{1}{5}$, rather broader on dorsum; second at $\frac{2}{5}$, equally broad on both margins; third at $\frac{4}{5}$, narrow on costa, expanding towards dorsum; fourth apical; extreme apex dark fuscous; cilia white, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Bribie Island, near Caloundra, in September; five specimens, bred from larvæ mining blotches in the leaves of *Halfordia drupifera*.

ACROCERCOPS HEDYMOPA, n.sp. [ἡδυμωπος, sweet, pleasant].

♂♀. 6 mm. Head and palpi white, labial palpi with slender fuscous annulations. Antennæ whitish-grey. Thorax white. Abdomen ochreous-whitish. Legs white, with blackish annulations. Forewings white, sparsely irrorated with fuscous scales; a blackish dot on base of costa; five transverse ochreous fasciæ; first slender, basal; second broad, sharply defined, and narrowly edged with fuscous scales, sub-basal; third and fourth similar at $\frac{1}{3}$ and $\frac{2}{3}$; fifth midway between fourth and apex, slender, ill-defined; a suffused ochreous apical spot; cilia white, with a basal blackish dot on apex, apices fuscous, on dorsum whitish-grey. Hindwings grey; cilia whitish-grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, and Atherton, in June; seven specimens.

ACROCERCOPS OCHROPTILA, n.sp. [ὠχροπτιλος, with pale wings].

♂. 10 mm. Head and palpi white. Antennæ grey, basal joint white. Thorax pale ochreous-grey. Abdomen grey. Legs whitish;

tarsi with fuscous annulations. Forewings pale ochreous-grey; markings whitish, ill-defined; an indistinct spot on mid-dorsum; a transverse fascia at $\frac{2}{3}$; a second midway between this and apex, and a third just before apex; cilia pale ochreous-grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Townsville, in February; one specimen, received from Mr. F. P. Dodd.

ACROCERCOPS STEREOMITA, n.sp. [στερεομιτος, with straight threads].

♀. 7-8 mm. Head and palpi snow-white; labial palpi annulated with fuscous at apex of second and middle of terminal joints. Antennæ fuscous. Thorax white, lateral and posterior margins dark-grey. Abdomen dark grey. Legs fuscous, with longitudinal white streaks. Forewings dark grey; markings white, edged with blackish; a slender streak on costa from base to $\frac{3}{4}$; a broader streak containing a few blackish scales on dorsum from base through tornus to mid-termen; a narrow outwardly oblique streak from costa near apex to termen; cilia white, with a blackish bar before middle, apices fuscous, on dorsum pale grey Hindwings and cilia pale grey. Type in Coll. Turner.

Q.: Brisbane, in October; two specimens.

ACROCERCOPS POLIOCEPHALA, n.sp. [πολιοκεφαλος, grey-headed].

♀. 7 mm. Head grey; face and palpi white; labial palpi grey on external surface. Antennæ dark fuscous. Thorax fuscous Abdomen dark grey. Legs fuscous, with inconspicuous whitish annulations. Forewings dark bronzy fuscous; an ochreous-whitish line along dorsum from base to middle, expanding into a large blotch at its extremity; a quadrangular dark-centred ochreous-whitish spot on dorsum at $\frac{3}{4}$; three or four dots of same colour on dorsum beyond this; a fine whitish subapical streak from costa to termen; cilia whitish, interrupted by fuscous near tornus, and with a strong median dark fuscous bar opposite apex, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Brisbane, in March; one specimen,

ACROCERCOPS EPIMICTA, n.sp. [ἐπίμικτος, mixed, confused].

♂♀. 7-9 mm. Head white. Palpi white; labial palpi with three fuscous annulations, on base and apex of second joint, and just before apex of terminal joint. Antennæ white, annulated with pale fuscous. Thorax pale fuscous, with posterior and lateral white spots. Abdomen pale fuscous or grey, towards base whitish. Legs fuscous, with white annulations. Forewings pale fuscous-ochreous; markings white, somewhat confused; a dot on base of costa, a second on costa near base, and a third on dorsum near base; an irregular spot on costa at $\frac{1}{4}$, confusedly prolonged posteriorly; spots on dorsum at $\frac{1}{4}$, just before, and at middle, extended posteriorly in disc; a streak from midcosta very obliquely outwards, and a similar streak from costa at $\frac{2}{3}$, a streak from dorsum at $\frac{3}{4}$, very obliquely outwards, nearly touching extremity of second costal streak; a dot on $\frac{5}{6}$ costa, giving off a fine straight streak to tornus; a dark fuscous subapical spot; cilia white, bases and apices dark fuscous, on dorsum pale grey. Hindwings and cilia pale grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in October.—Q.: Brisbane, in January and March; Toowoomba, in April. Five specimens.

ACROCERCOPS SYMPLOCA, n.sp. [σύμπλοκος, interwoven, complex].

♂. 10 mm. Head, thorax, and palpi snow-white. Antennæ grey-whitish. Abdomen grey-whitish. Legs white, sharply annulated with fuscous. Forewings in ♂ with a tuft of long expansible hairs from base of dorsum beneath; ochreous-grey; markings white edged with pale fuscous; a short basal subcostal streak; a blotch on base of dorsum containing a circular grey spot; an outwardly curved transverse fascia at $\frac{1}{5}$, succeeded by a fine short costal streak; a very irregular fascia from midcosta to mid-dorsum, much expanded posteriorly on costa, and containing several grey dots; an irregular broad-based short costal streak at $\frac{3}{5}$; a wedge-shaped costal streak at $\frac{7}{8}$, and another before apex; a short broad dorsal line before tornus; a blotch just beyond tornus, reaching half across disc; apical area fuscous; cilia grey-whitish, with a median fuscous line, on costa before apex white, on tornus and dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Coolangatta, in May; several pupæ, each under a slight web on the upper sides of the leaves of a large trailing bean, at Point Danger; two moths bred. The species attributed to Coolangatta, belong equally to New South Wales and Queensland, the locality being situated exactly on the artificial boundary line between these States.

Acrocercops spodophylla, n.sp. [σποδοφυλλος, with ashen leaves (wings)].

♂♀. 7-8 mm. Head, palpi, antennæ, thorax, and abdomen grey-whitish. Legs whitish; tarsi faintly annulated with pale grey. Forewings grey-whitish; a white subapical fascia gradually dilating from costa to tornus; cilia grey-whitish. Hindwings and cilia pale grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in June; five specimens.

Acrocercops melanommata, n.sp. [μελανομματος, black-edged].

♂♀. 7-8 mm. Head, palpi, and thorax white. Antennæ grey. Abdomen grey-whitish, with a dark fuscous penultimate ring. Legs white; tarsi with fuscous annulations. Forewings whitish or grey-whitish; a suffused grey fascia from $\frac{3}{4}$ costa to before tornus; a large blackish subapical spot extending from costa to tornus, and a smaller apical spot; cilia grey-whitish. Hindwing pale grey; cilia whitish.

Readily distinguished from the preceding, to which it is allied, by the terminal blackish dots of forewings. Type in Coll. Turner.

N.Q.: Cairns, Kuranda, and Atherton, in June and July; four specimens.

Gen. Phrixosceles.

Phrixosceles, Meyr., Journ. Bombay Nat. Hist. Soc., xviii., p. 814(1908); Gen. Insect., Gracilariadæ, p. 13.

I regard this as a derivative of *Cyphosticha,* to which it is closely akin, differing only in the bristly hairs on the middle tibiæ. Meyrick enumerates five species, of which four are Indian, and one (unknown to me) Australian. I add four new species, all minute and delicate insects.

PHRIXOSCELES LITHOGRAPHA.

Meyr., Gen. Insect., Gracilariadæ, p. 13.

N.Q.: Kuranda, near Cairns, in October (Dodd).

PHRIXOSCELES LECHRIOTOMA, n.sp. [λεχριοτομος, obliquely divided].

♀. 6 mm. Head and palpi white. Antennæ white, towards apex grey. Thorax white. Abdomen whitish. Legs white; middle and posterior tibiæ and proximal tarsal joints with long loose hairs on upper surface. Forewings white; markings very pale ochreous mixed with pale fuscous; an ill-defined suffusion along dorsum nearly to middle, connected by some irroration with midcosta, an inwardly oblique fascia from $\frac{3}{5}$ costa to dorsum, sharply defined anteriorly by a pale fuscous line; beyond this, disc is more suffused; cilia white, on dorsum grey-whitish. Hindwings and cilia grey-whitish. Type in Coll. Turner.

N.Q.: Cardwell, in August; one specimen.

PHRIXOSCELES ZOPHOPASTA, n.sp. [ζοφοπαστος, dusky-sprinkled]

♂. 8 mm. Head white. Palpi white; apex of second joint dark fuscous. Antennæ white, with fuscous annulations. Thorax white, mixed with fuscous. Abdomen whitish-grey. Legs fuscous, with white annulations; posterior pair mostly white; middle tibiæ and proximal tarsal joints much thickened with long hairs; posterior tibiæ and first two tarsal joints with rather long hairs on upper surface. Forewings white, thinly irrorated with fuscous scales; the irroration is denser on dorsum, where it forms a series of ill-defined spots and dots; cilia on costa white, on dorsum pale grey. Hindwings and cilia pale grey. Type in Coll. Turner.

Q.: Brisbane, in September; one specimen.

PHRIXOSCELES HOLOTELES, n.sp. [ὁλοτελης, perfect].

♂♀. 6-8 mm. Head and palpi white. Antennæ much longer than forewings; fuscous, towards base whitish. Thorax whitish. Abdomen grey, beneath whitish. Legs whitish, with fuscous annulations; middle and posterior tibiæ and proximal tarsal joints with rather long loose hairs on upper surface. Forewings with basal half white, with three inwardly oblique dark fuscous fasciæ containing more or less of pale ochreous, posterior half dark fuscous; a whitish spot over tornus; a white streak from $\frac{5}{6}$ costa nearly to tornus, broadening beneath; two fine white longitudinal streaks beyond this; a white apical dot; cilia dark fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Eumundi, near Nambour, in March; eight specimens, all taken at one spot at one time.

PHRIXOSCELES NIPHADIAS, n.sp. [νιφας, a snowflake].

♂♀. 6-8 mm. Head, palpi, and thorax snow-white. Antennæ grey, towards base white. [Abdomen broken]. Legs white, with fuscous annulations; middle and posterior tibiæ and proximal tarsal joints with long loose hairs on upper surface. Forewings snow-white, with some fuscous irroration; apical area pale ochreous-fuscous, sharply defined anteriorly; bounded by an inwardly oblique line from costa near apex to midtermen; cilia fuscous, on dorsum grey. Hindwings and cilia grey.

Allied rather closely to the preceding. Type in Coll. Turner.

N.Q.: Cairns, in October; three specimens.

Gen. CYPHOSTICHA.

A small genus, so far as known. Meyrick enumerates one species from Ceylon, and two from Australia, to which I am able to add three more.

CYPHOSTICHA ALBOMARGINATA.

Q.: Brisbane, in March; one specimen, corresponding accurately with Stainton's description, and certainly referable to this genus. The middle tibiæ and first two tarsal joints are thickened with scales throughout.

CYPHOSTICHA PANDOXA, n.sp. [πανδοξος, all-glorious].

♀. 10 mm. Head yellow; face and palpi white. Antennæ grey. Thorax brown-purple, with a large yellow central spot. Abdomen grey; undersurface white. Legs whitish-ochreous; tarsi with fuscous annulations; middle tibiæ and first two tarsal joints much thickened with fuscous scales. Forewings brown-purple; along costa, mixed with ochreous; a very irregular, bright yellow, broad dorsal streak, twice indented in basal $\frac{1}{4}$, interrupted at mid-dorsum, ending in a discal projection shortly before tornus; a white subapical costal spot, with a dark fuscous discal spot beneath it; cilia ochreous, with a dark fuscous postmedian line, on costal spot white, towards tornus with basal portion white, on dorsum grey. Hindwings and cilia grey.

Very similar to *C. pyrochroma*, differing in the forewings having no opaline streak, the dorsal line being interrupted, and the presence of a white subapical costal spot, also in the dark fuscous middle tibiæ. Type in Coll. Turner.

Q.: Stradbroke Island, in April; one specimen.

CYPHOSTICHA PANCONITA, n.sp. [παγκονιτος, all-dusty]

♂♀. 9-10 mm. Head and palpi whitish. Antennæ dark grey. Thorax whitish, with some fine fuscous irroration. Abdomen grey. Legs whitish, with fuscous annulations; middle tibiæ much thickened with dark fuscous scales; middle tarsi not thickened. Forewings white, with ill-defined fasciæ, ochreous densely irrorated with dark fuscous; first fascia very broad, extending from base to $\frac{1}{4}$; second moderate, median; third from $\frac{3}{4}$ costa to tornus, confusedly extended on dorsum and termen; cilia ochreous-whitish, more or less interrupted by fuscous at apex and above tornus, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in September, October, and November.—Q.: Brisbane, in March.—N.S.W.: Murwillumbah, in December. A long series.

Gen. PARECTOPA.

Parectopa Clemens, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 210.

Macarostola Meyr., Proc. Linn. Soc. N.S.Wales, 1907, p. 62.

A moderately large genus, found in all regions.

PARECTOPA THALASSIAS.

Q.: Stradbroke Island, in September.

Parectopa trapezoides.

Correctly referred to this genus; the posterior tibiæ are smooth.

N.Q.: Kuranda, near Cairns.

Parectopa formosa.

Q.: Brisbane, and Stradbroke Island, from August to April, probably throughout the year; Mt. Tambourine, in November and January; Toowoomba, in September.

Parectopa polyplaca.

I have gone fully into the distinctions between this and the next species, in Trans. R. Soc. S. Australia, 1900, p. 20.

Q.: Maroochydore, near Caloundra, in August; Brisbane, in August, September, October, and April; Mount Tambourine, in March; Coolangatta, in May. The Duaringa locality requires confirmation.

Parectopa ida.

N.Q.: Cairns, in June; Herberton, in February.—Q.: Brisbane, in July, August, and April; Toowoomba, in September.

Parectopa chalceopla, n.sp. [χαλκεοπλος, with brazen armour].

♂. 9 mm. Head and thorax brassy-white; face and palpi white. Antennæ grey-whitish. [Abdomen broken]. Legs white, with pale fuscous annulations. Forewings white, with brilliant brassy reflections; a rather broad grey streak on dorsum from $\frac{1}{4}$ to middle; a broad pale brownish fascia from $\frac{4}{5}$ costa to tornus; a large oval blackish apical spot; cilia whitish, with a narrow fuscous bar at apex, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; one specimen, received from Mr. F. P. Dodd.

Parectopa thiosema, n.sp. [θειοσημος, sulphur-marked].

♂. 8 mm. Head ochreous-fuscous; face pale yellowish. Palpi whitish, apices fuscous. Antennæ fuscous, towards base whitish. Thorax and abdomen ochreous-fuscous. Legs ochreous-fuscous; posterior pair whitish; all tarsi whitish, with fine fuscous annulations. Forewings ochreous-fuscous, with purplish reflections; a pale yellow wedge-shaped mark from costa at $\frac{1}{5}$, directed obliquely outwards, broad on costa, its edges irregularly dentate, its apex above middle of dorsum; cilia ochreous-fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Stannary Hills; one specimen, received from Dr. Thomas Bancroft.

PARECTOPA EURYTHIOTA, n.sp. [εὐρυθειοτος, broadly sulphur-marked].

♀. 9 mm. Head and thorax brownish; face ochreous-whitish. Palpi ochreous-whitish; apex fuscous. [Antennæ broken]. Legs ochreous-whitish, annulated with fuscous. Forewings pale brownish, with purple reflections; a pale yellowish costal spot near base; a pale yellow triangular fascia before middle, very broad on costa, narrowing to a point on mid-dorsum; edged with fuscous, and containing a few fuscous scales; cilia brownish, on dorsum grey. Hindwings and cilia grey.

Closely allied to the preceding, but quite distinct in its markings. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; one specimen, received from Mr. F. P. Dodd.

Gen. GRACILARIA.

A large and cosmopolitan genus.

GRACILARIA CRASIPHILA.

Meyr., Gen. Insect., Gracilariadæ, p. 27.

N.A.: Port Darwin (Dodd).

GRACILARIA IOPHANES.

Meyr., Gen. Insect., Gracilariadæ, p. 27.

N.Q.: Kuranda, near Cairns, in October (Dodd).

GRACILARIA LEUCOLITHA.

Meyr., Gen. Insect., Gracilariadæ, p. 30.

N.A.: Port Darwin (Dodd).

GRACILARIA OENOPELLA.

Q.: Stradbroke Island, in December.

Gracilaria octopunctata.

N.Q.: Kuranda, near Cairns.

Gracilaria plagata.

Q.: Brisbane, in September and March.

Gracilaria albispersa.

Q.: Brisbane, in September and March.

Gracilaria albicincta.

Q.: Brisbane, in September and October.

Gracilaria xanthopharella.

N.Q.: Herberton, in January.—Q.: Brisbane, in November; Mt. Tambourine, in December; Coolangatta, in May.

Gracilaria euglypta.

N.Q.: Cairns, in September.

Gracilaria xylophanes.

Q.: Brisbane, in September, December, January, and April; Mt. Tambourine, in November and December.

Gracilaria eurycnema.

Q.: Brisbane, in August, September, and December; Toowoomba, in April.

Gracilaria plagiotoma, n.sp. [πλαγιοτομος, obliquely divided].

♂♀. 9 mm. Head brown-reddish; face white. Palpi white; terminal joint with a dark fuscous subapical ring. Antennæ dark grey, with paler annulations. Thorax white; patagia brown-reddish. Abdomen grey-whitish. Legs dark purple-fuscous; posterior pair brown-whitish; all tarsi white, with fine fuscous annulations. Forewings brown-reddish with purple reflections; markings white, sharply defined; an outwardly oblique fascia from $\frac{1}{3}$ costa to before mid-dorsum, slightly broader on costa; a large suboval spot on costa beyond $\frac{2}{3}$; cilia brown-reddish mixed with dark fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kamerunga, near Cairns, in July; six specimens, taken at one spot.

GRACILARIA ÆGLOPHANES, n.sp. [αἰγλοφανής, brilliant, lustrous].

♀. 10 mm. Head white. Palpi white; second joint fuscous toward apex; terminal joint with fine median and subapical rings. Antennæ grey. Thorax grey, with a large central snow-white spot. Abdomen grey. Legs dark fuscous; posterior pair whitish; all tarsi white, with fuscous annulations. Forewings ochreous-grey; markings lustrous snow-white, narrowly edged with blackish scales; a large spot on base of dorsum, nearly reaching costa; a fascia before middle, broad on dorsum, gradually attenuating almost to a point on costa at $\frac{1}{3}$; a second similar fascia from tornus to $\frac{2}{3}$ costa; a terminal spot; cilia grey, Hindwings and cilia grey.

In general appearance this recalls *Acrocercops autadelpha*. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in June; one specimen.

GRACILARIA PANCHRISTA, n.sp. [πάγχριστος, all unctuous].

♀. 11-12 mm. Head, palpi, and antennæ brownish-ochreous. Thorax glossy ochreous. Abdomen grey. Legs brownish-fuscous; posterior pair brown-whitish; anterior and middle tarsi white, with fine brownish-fuscous annulations. Forewings ochreous, with an unctuous gloss, faintly strigulated transversely with brownish fuscous, and with brownish-fuscous dots; a dot at $\frac{1}{8}$ above fold, a second beneath costa at $\frac{1}{4}$, and a third on midcosta; a series of numerous very fine costal, and another of fainter dorsal dots; a purple iridescence along termen; cilia ochreous, with a double fuscous line about middle, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

This and the following five species are closely akin, and need careful discrimination.

N.Q.: Kuranda, near Cairns, in November; Townsville, in February; two specimens, received from Mr. F. P. Dodd.

GRACILARIA THIOPHYLLA, n.sp. [θειοφυλλος, sulphur-winged].

♀. 8 mm. Head pale ochreous; face white. Palpi white; terminal joint with a fuscous subapical ring. Antennæ whitish-grey, basal joint white and rather stout. Thorax pale ochreous. Abdomen grey. Legs brownish-ochreous; posterior pair and all tarsi whitish. Forewings pale ochreous, without strigulations, but with dark fuscous dots; a minute dot above fold near base; a second larger, roundish, above fold at $\frac{1}{4}$; a third on costa beyond middle; a series of minute dots on basal half of costa, and on termen; cilia fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Townsville, in July; one specimen.

GRACILARIA MEGALOTIS.

Gracilaria megalotis Meyr., Journ. Bombay Nat. Hist. Soc., xviii., p.830(1908).

♂. 9-10 mm. Head and thorax pale yellowish. Palpi ochreous-whitish. Antennæ grey, towards base yellowish; with a short tuft of scales on apex of basal joint. Abdomen grey. Legs ochreous-whitish; middle tibiæ much thickened with dark brown scales. Forewings pale yellow, with fine fuscous strigulations; with purple iridescence to oblique light; two oblique lines of brown fuscous dots from costa at $\frac{1}{4}$ and middle, converging to a point on dorsum before middle; a similar subapical line; cilia pale yellowish, apices fuscous. Hindwings and cilia grey.

N.Q.: Kuranda, near Cairns, in October; two specimens. Also from India.

GRACILARIA XYSTOPHANES, n.sp. [ξυστοφανης, polished].

♂. 8 mm. Head pale yellowish; face shining white. Palpi ochreous-whitish; terminal joint dark fuscous beneath. Antennæ whitish-ochreous, with fuscous annulations. Thorax pale yellow. Abdomen grey. Legs fuscous; posterior pair whitish; anterior and middle tarsi white, with fuscous annulations. Forewings pale lustrous golden-yellow; many purple-fuscous dots near base and apex, with two rows parallel to dorsum, one above and one beneath fold; cilia pale yellow, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in June; one specimen.

GRACILARIA PERIXESTA, n.sp. [περιξεστος, polished].

♀. 8 mm. Head and thorax yellow; face whitish. Palpi whitish; terminal joint, except apex, fuscous. Antennæ fuscous, with whitish annulations. Abdomen grey. Legs fuscous; posterior pair and all tarsi whitish; anterior coxæ yellowish. Forewings yellow, with a brassy gloss; base of costa fuscous; a fuscous dot in disc beneath midcosta, and a second above tornus; cilia yellow, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

Q.: Caloundra, in August; one specimen.

GRACILARIA EUXESTA, n.sp. [εὔξεστος, polished].

♂. 6 mm. Head yellowish; face ochreous-whitish. Palpi ochreous-whitish; apex of terminal joint fuscous. Antennæ grey. Thorax and abdomen grey. Legs fuscous: tarsi, except at apices of joints, whitish. Forewings pale yellow, with a glossy lustre, and fine transverse fuscous strigulations sparsely but evenly distributed; a fuscous dot in disc at $\frac{1}{3}$, a second slightly beyond middle, and a third, rather larger, at apex; some fuscous irroration along termen; cilia fuscous, on dorsum grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; one specimen, received from Mr. F. P. Dodd.

Subfam. ZELLERIANÆ.

MACARANGELA LEUCOCHRYSA.

Q.: Caloundra, in August.—N.S.W.: Sydney, also in March.

ZELLERIA CYNETICA.

In this species, the terminal joint of the labial palpi is thickened with scales, so as to appear club-shaped.

Q.: Brisbane, in August; Mount Tambourine, in November and February; Killarney, in October.

ZELLERIA ARÆODES.

Best distinguished from the preceding, which it nearly resembles, by the slender, acute, terminal joint of palpi.

Q.: Brisbane, in August.

Zelleria callidoxa.

Q.: Stanthorpe, in February.

Zelleria sigillata.

N.S.W.: Glen Innes, in March.

Zelleria notoleuca, n.sp. [νωτολευκος, dorsally white].

♀. 9 mm. Head and palpi white. Antennæ grey, annulated with dark fuscous; basal joint white. Thorax white; patagia and a lateral stripe ochreous-fuscous. Abdomen dark fuscous, towards base pale ochreous-fuscous. Legs whitish annulated with fuscous. Forewings with costa nearly straight; brassy-fuscous, with some purple reflections, and fine transverse fuscous strigulations; a broad white dorsal streak from base to $\frac{3}{4}$, its upper edge irregularly indented; a white streak along termen from tornus nearly to apex, becoming slender and interrupted towards apex; two minute subapical costal white dots; cilia brassy-fuscous, with a fine basal dark fuscous line around apex, white beneath apex, thence grey. Hindwings and cilia grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in October; one specimen, received from Mr. F. P. Dodd.

Xyrosaris dryopa.

Q.: Brisbane, in September and January.

Subfam. Cyclotorninæ.

Gen. Cyclotorna.

Of this very peculiar and isolated genus, Mr. Meyrick has described two new species, both agreeing closely in structure with the type, except that, in one of them, vein 4 of the hindwings has become absent by coalescence with vein 3. Of the habits of a fourth species here described, I have no knowledge, nor have I any record of the circumstances of its capture. The other three species were bred, some ten years ago, by Mr. F. P. Dodd. Their life-histories, which have been recently published (Trans. Ent. Soc. 1911, p.577) are of extraordinary interest.

CYCLOTORNA MONOCENTRA.

N.Q. Townsville, in November and April.

CYCLOTORNA EXPERTA.

Meyr., Trans. Ent. Soc. 1911, p.589.

N.Q.: Townsville, from October to January(Dodd).

CYCLOTORNA DIPLOCENTRA, n.sp. [διπλοκεντρος, with double centre].

♀. 30 mm. Head, thorax, and legs brownish-fuscous, finely irrorated with whitish. Antennæ fuscous. Abdomen brownish-fuscous. Forewings elongate-oval, costa rather strongly arched, apex rounded, termen obliquely rounded, dorsum strongly arched before middle; brownish-grey, finely irrorated with whitish, and with sparsely scattered dark fuscous scales; two roundish dark fuscous discal spots; first above $\frac{2}{3}$ dorsum, second larger, beneath $\frac{2}{3}$ costa; cilia grey, with some whitish irroration. Hindwings and cilia fuscous. Type in Coll. Turner.

Q.: Brisbane; one specimen.

CYCLOTORNA EGENA, n.sp.

Meyr., Trans. Ent. Soc. 1911, p.590.

♀. 12-13 mm. Head whitish. Antennæ, thorax, and abdomen fuscous. Legs pale fuscous; posterior pair ochreous-whitish. Forewings elongate-oval, costa rather strongly arched, apex rounded, termen obliquely rounded, dorsum strongly arched before middle; a hyaline fovea on underside beneath costal vein at $\frac{1}{4}$; fuscous, with fine whitish irroration; a suffusedly darker roundish spot above dorsum beyond middle, and a second in mid-disc at $\frac{2}{3}$; cilia grey, with some whitish irroration. Hindwings with vein 4 absent; grey; cilia grey.

N.Q.: Townsville, in October and December; two specimens, of which one is in Coll. Lyell, received from Mr. F. P. Dodd.

Subfam. HYPONOMEUTINÆ.

HYPONOMEUTA INTERNELLUS.

N.Q.: Townsville, in August.—Q.: Brisbane, in November, January, and June; Mount Tambourine, in October and December; Killarney, in October.—N.S.W.: Glen Innes, in October; Ben Lomond, in January; Gosford, in August.

Hypnomeuta myriosemus.

N.Q.: Townsville, in July and August.—Q.: Brisbane, in August; Mount Tambourine, in November and January; Coolangatta, in January and May. I do not think that *H. paurodes* Meyr., is a distinct species.

Atteva charopis.

N.Q.: Kuranda, near Cairns, in October and November.

Atteva niphocosma.

N.Q.: Cape York; Cairns, in August; Townsville, in February and April.—Q.: Brisbane, in March.

Atteva albiguttata.

N.S.W.: Tweed River.

Tonza purella.

N.A.: Port Darwin, in February.—Q.: Brisbane, in February, March, and April; Stradbroke Island; Rosewood, in March; Coolangatta, in May.

Anticrates paraxantha.

In my example, 2 and 3 of forewings are stalked.

N.Q.: Stannary Hills.

Anticrates metreta.

I cannot re-examine the type, but have before me one female example with the following neuration—forewings with 2 and 3 stalked, 7, 8, 9 separate. Hindwings with 3 and 4 short-stalked, 6 and 7 widely separate at base, parallel.

N.Q.: Kuranda, near Cairns, in December(Dodd).

Anticrates zapyra.

My example agrees exactly with Mr. Meyrick's description, but 7 and 8 of forewings are long-stalked. Veins 2 and 3 of forewings are separate, but closely approximated; 3 and 4 of hindwings are connate.

N.Q.: Kuranda, near Cairns, in March(Dodd).

ANTICRATES PHÆDIMA, n.sp. [φαιδιμος, brilliant].

♂. 18 mm. Head pale yellow. Palpi ochreous-whitish; second joint dark fuscous on outer surface. Antennæ pale fuscous. Thorax dark fuscous, with an ochreous-whitish bar across middle of patagia. Abdomen pale red. Legs whitish-red; anterior pair fuscous. Forewings rather narrow-elongate, costa gently arched, apex rounded, termen oblique, slightly bowed: 2 and 3 stalked, 7 to 9 separate; whitish-yellow, markings dark fuscous; a triangular basal spot; a suffused triangular blotch on costa from $\frac{1}{6}$ to middle; an oblique fascia twice constricted or interrupted in disc, from $\frac{1}{4}$ dorsum to $\frac{3}{4}$ costa: an oblong spot on $\frac{3}{4}$ dorsum; a narrow mark on midtermen; cilia whitish-yellow, on midtermen and tornus dark fuscous. Hindwings elongate-ovate; red, towards base paler; cilia red, paler towards tornus. Type in Coll. Turner.

Q.: Mt. Tambourine, in November; one specimen.

Gen. LACTURA.

In this genus, vein 7 of forewings may run to hindmargin, to apex, or to a little on the costal side of apex.

LACTURA EGREGIELLA.

This species shows considerable variability in the forewings, which are grey, with white or whitish-ochreous blotches, of which the three basal appear constant, the remainder being very variable; the reddish lines also vary, and may be obsolete.

Q.: Eidsvold; Gayndah, in October; Brisbane, in October, January, and February; Rosewood, in March; Bunya Mountains, in December.

LACTURA DIVES.

N.A. Port Darwin, in January(Dodd).

LACTURA LÆTIFERA.

Q.: Gympie, in October.

LACTURA SUFFUSA.

N.Q.: Cairns, in February, March, and April.—Q.: Gympie; Brisbane, in November and February.

Lactura pilcheri.

Q.: Brisbane, in November and March.

Lactura cristata.

Q.: Gympie, in April; Brisbane, in March.

Lactura calliphylla.

Q.: Mount Tambourine, in November, February, and March (not from Brisbane); Coolangatta, in March.—N.S.W.: Tweed River, in October.

Lactura erythractis.

N.A.: Port Darwin, in October.—N.Q.: Thursday Island; Cape York; Stannary Hills; Townsville, in January.

Lactura mactata.

N.Q.: Kuranda, near Cairns, in October and April; Innisfail, in November; Atherton, in June.

Lactura pteropœcila, n.sp. [πτεροποικιλος, with variegated wings].

♀. 20 mm. Head yellow. Palpi fuscous; terminal joint ochreous-whitish. Antennæ fuscous; basal joint pale yellow. Thorax fuscous, with a posterior yellow spot. Abdomen fuscous; extreme base and apex reddish; under surface yellowish, with a reddish lateral line. Legs reddish; anterior pair fuscous; middle tibiæ, apex of posterior tibiæ, and all tarsi fuscous. Forewings elongate-oval, costa strongly arched, apex rounded, termen obliquely rounded; 7 and 8 stalked, 7 to apex or costa; yellow; markings fuscous; a broad line on costa from base to $\frac{1}{4}$; a broadly Y-shaped blotch with its base on midcosta, the limbs diverging widely in disc; beneath this, three small discal dots, the first two forming a transverse pair, and a dot on mid-dorsum; a large terminal blotch containing a yellowish spot before middle; cilia yellow, on apex and tornus fuscous. Hindwings elongate-ovate; dark fuscous, extreme base red; cilia fuscous.

Nearest to *L. cristata.* Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in December and April; two specimens.

Gen. TRYCHNOMERA, n.g. [τρυχνομηρος, rough-thighed].

Labial palpi moderate, porrect, smooth-scaled; terminal joint stout. Maxillary palpi rudimentary. Posterior tibiæ with long hairs on upper surface. Forewings with 11 veins, 7 and 8 coincident. Hindwings ovate, cilia extremely short; 3 and 4 remote at origin, 4 and 5 short-stalked, 6 and 7 remote at origin, tolerably parallel.

Closely allied to *Lactura*, the neuration of the hindwings being identical, and that of the forewings differing only by the coincidence of 7 and 8, but differing conspicuously in the hairy posterior tibiæ.

TRYCHNOMERA ANTHEMIS, n.sp. [ἀνθεμις, a flower].

♀. 31 mm. Head and palpi reddish-orange. Antennæ whitish-yellow; basal joint reddish-orange. Thorax and abdomen pale purple-reddish; base of patagia whitish-yellow. Legs whitish-yellow; anterior pair reddish-orange. Forewings oval, costa strongly arched, apex rounded, termen obliquely rounded; pale purple-reddish; costal, dorsal, and terminal edges reddish-orange, except where occupied by pale markings; markings whitish-yellow; an elongate spot on costa at $\frac{1}{4}$, and another rather shorter at $\frac{3}{4}$; two round subdorsal spots at $\frac{1}{4}$ and middle, and at dot at $\frac{3}{4}$; an apical spot; an elongate terminal spot from slightly beneath this to tornus; cilia whitish-yellow, before apex and on tornus reddish-orange. Hindwings and cilia pale red. Beneath pale red with a whitish-yellow terminal fascia on forewings. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in April; one specimen, received from Mr. F. P. Dodd.

CEBYSA LEUCOTELES.

N.S.W.: Glen Innes, in March.—Tasm.: Hobart.

PIESTOCEROS CONJUNCTELLA.

Q.: Nambour, Brisbane, and Stradbroke Island, in October and November.

Gen. SYNECHODES, n.g. [συνεχωδης, apparently connecting].

Head with appressed scales. Tongue developed. Palpi moderate, somewhat ascending, thickened with appressed scales; terminal joint short, rather obtuse. Maxillary palpi obsolete. Antennæ of ♂ thickened, and broadly laminate, the laminations closely appressed. Posterior tibiæ rough-haired above. Forewings with all veins present and separate, 7 to apex, 11 from middle, no secondary cell. Hindwings with all veins present, 3 and 4 connate, 5, 6, 7 parallel.

Near *Miscera*, differing in the palpi and ♂ antennæ; also with affinity to *Tortyra*, being, in fact, intermediate between the two genera.

SYNECHODES CONIOPHORA, n.sp. [κονιοφορος, dust-covered].

♂. 16-17 mm. Head dark fuscous. Palpi white, terminal and apical part of second joint dark fuscous. Antennæ dark fuscous, with an ochreous ring at $\frac{2}{3}$. Thorax dark fuscous; patagia orange, with a few fuscous scales. Abdomen dark fuscous, with some pale ochreous scales on apices of segments. Legs dark fuscous, with whitish annulations. Forewings somewhat dilated posteriorly, costa straight, slightly arched towards apex, apex rounded, termen obliquely rounded; dark fuscous, evenly dusted with pale ochreous scales; two or three orange suffused sub-basal spots in disc arranged transversely, and closely connected; cilia fuscous. Hindwings dark fuscous; a pale ochreous median streak from base, broadening costally and reaching middle of disc; cilia pale ochreous. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in March; three specimens, received from Mr. F. P. Dodd.

Gen. EUTHORYBETA, n.g. [εὐθορυβητος, easily confounded].

Head loosely scaled. Tongue well developed. Palpi moderate, ascending, second joint densely rough-haired beneath; terminal joint short, obtuse. Maxillary palpi obsolete. [Antennæ in ♂ unknown]. Posterior tibiæ rough-scaled above. Forewings with all veins present and separate, 7 to apex. Hindwings with seven veins, 3 and 4 coincident, 5, 6, 7 parallel.

Closely allied to *Miscera*, but distinguishable by the loss of vein 4 in hindwings. Type *E. xanthoplaca*.

EUTHORYBETA XANTHOPLACA, n.sp. [ξανθοπλακος, broadly yellow].

♀. 14 mm. Head fuscous, posteriorly fringed with ochreous; face whitish, upper third fuscous. Palpi white, apices of second and terminal joints fuscous. Antennæ fuscous. Thorax and abdomen fuscous, with a few whitish scales. Legs fuscous, annulated with whitish and whitish-ochreous. Forewings somewhat dilated posteriorly, costa straight, apex rounded, termen not oblique, rounded beneath; fuscous, with a few scattered white scales; a patch of whitish irroration from mid-dorsum nearly to costa; a white dot on costa at $\frac{2}{3}$, with a line of irroration between it and tornus; a similar subterminal line; cilia fuscous, apices pale ochreous from beneath apex nearly to mid-termen. Hindwings fuscous; a broad ochreous-yellow subbasal fascia; cilia fuscous, apices whitish-ochreous, towards termen wholly whitish-ochreous. Type in Coll. Turner.

Q.: Stradbroke Island, in September. N.S.W.: Sydney(Lyell). Two specimens.

EUTHORYBETA OCHROPLACA, n.sp. [ὠχροπλακος, broadly pale].

♀. 18 mm. Head fuscous, posteriorly fringed with ochreous. Palpi white, apices of second and terminal joints fuscous. Antennæ fuscous. Thorax fuscous, a white dot on each shoulder, and a pair of white dots near posterior edge. Abdomen fuscous; bases of first two segments whitish. Legs whitish, annulated with whitish and whitish-ochreous. Forewings only slightly dilated, costa straight, apex rounded, termen rather obliquely rounded; fuscous, markings white; a subcostal dot near base; a suffused spot in disc before middle, connected with dorsum; a spot on costa at $\frac{3}{4}$, and another in disc just above tornus; cilia fuscous. Hindwings fuscous; a broad white subbasal fascia; cilia fuscous, towards tornus with white apices. Type in Coll. Turner.

Q.: Stanthorpe, in February; one specimen.

MISCERA LEUCOPIS.

Vic.: Wallington, near Geelong, in February; Dimboola, in November. Two ♀ examples, in Coll. Lyell.

MISCERA MESOCHRYSA.

W.A.: Waroona, in November.

MISCERA DESMOTONA.

N.S.W.: Sydney, in March.—Vic.: Wandin, in November.

MISCERA CENTROPUS.

W.A.: Waroona, in December and January; one example, in Coll. Lyell. The forewings without whitish spot, but with some whitish irroration near base and beyond middle.

MISCERA HOLODISCA.

W.A.: Waroona, in November; two specimens, taken on the same day, a wasted male, and a female differing from type in forewings having a white spot at $\frac{2}{3}$, a whitish erect mark on mid-dorsum, and some whitish irroration towards termen.

MISCERA MICRASTA.

W.A.: Waroona, in December and January.

MISCERA HETEROZYGA, n.sp. [ἑτερόζυγος, unevenly yoked].

♂. 20-22 mm. Head blackish; posterior edge and face ochreous. Palpi $2\frac{1}{2}$; blackish, undersurface, except at apex, with long ochreous hairs. Antennæ blackish; pectinations $2\frac{1}{2}$. Thorax blackish, with a posterior pair of orange-ochreous spots. Abdomen blackish, with an orange-ochreous ring on 4th segment; tuft large, expanded, blackish, sides orange-ochreous. Legs blackish; tibiæ banded with ochreous; tarsi annulated with whitish; spurs whitish. Forewings elongate, rather abruptly dilated posteriorly, costa sinuate, apex rounded, termen obliquely rounded; blackish; an orange streak at basal third of costa; an orange spot in disc at $\frac{4}{5}$, connected by a line with $\frac{3}{5}$ dorsum; cilia fuscous, apices whitish. Hindwings with disc scaleless, translucent; some ochreous and fuscous scales on veins; extreme base and a broad terminal band blackish; cilia whitish, bases more or less fuscous.

♀. 22-25 mm. Head and face blackish, with a few ochreous scales between antennæ. Palpi with appressed scales; whitish-ochreous; terminal and apex of second joint blackish; antennæ with an ochreous ring at $\frac{3}{4}$; thickened, slightly serrate towards apex. Thorax with patagia orange. Abdomen orange, except at apex; no tuft. Tibiæ without orange bands. Forewings with costa straight to near apex; blackish, evenly dusted with whitish-ochreous scales; an orange subbasal fascia not reaching dorsum; an outwardly oblique orange band from $\frac{2}{3}$ costa to mid-disc, nearly joined by another very oblique band from $\frac{1}{3}$ dorsum; cilia fuscous. Hindwings orange; base of costa and a broad terminal band blackish; cilia orange. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in January, February and April; four specimens, received from Mr. F. P. Dodd, two of each sex.

MISCERA ANDROGYNA, n.sp. [ἀνδρογυνος, having the characters of both sexes].

♀. 25 mm. Head orange. Palpi 3, loosely haired beneath; ochreous, mixed with fuscous on upper surface. Antennæ blackish; in ♀ with a single row of long pectinations(2). Thorax blackish; tongue orange; patagia orange except in centre. Abdomen orange; apex and four rings on 3rd, 4th, 6th, and 7th segments, blackish. Legs dark fuscous, with some ochreous scales; dorsum of middle and posterior tibiæ with orange hairs; tarsi with some whitish scales. Forewings with termen slightly sinuate, apex rounded, termen obliquely rounded; blackish; dorsal edge orange; an orange basal fascia produced along costa; a large posterior orange blotch, not quite reaching termen, broadly connected with dorsum beyond middle; cilia fuscous. Hindwings orange; a narrow blackish terminal band from apex not reaching tornus; cilia on band fuscous, on tornus orange. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in January; one specimen, received from Mr. F. P. Dodd.

MISCERA LYGROPIS, n.sp. [λυγρωπις, gloomy].

♂. 39-41 mm. Head fuscous. Palpi with appressed scales; fuscous, beneath whitish. Antennæ dark fuscous; pectinations 4. Thorax and abdomen dark fuscous. Legs fuscous, with some ochreous hairs. Forewings elongate, posteriorly dilated, costa nearly straight to near apex, apex rounded, termen slightly rounded, slightly oblique; dark fuscous; a slightly paler discal dot at $\frac{2}{3}$; cilia fuscous. Hindwings dark fuscous; two elongate pale ochreous antemedian spots, nearly confluent; hairs on vein 1c pale ochreous; cilia pale ochreous, with a dark fuscous basal line.

Distinguished from *M. desmotona* by the longer antennal pectinations, absence of white markings on forewings, and obsolescence of dorsal spot of hindwings. Type in Coll. Turner.

Q.: Stradbroke Island, in January; five specimens.

MISCERA PAMMELAS, n.sp. [παμμελας, all-black].

♂. 38 mm. Head dark fuscous. Palpi slightly rough-scaled; dark fuscous, beneath whitish. Antennæ dark fuscous; pectinations 2. Thorax and abdomen dark fuscous. Legs dark fuscous, with ochreous hairs. Forewings elongate, posteriorly slightly dilated, costa straight to near apex, apex rounded, termen scarcely rounded, moderately oblique; dark fuscous; cilia dark fuscous. Hindwings dark fuscous; cilia fuscous. Type in Coll. Lyell.

W.A.: Waroona, in January; one specimen, received from Mr. G. F. Berthoud.

Gen. TANAOCTENA, n.g. [τανaοκτενος, with long combs].

Head with appressed scales. Tongue minute. Palpi moderate, porrect, diverging; second joint rather long, thickened with appressed scales beneath; terminal joint short, slender, acute. Maxillary palpi obsolete. Antennæ with strong basal eyecap of broad overlapping scales; in ♂ with a single row of long pectinations. Posterior tibiæ smooth. Forewings with 2 from well before angle, 7 separate, running to termen just below apex, 8 and 9 stalked. Hindwings with 4, 5, 6, and 7 parallel.

TANAOCTENA OOPTILA, n.sp. [ὠοπτιλος, oval-winged].

♂. 14-16 mm. Head and palpi ochreous-whitish. Antennæ ochreous-whitish; in ♂ with a single row of long pectinations (5). Thorax pale fuscous; in ♂ with a pencil of hairs anteriorly extending backwards beneath root of forewing. Abdomen pale grey. Legs pale fuscous; posterior pair ochreous-whitish. Forewings elongate-oval, costa strongly arched, apex rounded, termen obliquely rounded; ochreous-whitish, with irregular fuscous suffusion which tends to form transverse lines; a dark fuscous median discal dot at $\frac{1}{3}$, and a second before $\frac{2}{3}$; two closely approximated lines from costa at $\frac{1}{4}$, diverging in disc, the first inwardly curved to $\frac{1}{4}$ dorsum, the second outwardly to mid-dorsum; a pale area around first discal dot; two suffused lines between this and second dot; cilia grey-whitish. Hindwings ovate, ciliations $\frac{1}{4}$; whitish; cilia whitish. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in July; two specimens, received from Mr. F. P. Dodd.

IMMA ALBIFASCIELLA.

N.Q.: Kuranda, near Cairns, in December and April; Townsville, in March.

IMMA ACOSMA.

Tortricomorpha leiochroa Low., Trans. Roy. Soc. S. Aust., 1903, p.69, is a synonym.

N.A.: Port Darwin.—N.Q.: Townsville, in June and July.—Q.: Brisbane, in September, October, November, February, April, and May; Rosewood, in March; Warwick, in March.—N.S.W.: Jenolan, in February.

IMMA MARILEUTIS.

N.Q.: Cape York; Kuranda, near Cairns, in April.

IMMA LYRIFERA.

Imma lyrifera Meyr., Trans. Ent. Soc. 1910, p.466.

N.Q.: Atherton. Also from Louisiades.

My example lacks the interneural streaks on forewing, but otherwise agrees exactly with the description.

IMMA PLATYXANTHA, n.sp. [πλατυξανθος, broadly yellow].

♂. 20 mm. Head yellow-ochreous. Palpi yellow-ochreous, anteriorly fuscous. Antennæ yellow-ochreous; ciliations in ♂ $\frac{2}{3}$. Thorax pale ochreous-fuscous, with a yellow-ochreous central spot. Abdomen fuscous; beneath ochreous-whitish. Forewings dilated posteriorly, costa gently arched, apex rectangular, termen gently bowed, scarcely oblique; pale fuscous, with large yellow-ochreous blotches; a small subcostal basal spot; a large squarish blotch on costa near base, nearly touching a smaller spot on $\frac{1}{4}$ dorsum; a second rounded spot on costa before middle, nearly touching a large squarish blotch on mid-dorsum; a spot on costa at $\frac{2}{3}$; a triangular spot on costa immediately before apex; a dark fuscous terminal line not extending to tornus; cilia pale fuscous. Hindwings dark fuscous; cilia fuscous, on dorsum whitish. Type in Coll. Lyell.

N.Q.: Kuranda, near Cairns, in April; one specimen, received from Mr. F. P. Dodd.

IMMA ATROSIGNATA.

Tortricomorpha atrosignata Feld., Reise Novara, Pl.108, f.3.

♂. 20 mm. Head, palpi, antennæ, thorax, and abdomen fuscous. Antennal ciliations in ♂ minute. Legs fuscous; tarsi with apices of segments and under surface whitish; anterior femora whitish posteriorly; anterior tibiæ whitish, with two fuscous bars on anterior surface, one at base, the other before apex; posterior and middle tibiæ in ♂ densely hairy beneath. Forewings dilated posteriorly, costa almost straight, apex round-pointed, termen bowed, oblique; 7 and 8 stalked, 8 to termen; fuscous; a slightly darker crescentic mark at end of cell; cilia fuscous. Hindwings fuscous-grey; towards base and dorsum thinly scaled and translucent; an elongate wedge-shaped deep black mark on either side of antemedian vein from base to near, but not touching termen; cilia pale grey, with a darker basal line.

Conspicuously distinct by the black brand on hindwings. Felder's figure is poor, but I do not think there can be much doubt as to the identification.

N.A.: Port Darwin, in January; one specimen, received from Mr. F. P. Dodd. Also from Amboyna.

IMMA LOXOSCIA, n.sp. [λοχοσκιος, obliquely shaded].

♂. 18-20 mm. Head and palpi ochreous-whitish. Antennæ ochreous-whitish; ciliations in ♂ 1. Thorax ochreous-whitish, irrorated with grey. Abdomen grey; beneath ochreous-whitish. Legs ochreous-whitish; anterior and middle tibiæ and all tarsi grey, with ochreous-whitish annulations. Forewings elongate-triangular, costa obtusely angled beyond middle, apex rectangular, termen straight, slightly rounded towards tornus, dorsum strongly angled at $\frac{1}{4}$; ochreous-whitish usually irrorated with grey; a grey or fuscous line on dorsum from base to $\frac{1}{4}$; a slightly waved oblique fuscous line from costa just beyond middle to dorsum near tornus; beyond this ground-colour is more brownish and usually with fuscous irroration; a dark fuscous terminal line narrowing beneath and not reaching tornus, its anterior edge with minute dentations; cilia grey, bases paler, with a dark sub-basal line opposite upper $\frac{2}{3}$ of termen. Hindwings with termen rounded and slightly waved; dark grey; cilia whitish, with a grey sub-basal line. Type in Coll. Turner.

N.A.: Port Darwin, in December.—N.Q.: Townsville, in December and March. Four specimens, received from Mr. F. P. Dodd.

IMMA CLEIS.

Feld., Reise Nov., Pl.130, f.22.

♂♀. 30-34 mm. Head and palpi ochreous; face sometimes fuscous. Antennæ ochreous sometimes suffused or barred with fuscous; antennæ in ♂ serrate with long cilia ($2\frac{1}{2}$) in tufts. Thorax and abdomen blackish; the latter usually pale ochreous beneath. Legs fuscous; anterior pair ochreous. Forewings broadly triangular, costa moderately arched, apex rounded, termen bowed, slightly oblique; blackish; an orange fascia from midcosta to dorsum before tornus; outwardly oblique and slightly curved; cilia blackish. Hindwings broader than forewings; blackish; a broad orange median fascia; cilia blackish.

In specimens from Port Darwin and Cape York, the fasciæ are broader, and the antennæ ochreous. In those from Cairns, the fasciæ are narrower and deeper orange, and diminish towards tornus. It is a large and conspicuous insect, very different from its Australian congeners.

N.A.: Port Darwin, in November and March.—N.Q.: Cape York; Kuranda, near Cairns, in February and May.

Gen. CALLIZYGA.

Callizyga Turn., Trans. Roy. Soc. S. Aust., 1894, p. 132.

Head with closely appressed hair-scales, forming a strong anterior projection between antennæ. Palpi rather stout, smooth, erect; second joint reaching to base of antennæ; terminal joint $\frac{2}{3}$ of second, nearly as stout, apex obtusely rounded. Antennæ in ♂ with long ciliations. Posterior tibiæ rough-haired above. Forewings with 7 and 8 stalked, 8 to termen. Hindwings with cilia very short; 3 and 4 approximated at origin, 5, 6, and 7 parallel.

Though not closely related to any genus known to me, I think *Callizyga* must be placed in this group. The palpi and neuration of forewings are those of *Imma*. The neuration of the hindwings suggests a closer relationship with the *Lactura*-group.

CALLIZYGA DISPAR.

Callizyga dispar Turn., Trans. Roy. Soc. S. Aust., 1894, p. 132.

N.Q.: Kuranda, near Cairns, in January.—Q.: Brisbane.

Subfam. GLYPHIPTERYGINÆ.

EPICRŒSA THIASARCHA.

N.Q.: Kuranda, near Cairns, from June to November.

EPICRŒSA AMBROSIA.

N.Q.: Kuranda, near Cairns, from September to November; Townsville.—Q: Burpengary, near Brisbane, in December.

TORTYRA LIBANOTA

Tortyra libanota Meyr., Trans. Ent. Soc. 1910, p.463.

N.Q.: Townsville. Also from Louisiades.

Tortyra exanthista.

Tortyra exanthista Meyr., Trans. Ent. Soc., 1910, p. 464.

This is the species which Mr. Meyrick described, in his revision, as *T. prodigella* Wlk.

N.Q.: Kuranda, near Cairns, in November, February, March, and April.

Brenthia quadriforella.

N.Q.: Kuranda, near Cairns, in June and September.

Brenthia hecatæa.

N.Q.: Kuranda, near Cairns, in October.

Brenthia pampœcila, n.sp. [παμποικιλος, all variegated].

♂. 8 mm. Head ochreous. Palpi white towards base, second joint towards apex blue, terminal joint fuscous. Antennæ whitish-ochreous; ciliations in ♂ 1½. Thorax and abdomen ochreous-fuscous. Legs ochreous-fuscous; tarsi annulated with white; spurs white. Forewings dilated posteriorly, costa gently arched, more strongly towards apex, apex rounded, termen straight, moderately oblique; pale ochreous, towards costa and termen and in mid-disc orange-red; with numerous purple-fuscous lines forming an intricate pattern; five short costal streaks metallic-purple, the first four commencing as white costal dots at $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{5}{6}$, the last small, subapical; a large triangular dorsal fuscous blotch on base extending to $\frac{1}{4}$ dorsum, acutely angled in disc, containing an orange-red spot; nine lines from dorsum beyond this, all narrow, extending $\frac{2}{3}$ across disc, those in centre connected or anastomosing; a fuscous spot on tornus and three more on termen; cilia on costa white, on termen pale ochreous, on tornus fuscous, a fuscous apical line opposite apex. Hindwings ochreous-grey; cilia grey, with a darker basal line. Type in Coll. Lyell.

N.Q.: Townsville, in December; one specimen, received from Mr. F. P. Dodd.

Choreutis bjerkandrella.

N.Q.: Kuranda, near Cairns, in March.—Q.: Brisbane, from October to February; Mount Tambourine, in September; Stanthorpe, in February.—N.S.W.: Tabulam, in December; Mt. Kosciusko (3,000ft.), in March.—Vic.: Gisborne, in December.

SIMÆTHIS BASALIS.

N.Q.: Kuranda, near Cairns, in February; Innisfail, in November and May. The Brisbane locality is doubtful.

SIMÆTHIS LIMONIAS.

N.Q.: Kuranda, near Cairns, in October and March; Innisfail, in November.

SIMÆTHIS SYCOPOLA.

Q.: Brisbane, in April.

SIMÆTHIS OPHIOSEMA.

N.Q.: Townsville, in December, January, February, and March.

SIMÆTHIS METALLICA.

N.Q.: Kuranda, near Cairns, in December and April; Townsville, in March.—Q.: Brisbane, in January.

SIMÆTHIS PERIPLOCA, n.sp. [περιπλοκος, entangled, intricate].

♂♀. 15-17 mm. Head grey, with fine whitish irroration. Palpi white, ringed with dark fuscous. Antennæ blackish, ringed with white; ciliations in ♂ 4. Thorax and abdomen ochreous-grey; the former with some whitish irroration. Legs dark fuscous, with white annulations; posterior tarsi with white basal rings on first and second joints, third joint wholly white. Forewings broadly triangular, costa strongly arched, apex rectangular, termen slightly bowed, moderately oblique; ochreous-grey; markings formed by bands of fine white irroration; some white irroratien near base; first fascia sub-basal; second at $\frac{1}{3}$, broad and straight-edged; third and fourth from $\frac{2}{3}$ costa, separated only by a fine line of ground-colour, parallel, acutely and irregularly angled, diverging on dorsum to $\frac{3}{4}$ and tornus; an oval spot in disc before third line, occupying a large concavity formed by this line; cilia fuscous, with a darker basal line, apices white on costa before apex, on termen beneath apex, and again sometimes below middle. Hindwings ochreous-grey; a short whitish subterminal line above tornus; cilia grey, extreme bases whitish, succeeded by a dark grey line. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, and Townsville, in November; two specimens received from Mr. F. P. Dodd, of which ♀ is in Coll. Lyell.

GLYPHIPTERYX PROTOMACRA.

W.A.: Waroona, in October.

GLYPHIPTERYX ACINACELLA.

Q.: Stradbroke Island, in October.

GLYPHIPTERYX PALÆOMORPHA.

N.Q.: Kuranda, near Cairns, in October.—Q.: Nambour, in September, December, and April.

GLYPHIPTERYX EUTHYBELEMNA.

Vic.: Gisborne, in November.

GLYPHIPTERYX MACRANTHA.

Vic.: Gisborne, also in January and March.

GLYPHIPTERYX PLATYDISEMA.

Vic.: Gisborne, in November. Mr. G. Lyell informs me that this is the ♀ of *G. palæomorpha*, and that he has taken the two forms *in cop.*, on several occasions.

GLYPHIPTERYX METEORA.

Q.: Mt. Tambourine, in September.

GLYPHIPTERYX CHRYSOPLANETIS.

Q.: Brisbane, in October, November, and December; Mt. Tambourine, in February; Helidon, in April; Toowoomba, in November and April; Stanthorpe.

GLYPHIPTERYX LEUCOCERASTES.

Q.: Brisbane, in September; Mount Tambourine, in November.

GLYPHIPTERYX DROSOPHAES.

Vic.: Beaconsfield, in October.

Glyphipteryx asteriella.

Vic.: Gisborne, in March; Loch, in April.

Glyphipteryx isozela.

N.S.W.: Mt. Kosciusko (3,000 to 5,000ft.), in March.—Vic.: Mt. Macedon, in December; Mt. St. Bernard (5,000ft.), in February. The specimens from Mt. Kosciusko and Mt. St. Bernard appear to form a local race, in which the first costal streak does not reach the second dorsal spot, the two being rather widely separate on fold.

Glyphipteryx parazona.

Vic.: Gisborne, in April; Mt. St. Bernard, in February.

Glyphipteryx cyanophracta.

N.S.W.: Mt. Kosciusko (5,000ft.), in March.

Glyphipteryx iometalla.

N.Q.: Cairns, in August.—Q.: Brisbane, in August, September, and October; Coolangatta, in December.

Glyphipteryx argyrosema.

Q.: Dulong, near Nambour, in April; Mt. Tambourine, in February; Toowoomba, in October.

Glyphipteryx phosphora.

Q.: Mt. Tambourine, in November; Toowoomba, in November.—N.S.W.: Glen Innes, in December.

Glyphipteryx calliscopa.

Vic.: Gisborne, in March; Beaconsfield, in March; Mt. St. Bernard, in February.—Tasmania: Hobart, in February.

Glyphipteryx cometophora.

Vic.: Beaconsfield, in October.

Glyphipteryx gemmipunctella.

N.Q.: Herberton, in February.—Q.: Brisbane, in May.—Vic.: Sale, in March.

GLYPHIPTERYX TRIPSELIA.

Vic.: Mt. St. Bernard, in February.

GLYPHIPTERYX CYANOCHALCHA.

Vic.: Gisborne, from January to March.

GLYPHIPTERYX POLYCHROA.

N.S.W.: Mt. Kosciusko (5,000-6,000ft.), in March.

GLYPHIPTERYX PYRISTACTA, n.sp. [πυριστακτος, streaming with fire].

♂♀. 12-14 mm. Head, thorax, and antennæ dark fuscous. Palpi dark fuscous, bases ochreous. Abdomen orange-ochreous; terminal segments and a series of median dorsal dots dark fuscous. Legs fuscous, annulated with whitish-ochreous; posterior tibiæ ochreous, except at apex; apex of posterior tarsi snow-white. Forewings elongate, termen incised beneath apex; dark fuscous; an antemedian fascia commencing as a broad greenish or purple metallic line from $\frac{1}{3}$ costa, expanding in disc into a broadly triangular orange spot, with base on dorsum; a short metallic line with green and purple lustre from midcosta obliquely outwards; a similar line from $\frac{2}{3}$ costa to tornus; on costa, these lines form white dots, and there are two white dots on costa beyond them; another brilliant metallic line on termen; cilia pale ochreous. Hindwings fuscous; base broadly ochreous; cilia ochreous, with a fuscous basal line, obsolete towards tornus. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; two specimens, received from Mr. F. P. Dodd.

GLYPHIPTERYX LYCNOPHORA, n.sp. [λυχνοφορος, carrying a light].

♀. 6 mm. Head and thorax bronzy-grey. Palpi white, with three dark fuscous rings. Antennæ fuscous. Abdomen dark grey. Legs dark fuscous; tarsi with white annulations. Forewings bronzy-grey; six white costal streaks partly edged with dark fuscous; first at $\frac{1}{3}$, short, strongly outwardly oblique; second from middle, similar but longer; third from $\frac{2}{3}$, less oblique, silvery at apex; fourth, fifth, and sixth short, rather inwardly oblique, subapical; a short, very slender white streak from above mid-dorsum to fold at $\frac{3}{4}$; a silvery erect mark from tornus, and a second along termen at middle; a round black apical spot; cilia white, bases bronzy, indented beneath apex, and with a dark fuscous apical hook. Hindwings and cilia grey.

This minute species appears to be nearest *G. autopetes*. Type in Coll. Turner.

Q.: Caloundra, in September; one specimen.

GLYPHIPTERYX HARPOGRAMMA, n.sp. [ἁρπογραμμος, sickle-marked].

♂. 5 mm. Head and thorax bronzy-grey. Palpi whitish. Antennæ grey. Abdomen grey. Legs grey; tarsi with white annulations. Forewings bronzy-grey; five short white costal streaks between $\frac{2}{3}$ and apex; a white sickle-shaped streak from mid-dorsum; curved obliquely outwards and gradually narrowing to a sharp point, its outer edge sometimes ill-defined; a white dot on dorsum; two purplish-metallic dots, or an ill-defined metallic blotch between this and second costal streak; cilia white, bases bronzy grey, incised beneath apex. Hindwings and cilia grey.

Near *G. acinacella*, but much smaller and paler, the palpi without blackish rings, no metallic spots near termen, and no apical dark hook in cilia. The last is present in my examples of *G. acinacella*. Type in Coll. Turner.

N.Q.: Cardwell, in August; Mourilyan Harbour, near Innisfail, in July; two specimens.

GLYPHIPTERYX ARGYROTOXA, n.sp. [ἀργυροτοξος, with silver bow].

♀. 6 mm. Head and thorax silvery grey-whitish. Palpi whitish. Antennæ pale grey. Abdomen and legs grey-whitish. Forewings pale bronzy-grey; a broad, ill-defined silvery-white oblique streak from mid-dorsum; four silvery-white costal streaks; first from beyond middle, strongly outwardly oblique; second from $\frac{2}{3}$, moderately oblique, long, ending in a silvery spot above tornus; third and fourth very short, subapical; a small black apical spot; cilia whitish, bases fuscous, incised beneath apex. Hindwings and cilia grey-whitish. Type in Coll. Turner.

Q.: Brisbane, in May; one specimen.

GLYPHIPTERYX CHALCERES, n.sp. [χαλκηρης, inlaid with brass].

♂♀. 7-11 mm. Head and thorax bronzy-fuscous. Palpi whitish, with four dark fuscous rings; second joint with rough projecting scales beneath. Antennæ fuscous. Abdomen fuscous; apex of tuft whitish. Legs fuscous, annulated with white; spurs white. Forewings rather pale bronzy-fuscous; a large whitish sub-basal dorsal blotch sometimes narrowly connected with costa; a squarish rather irregularly edged whitish spot on costa beyond middle; five whitish costal streaks, the first three with brassy lustre except at bases, partially edged with dark fuscous; first at $\frac{2}{5}$, short, slightly oblique, sometimes running into second dorsal spot; second from $\frac{3}{5}$, rather longer, oblique; third from before $\frac{4}{5}$, like second; fourth and fifth short, subapical; a brassy-metallic spot on tornus, and two on termen, one above and one below incision; a blackish apical spot; cilia whitish, bases bronzy-fuscous, incised beneath apex, with an apical blackish hook, on tornus fuscous. Hindwings and cilia grey.

Near *G. meteora,* but forewings paler, dorsal spot not clear white, and basal spot not forming a complete fascia. Type in Coll. Turner.

Q.: Mt. Tambourine, in September; five specimens.

GLYPHIPTERYX CHALCODÆDALA, n.sp. [χαλκοδαιδαλος, wrought with brass].

♂. 11 mm. Head and thorax bronzy-fuscous. Palpi white, four rings and apex blackish; scales short. Antennæ fuscous. Abdomen fuscous; apex of tuft whitish. Legs fuscous, with white annulations, spurs white. Forewings with 7 and 8 separate; rather pale bronzy-fuscous; markings more or less èdged with fuscous; two short whitish erect streaks from dorsum, first sub-basal, second from middle; six violet-metallic costal streaks, whitish on costa; first from $\frac{1}{4}$, moderately long, somewhat oblique; second similar, from $\frac{3}{8}$; third longer, from middle; fourth from $\frac{5}{8}$, like third; fifth from $\frac{3}{4}$, very short; sixth from $\frac{7}{8}$, like fifth; a metallic dot in mid-disc before third costal streak, and a second similar dot below and beyond it; a metallic streak from tornus nearly meeting fourth costal streak; metallic discal dots opposite apices of fifth and sixth streaks; a metallic line along lower part of termen; cilia bronzy-fuscous, apices white, incised with white beneath apex, a dark fuscous apical hook, on tornus dark fuscous. Hindwings and cilia dark grey. Type in Coll. Turner.

Q.: Mt. Tambourine, in March; one specimen.

GLYPHIPTERYX RHANTERIA, n.sp. [ῥαντηριος, sprinkled].

♂♀. 7 mm. Head and thorax bronzy-fuscous. Palpi white, with four blackish rings. Antennæ fuscous. Abdomen fuscous; apex of tuft whitish. Legs dark fuscous, with whitish annulations. Forewings ochreous-fuscous mixed with fuscous, and partly sprinkled with whitish; a transverse fascia of whitish irroration at $\frac{1}{3}$, its anterior edge concave; five very short whitish costal streaks, the second or third more or less prolonged obliquely by whitish irroration; a white dot on $\frac{3}{4}$ dorsum, and another at tornus; cilia dark fuscous, incised with white beneath apex. Hindwings grey; much paler towards base; cilia grey.

Very distinct by the whitish irroration of forewings and absence of metallic lustre. Type in Coll. Turner.

Q.: Brisbane, in November and January; three specimens.

GLYPHIPTERYX HYPERLAMPRA, n.sp. [ὑπερλαμπρος, exceeding bright].

♂♀. 8-9 mm. Head and thorax dark fuscous. Palpi white, four rings and apex blackish. Antennæ dark fuscous. Abdomen dark fuscous. Legs dark fuscous, with whitish annulations. Forewings bronzy-ochreous, markings outlined with dark fuscous; a bluish-metallic streak from base along fold to $\frac{1}{5}$; six bluish-metallic costal streaks, white on costa; first from $\frac{1}{4}$, moderately long, strongly oblique; second similar but longer, from $\frac{3}{8}$ nearly to fold; third similar but short, from $\frac{5}{8}$; fourth from $\frac{3}{4}$, as long as first; fifth from $\frac{7}{8}$, extremely short; sixth from before apex to termen at incision; a bluish-metallic dot on fold opposite apex of first streak; a blackish tornal blotch containing a violet-metallic dot;

an erect violet-metallic mark on tornus; a violet-metallic line on lower part of termen; a blackish apical spot; cilia whitish, bases fuscous, incised beneath apex. Hindwings and cilia dark grey. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns; two specimens, received from Mr. F. P. Dodd.

Glyphipteryx pyrophora, n.sp. [πυροφορος, fiery].

♂. 10-12 mm. Head, thorax, and abdomen bronzy-fuscous; apex of tuft whitish. Palpi white, annulated with black; with loose rough hairs beneath. Antennæ fuscous. Legs bronzy-fuscous; apices of tarsal joints narrowly white. Forewings shining bronzy-fuscous; with four narrow violet-silvery transverse fasciæ; first from $\frac{1}{5}$ costa to $\frac{1}{3}$ dorsum, becoming white on dorsum; second from $\frac{2}{5}$ costa to mid-dorsum,; third very slender, bowed outwards, from $\frac{4}{5}$ costa to termen above tornus; fourth subapical, white at each end; a violet-silvery spot on midcosta, touching a large tornal blotch, which reaches nearly across wing; lower part of blotch black, containing five or six golden and violet-silvery spots; upper part of blotch golden, interrupted by five slender longitudinal black striæ; cilia bronzy-fuscous, apices paler, interrupted by white on costa before apex and on termen slightly above middle. Hindwings and cilia dark fuscous. Type in Coll. Turner.

N.S.W.: Red Range, near Glen Innes, in March; three specimens.

Glyphipteryx leucoplaca, n.sp. [λευκοπλακος, broadly white].

♂. 13-16 mm. Head and thorax fuscous. Palpi with very long dense hairs beneath; whitish mixed with fuscous. Antennæ fuscous. Abdomen fuscous; tuft whitish. Legs fuscous, with obscure whitish annulations. Forewings fuscous; markings white, without metallic lustre; a broad streak from base of dorsum obliquely upwards, truncate, a large triangular spot on dorsum at $\frac{2}{5}$, its apex reaching half across disc; a dot on $\frac{1}{3}$ costa; a fascia from costa beyond middle, broad on costa where it is divided into two limbs, much constricted below middle, ending on $\frac{4}{5}$ dorsum; a short broad streak from costa at $\frac{4}{5}$, with a narrower streak shortly beyond it; a subterminal series of five shining white dots, one subapical, one opposite incision, and three between this and tornus; cilia white, bases fuscous, incised beneath apex, on apex and tornus fuscous. Hindwings and cilia grey.

The hairiness of the palpi, which is a variable feature in this genus, reaches its maximum in this species, which is conspicuously distinct in pattern and absence of metallic ornament. Type in Coll. Turner.

Q.: Stanthorpe, in October.—Vic.: Castlemaine, in September and October.—Tasm.: Hobart. Five specimens.

GLYPHIPTERYX MARMAROPA, n.sp. [μαρμαρωπος, sparkling].

♂♀. 11-13 mm. Head and thorax fuscous. Palpi whitish; beneath shortly rough-scaled. Antennæ fuscous. Abdomen grey. Legs pale fuscous, with obscure whitish annulations. Forewings whitish, densely irrorated with bronzy-fuscous; seven short whitish costal streaks at $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and subapical; fourth, sixth, and seventh streaks longer and violet-metallic in disc, the last prolonged along termen; a violet-metallic dot in disc opposite third streak; a broad elongate blackish streak from disc before middle to lower end of termen, crossed by five stout violet-metallic bars, of which two are terminal; in the four intervals are fine elongate golden dots, one each in the lateral spaces, two side by side in each of the two central spaces; cilia fuscous-whitish, with a fuscous line before middle. Hindwings and cilia grey-whitish.

Conspicuously distinct, belonging to the *G. cometophora* group, in which the cilia are not indented. Type in Coll. Turner.

Q.: Eumundi, near Nambour, in March; Brisbane, in November; two specimens.

Gen NAPECŒTES, n.g. [ναπηκοιτης, lurking in shady gullies].

Head smooth-scaled; frons rounded, somewhat projecting. Tongue obsolete. Palpi moderate, porrect, slender; second joint with loose scales towards apex, beneath forming a slight tuft; terminal joint short, rather obtuse. Maxillary palpi obsolete. Antennæ of ♂ shortly and evenly ciliated. Legs with outer spurs $\frac{1}{2}$ or less than $\frac{1}{2}$ inner spurs; posterior tibiæ smooth-scaled. Forewings with all veins present, 7 and 8 stalked, 7 to apex. Hindwings with all veins present, 3 and 4 tolerably remote at origin, 5, 6, 7 parallel.

Near *Glyphipteryx,* but differing in 3 and 4 of hindwings not being connate, in palpi, and in ciliation of ♂ antennæ.

NAPECŒTES CROSSOSPILA, n.sp. [κροσσοσπιλος, with marginal spot].

♂. 10 mm. Head and thorax dark fuscous. Palpi fuscous, towards base whitish. Antennæ fuscous; ciliations in ♂ 1. Abdomen dark fuscous, beneath whitish. Legs fuscous, with whitish annulations. Forewings dark fuscous; faint whitish marks on costa at $\frac{3}{5}$ and $\frac{4}{5}$; a minute white dot on tornus; a fairly large white spot on midtermen; a very faint whitish subapical dot; cilia dark fuscous, on marginal spot white. Hindwings fuscous; base of costa whitish; cilia fuscous. Type in Coll. Turner.

Q.: Montville (1500ft.), near Nambour, in October; one specimen.

Subfam. TINÆGERIANÆ.

I have followed Lord Walsingham (Trans. Ent. Soc., 1889) in including there the genus *Eretmocera,* though this course is open to some doubt. On this view, the absent vein in the forewing is 6 and not 8, 7 and 8 are stalked, but 7 runs to termen and not to costa, as in *Snellenia.*

ERETMOCERA CHRYSIAS.

N.Q.:Townsville in May, July, and August.—Q.: Duaringa and Maryborough, from February to April.

ERETMOCERA FLAVICINCTA, n.sp. [Flavicinctus, girt with yellow].

♂♀. 9-11 mm. Head, palpi, and antennæ fuscous. Thorax fuscous, with two yellow spots on posterior margin, more or less developed. Abdomen dark fuscous, with a deep purple sheen; dorsum of first segment sometimes yellow except at base; two or three penultimate segments deep yellow; tuft dark fuscous, at apex yellow; underside yellow. Legs fuscous. Forewings fuscous, with purplish lustre; a few whitish-ochreous scales; sometimes with three indistinct whitish-ochreous spots, first on dorsum before middle, second on tornus, third (seldom developed) on costa at $\frac{4}{5}$; cilia fuscous. Hindwings and cilia dark grey. Type in Coll. Turner.

Q.: Brisbane, in December; Toowoomba, in April; Warwick, in September; Killarney, in October; a good series.

Eretmocera cyanauges, n sp. [κυαναυγης, dark gleaming].

♂♀. 14-17 mm. Head bronzy-fuscous. Palpi dark fuscous; towards base whitish-ochreous. Antennæ thickened with dense scales on upper surface for $\frac{3}{5}$, then slender; dark fuscous. Thorax bronzy-fuscous, with a posterior pair of small yellow spots. Abdomen orange-yellow; terminal segment and tuft dark fuscous; centre tuft in ♀ orange-yellow; underside similar, but with a broad basal dark fuscous band. Legs dark fuscous; base of posterior tibiæ yellow. Forewings dark fuscous, with blue and purple sheen; four orange-yellow spots; first on dorsum at $\frac{1}{4}$, second in disc before middle, third on tornus, fourth on costa at $\frac{5}{6}$; cilia fuscous. Hindwings yellow; apex fuscous; cilia fuscous, towards tornus yellow.

Differs from *E. chrysias* in the more heavily scaled antennæ, the absence of the sub-basal dorsal band on abdomen, and the yellow hindwings. Type in Coll. Turner.

N.Q.: Townsville, in February and May; three specimens, received from Mr. F. P. Dodd.

Snellenia lineata.

I have one example (from Coolangatta) in which the apical third of forewing is wholly suffused with dark fuscous.

Q.: Eumundi, near Nambour, in November; Brisbane, in January; Coolangatta, in December.—N.S.W.: Tabulam, in December. —Vic.: Gisborne.

SNELLENIA HYLÆA, n sp. [ὑλαιος, of the woods].

♂♀. 15-17 mm. Head and antennæ blackish. Palpi blackish; at base yellow. Thorax blackish; patagia and a posterior spot reddish-orange, the latter containing a few blackish scales. Abdomen blackish. Legs blackish; tarsi with whitish annulations. Forewings elongate, costa straight to $\frac{4}{5}$, apex and termen rounded; reddish-orange; base of dorsum black; a black dorsal streak from beyond middle, continued on termen to apex; apical portion of disc with fuscous streaks between veins; cilia dark fuscous, on costa reddish-orange. Hindwings elongate; dark fuscous; a small orange-yellow area on basal part of costa; cilia dark fuscous.

Var. Posterior third of forewings suffused with fuscous; costal cilia dark fuscous.

Best distinguished from *S. lineata* by the wholly black abdomen. Type in Coll. Turner.

Q.: Mount Tambourine, a series in December and February. The typical form and variety (between which there seem to be no intermediates) mimick two different species of coleoptera, which occur at the same time and place. When on the wing, the resemblance is perfect.

SNELLENIA CAPNORA, n.sp. [καπνορος, smoky].

♀. 15 mm. Head black. Palpi black; extreme base yellow. Antennæ black. Thorax yellow. Abdomen black; dorsum of first two segments yellow. Legs black; anterior coxæ yellow. Forewings narrow-elongate, costa straight to $\frac{1}{2}$, then sinuate, apex and termen rounded; blackish-fuscous; slightly paler on veins; base narrowly yellow; cilia blackish-fuscous. Hindwings narrow; fuscous; basal third yellow; cilia fuscous. Type in Coll. Turner.

N.Q.: Herberton, in January; one specimen, received from Mr. F. P. Dodd.

PSEUDÆGERIA POLYTITA, n.sp. [πολυτιτος, held in honour].

♂♀. 18-20 mm. Head blackish; in ♂ with some reddish-orange scales on crown. Palpi reddish-orange; terminal joint fuscous anteriorly. Antennæ blackish. Thorax reddish-orange, more or less mixed with blackish in centre. Abdomen blackish, sometimes mixed with orange; dorsum of first two segments orange; apex of fifth segment narrowly whitish on dorsum in ♂. Legs blackish; anterior coxæ yellow; anterior tibiæ with an internal reddish-orange spot; middle tibiæ with spurs white, and with a broad median reddish-orange ring; first joint of anterior and middle tarsi with a broad white median ring. Forewings elongate, with costa straight to near apex, in ♂ slightly sinuate, apex rounded, termen slightly bowed, strongly oblique; bright reddish-orange; termen broadly blackish, with blackish streaks extending from it between veins; cilia dark fuscous. Hindwings elongate; orange; a broad dark fuscous apical area extending towards base on costa, and narrowly along termen to tornus; cilia dark fuscous, becoming whitish or white towards apex in ♂, on dorsum orange. Type in Coll. Turner.

N.Q.: Townsville, in January and February; three specimens, received from Mr. F. P. Dodd, of which one is in Coll. Lyell.

PSEUDÆGERIA HYALINA, n.sp. [ὑάλινος, transparent].

♀. 21 mm. Head, palpi, and antennæ dark fuscous. Thorax dark fuscous; patagia reddish-orange. Abdomen dark fuscous; apex of fifth segment narrowly whitish on dorsum. Legs dark fuscous. Forewings elongate, costa sinuate, apex rounded, termen slightly bowed, strongly oblique; reddish-orange suffused with fuscous except towards costa, and with fuscous interneural streaks in terminal area; cilia fuscous, on costa reddish-orange. Hindwings elongate; fuscous; whole of basal and central areas hyaline, with very few scales; cilia fuscous. Type in Coll. Lyell.

Vic.: Birchip, in November; one specimen, received from Mr. D. Goudie.

Subfam. PLUTELLINÆ.

Gen. HETEROCRITA Meyr.

Head shortly rough-haired. Tongue well-developed. Labial palpi long, porrect; second joint very long, vertically thickened throughout, smooth-scaled, upper edge densely clothed with long hairs; terminal joint much narrower, short, obtuse. Maxillary palpi short, filiform, concealed under labial palpi. Forewings with all veins present and separate, 2 from well before angle, 3 from angle, closely approximated to 4 at origin, 7 to termen. Hindwings with all veins present, 3 and 4 short-stalked, 5, 6, 7 parallel. Posterior tibiæ smooth-scaled. Antennæ of ♂ simple.

Heterocrita chersodes Meyr.

♂♀. 15-18 mm. Head, palpi, thorax, and abdomen ochreous-whitish, mixed with fuscous. Antennæ fuscous-whitish. Abdomen and legs fuscous-whitish. Forewings strongly dilated posteriorly, costa strongly arched, apex rounded, termen scarcely rounded, slightly oblique; ochreous-whitish irrorated and suffused with fuscous; a fuscous dot in mid-disc at $\frac{1}{4}$, and another beyond middle; a fine fuscous terminal line; cilia pale fuscous. Hindwings and cilia ochreous-whitish suffused with fuscous.

N.Q.: Kuranda, near Cairns, in October and February; five specimens, received from Mr. F. P. Dodd.

Gen. Amphithera.

Amphithera Meyr., Proc. Linn. Soc. N.S.Wales, 1892, p. 597.

Zonops Turn., Trans. Roy. Soc. S. Aust., 1900, p. 17; Meyr., Gen. Insect., Adelidæ, p. 8.

The type, *A. heteromorpha* Meyr., has the eye clearly divided into two parts by an incision, which does not contain any ridge of scales, and the upper part is about twice as large as the lower.

Amphithera heteroleuca.

Zonops heteroleuca Turn., Trans. Roy. Soc. S. Aust., 1900, p. 17; Meyr., Gen. Insect., Adelidæ, p. 8.

Q.: Dulong, near Nambour, in December; Brisbane.

Amphithera monstruosa. n.sp. [Monstruosus, strange, marvellous].

♂. 15-18 mm. Head bronzy-fuscous; face and palpi fuscous. Antennæ and thorax bronzy-fuscous. Abdomen fuscous; the two terminal segments white. Legs fuscous; tarsi with obscure whitish annulations. Forewings narrow-elongate, costa moderately arched, apex acute, termen slightly rounded, strongly oblique; bronzy-fuscous; towards apex irrorated with shining bluish-white scales; a fuscous dot on extreme apex; cilia whitish, with some pale fuscous suffusion. Hindwings more than twice breadth of forewings; termen strongly sinuate; dark fuscous tinged with bronzy-purple; cilia fuscous, apices whitish.

The structure of the eye is exactly that of the ♂ of the type-species. Type in Coll. Turner.

N.Q.: Herberton, and Evelyn Scrub, in January; five specimens, received from Mr. F. P. Dodd.

PHALANGITIS VETERANA.

Q.: Stanthorpe, in October; Brisbane.

PHALANGITIS PELLOCHROA, n.sp. [πελλοχροος, dusky-grey].

♂. 15 mm. Head and thorax brownish-grey. Palpi ochreous-whitish. Antennæ grey. Abdomen grey; base of dorsum whitish; male genital tuft large, with extrusible pale yellow hairs. Legs grey-whitish. Forewings moderately elongate, costa strongly arched near base, thence nearly straight, apex obtusely pointed, termen oblique, scarcely rounded; brownish-grey mixed with whitish; markings indistinct and confused; an ill-defined broad whitish costal streak from base, lost posteriorly; a series of dark costal dots; two irregular spots in disc at $\frac{1}{3}$ and before $\frac{2}{3}$; a well marked dark line on apical half of termen; cilia brownish-grey. Hindwings grey-whitish; cilia whitish.

Differs from *P. veterana* in its browner colouring, less distinct whitish streak, and especially in the dark terminal line. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in October; one specimen, received from Mr. F. P. Dodd.

PLUTELLA MACULIPENNIS.

This species is ubiquitous, but I was surprised to find it on Mt. Kosciusko, at 6,500 feet; on March 1st, many miles from the nearest cabbage-plot.

Subfam. Adelinæ.

I give a complete list of the known Australian species, with localities. Mr. Meyrick, however, having seen an example of *A. monstruosa*, which I referred to my genus Zonops, says that it is an Amphithera, and has no real connection with the *Adelinæ*.

Gen. Nemotois.

Nemotois Hb., Verz., p. 416; Meyr., Gen. Insect., Adelidæ, p. 4.

The Australian species, though exceedingly brilliant insects, are very closely related, and their discrimination is difficult. The following tabulation may be of service:—

1.	Forewings with a longitudinally striated median fascia	3.
	Forewings without such fascia	2.
2.	Forewings with a blackish postmedian fascia	*brachypetala.*
	Forewings with a yellow bar from costa beyond middle	*polydædala.*
3.	Forewings with basal yellow markings	4.
	Forewings without basal yellow markings	5.
4.	Forewings with an oval yellow spot in disc near base	*topazias.*
	Forewings with a yellow blotch on dorsum near base	*panæola.*
	Forewings with a yellow median basal streak	*opalina.*
5.	Palpi moderately long. Median fascia narrowed to a point on dorsum	*selasphora.*
	Palpi short. Median fascia broad on dorsum	*sparsella.*

Nemotois brachypetala.

Nemotois brachypetala Meyr., Gen. Insect., Adelidæ, p.6.

N.A.: Port Darwin, in January. I have a single ♀ specimen received from Mr. F. P. Dodd.

Nemotois topazias.

Nemotois topazias Meyr., Proc. Linn. Soc. N.S.Wales, 1892, p. 485.

N.S.W.: Blackheath, near Katoomba.—Tasm.: George's Bay.—S.A.: Wirrabara and Mt. Lofty.

Nomotois sparsella.

Nemotois sparsella Walk., Brit. Mus. Cat. xxviii., p.506; Meyr., Proc. Linn. Soc. N.S.Wales, 1892, p. 483.

Q.: Caloundra, in September; Southport, in December; Brisbane.—N.S.W.: Sydney.—Vic.: Melbourne; Macedon, near Gisborne, in December.

NEMOTOIS ORICHALCHIAS.

Nemotois orichalchias Meyr., Proc. Linn. Soc. N. S. Wales, 1892, p. 484.

I do not know this species. Mr. Meyrick says it is obviously broader-winged than *N. sparsella,* and certainly distinct.

N.S.W.: Sydney and Bowenfels.—Vic.: Melbourne.—Tasm.: Launceston, and Hobart.—S.A.: Mount Lofty.

NEMOTOIS POLYDÆDALA, n.sp. [πολυδαιδαλος, richly dight].

♂. 13 mm. Head and palpi ochreous; frons brilliant bluish-metallic. Antennæ fuscous, paler towards apex; basal joint iridescent. Thorax bronzy-metallic. [Abdomen broken.] Legs fuscous, with metallic reflections; tarsi with whitish annulations. Forewings shining coppery-purple; a large triangular golden-yellow basal patch, containing a costal and a subdorsal short bluish-metallic longitudinal streaks, and between these two raised bronzy-metallic knobs; a fine blackish line edging basal patch; a golden-yellow transverse bar from $\frac{3}{5}$ costa, reaching mid-disc, edged posteriorly by a blackish bar, and anteriorly by a narrow blackish suffusion, which extends to $\frac{3}{4}$ dorsum, forming an incomplete fascia; cilia coppery-purple. Hindwings thinly scaled; fuscous, with slight purple reflections, cilia fuscous Type in Coll. Turner.

Q.: Kuranda, near Cairns, in November; one specimen, received from Mr. F. P. Dodd.

NEMOTOIS PANÆOLA, n.sp. [παναιολος, all-glittering].

♂. 12-13 mm. Head shining fuscous-purple; frons brilliantly metallic bluish or greenish. Palpi fuscous. Antennæ fuscous, towards apex paler; basal joint coppery-purple. Thorax coppery-purple. Abdomen dark fuscous. Legs fuscous, with metallic reflections; tarsi with whitish annulations. Forewings brilliant purple intermixed with fiery gold and deep blue scales; a broad triangular sub-basal dorsal yellow blotch reaching $\frac{2}{3}$ across wing; opposite its apex is a small yellow costal spot at $\frac{1}{5}$; a narrow median yellow transverse fascia with longitudinal fuscous striations; cilia fuscous-purple. Hindwings thinly scaled; fuscous; cilia fuscous. Type in Coll. Turner.

N.Q.: Kuranda, near Cairns, in December.—Q.: Killarney, in October. Two specimens.

Nemotois opalina.

Nemotois opalina Meyr., Gen. Insect., Adelidæ, p. 6.

♂♀. 11 mm. Head and palpi ochreous; frons brilliantly bluish-metallic. Antennæ fuscous. Thorax bronzy-metallic. Abdomen dark fuscous. Legs fuscous, with metallic reflections; tarsi with whitish annulations. Forewings bright golden, in some lights purple; a short broad longitudinal yellow streak from base of dorsum; between it and dorsum a blackish streak; between it and costa first a bluish-metallic streak, then a blackish streak; a bluish-metallic streak on base of costa; a broad transverse yellow band with longitudinal blackish striations, extending on costa from $\frac{2}{7}$ to $\frac{4}{7}$, and on dorsum from $\frac{1}{4}$ to $\frac{3}{4}$; cilia fuscous, with golden reflections. Hindwings thinly scaled; fuscous, with slight purplish iridescence; cilia fuscous, towards tornus whitish.

N.Q.: Kuranda, near Cairns, in April (Dodd).—Q.: Montville, near Nambour, in October; four specimens.

Nemotois selasphora, n.sp. [σελασφορος, gleaming with light].

♂. 12-13 mm. Head fuscous; frons brilliant bluish-metallic. Palpi moderately long; fuscous. Antennæ fuscous; basal joint iridescent. Thorax bronzy-metallic. Abdomen dark fuscous. Legs fuscous, with metallic reflections; tarsi with whitish annulations. Forewings brilliant purple or golden according to incidence of light; a blackish subcostal streak from base to $\frac{1}{4}$; a pear-shaped transverse yellowish fascia with longitudinal striations, from costa beyond middle, broadening in costal portion of disc, then tapering to a point on dorsum before tornus; cilia gleaming with purple and gold. Hindwings thinly scaled; fuscous, with purple iridescence; cilia fuscous. Type in Coll. Turner.

Q.: Mount Tambourine, in November; five specimens.

Gen. NEMOPHORA.

Nemophora Hb., Verz., p. 417; Meyr., Gen. Insect., Adelidæ, p.2.

NEMOPHORA IOLAMPRA.

Nemophora iolampra Turn., Trans. Roy. Soc. S. Aust., 1900, p.17.

Vic.: Gisborne.

NEMOPHORA LEPTOSTICTA.

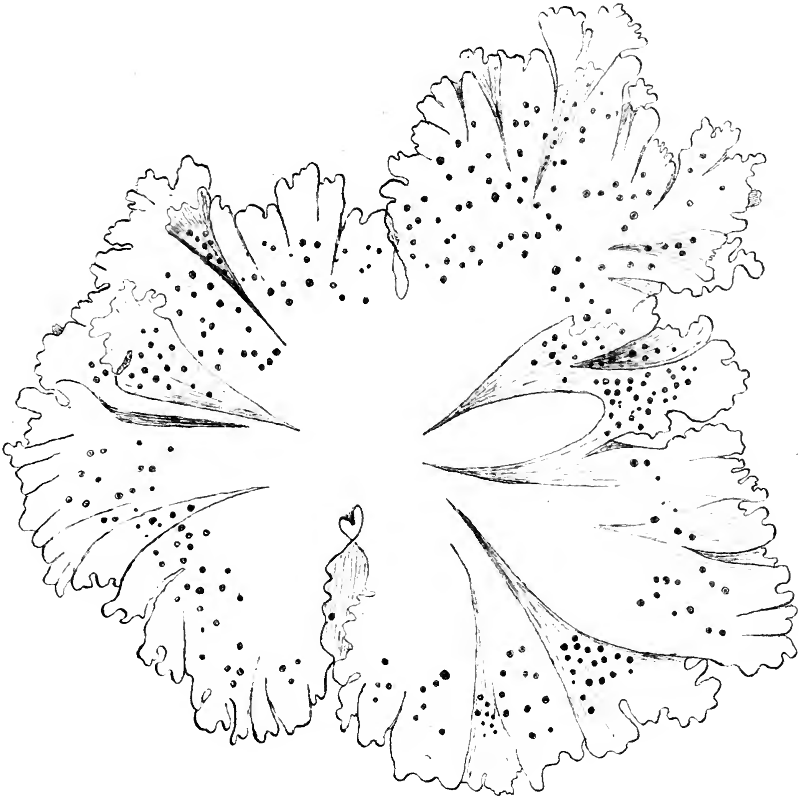
Nemophora leptosticta Turn., Trans. Roy. Soc. S. Aust., 1900, p. 16.

Q.: Stanthorpe, in February.

[Printed off, 12th September, 1913.]

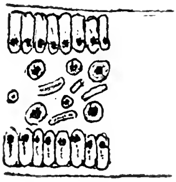
Spermatochnus lejolisii (Thur.) De Toni.

Nitophyllum sinuosum, n.sp. Tetrasporangiferous Plant.

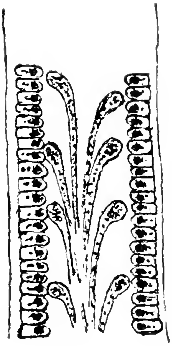


Nitophyllum sinuosum, n.sp. [Cystocarpiferous Plant].

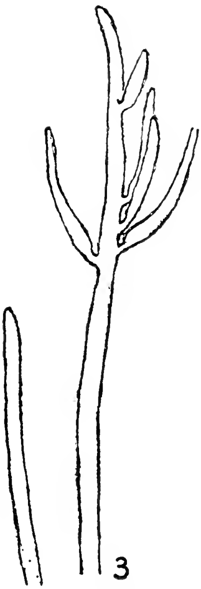
Sonderia bennettiana (Harv.) F.v.M.



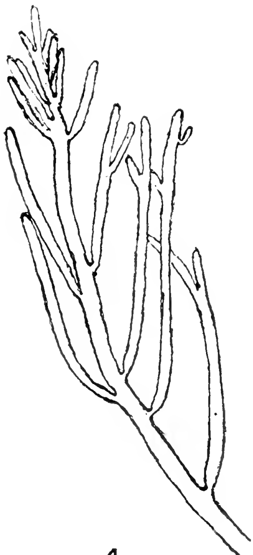
1



2



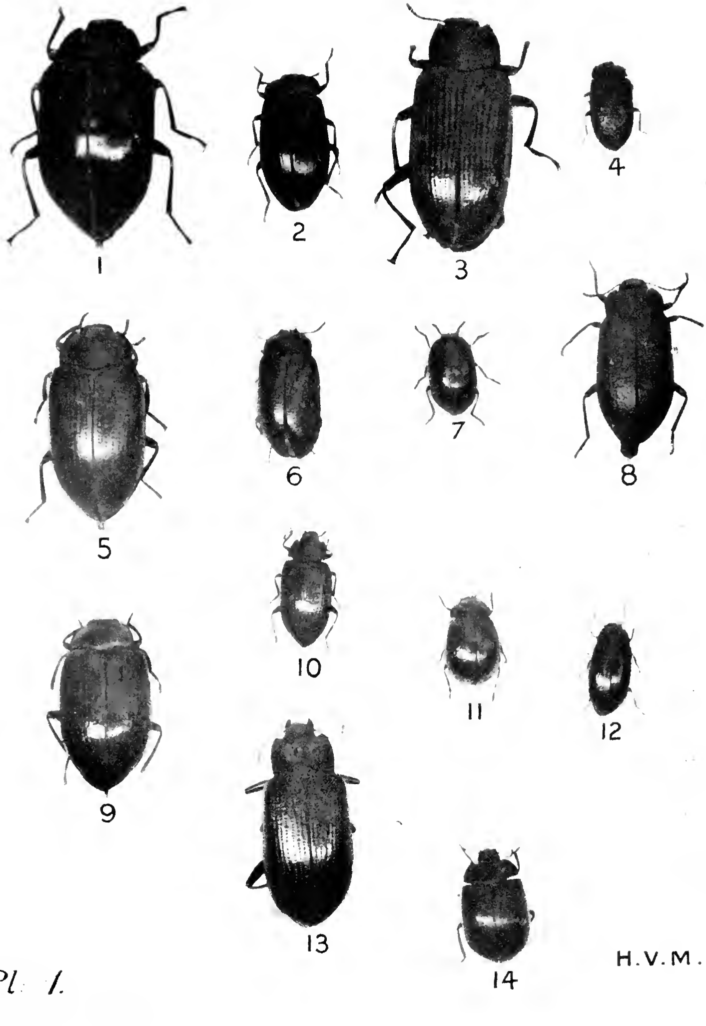
3



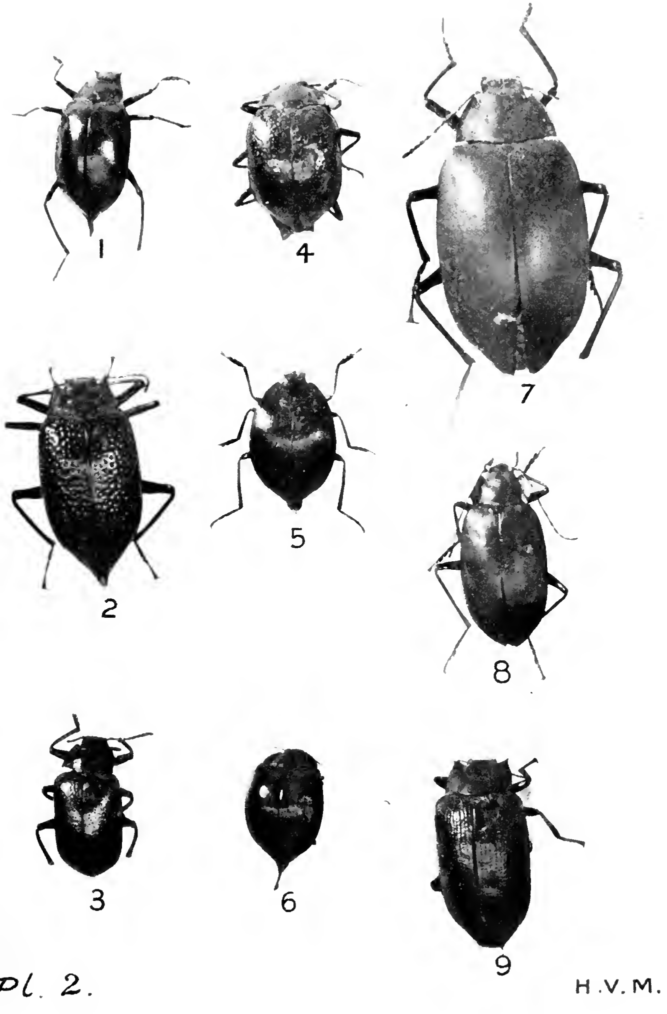
4

Figs. 1-2. Ulva lactuca L.

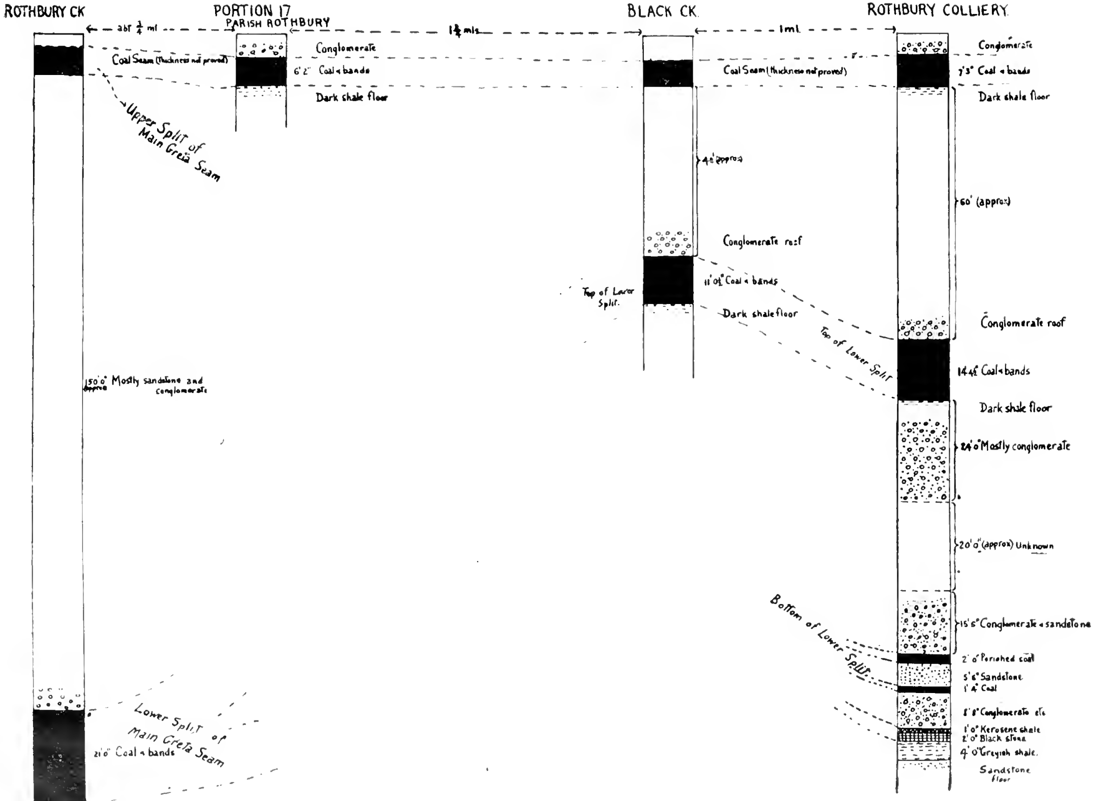
Figs. 3-4. Bryopsis baculifera J. Ag.



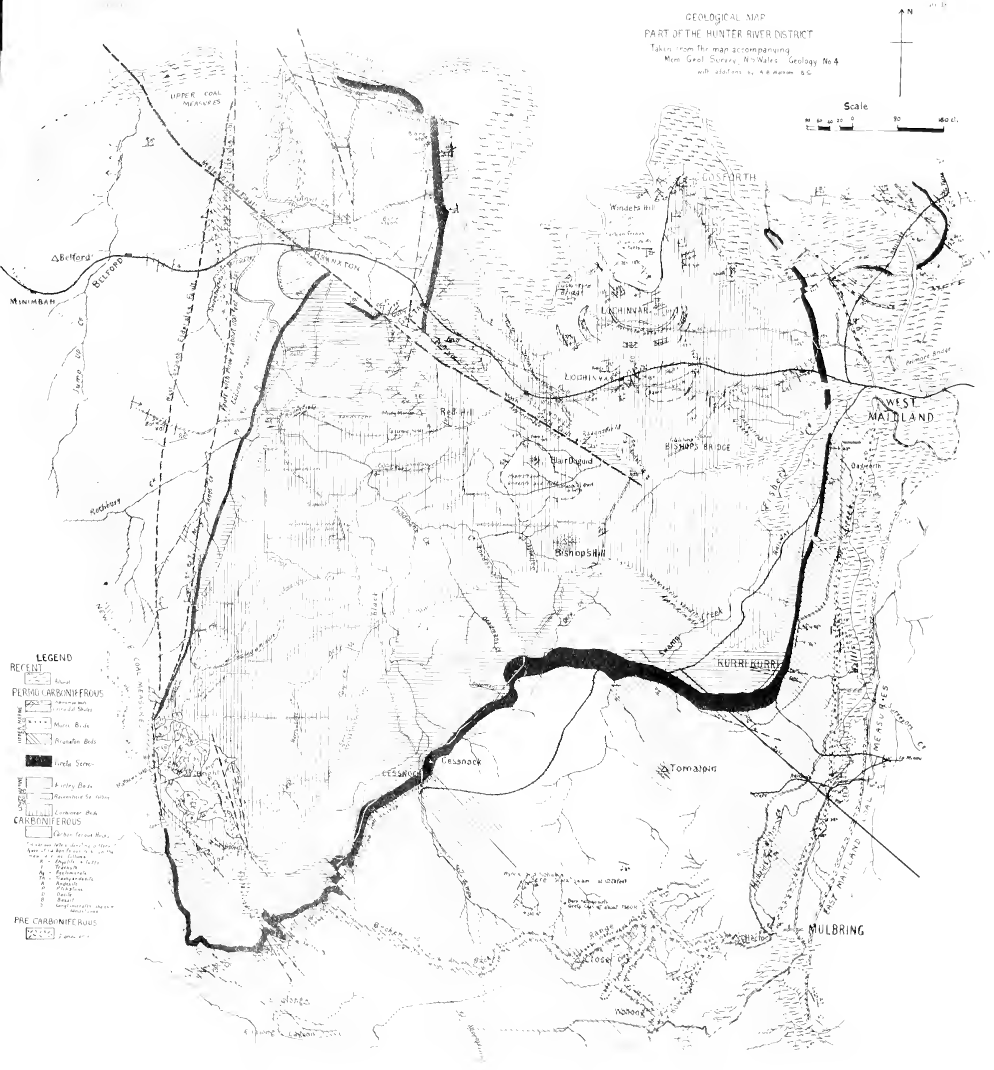
Australian Cyphaleinæ.



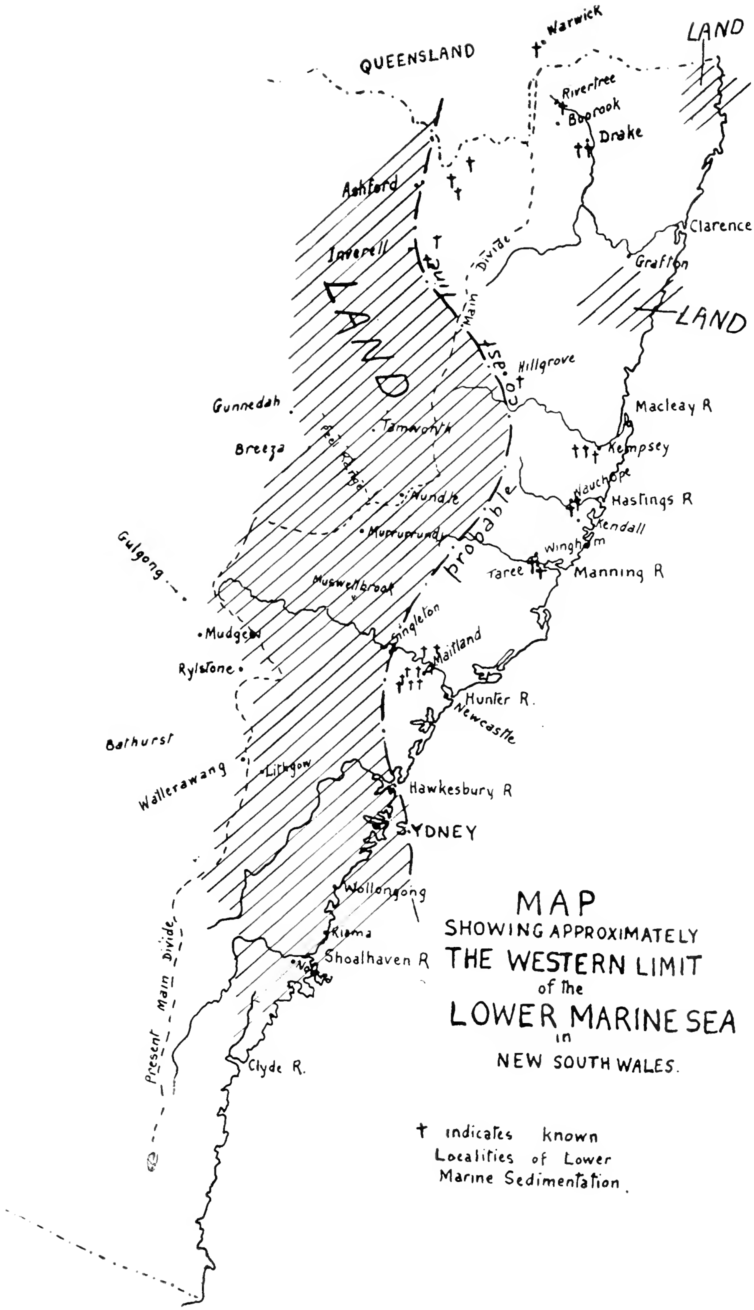
Australian Cyphaleinæ.



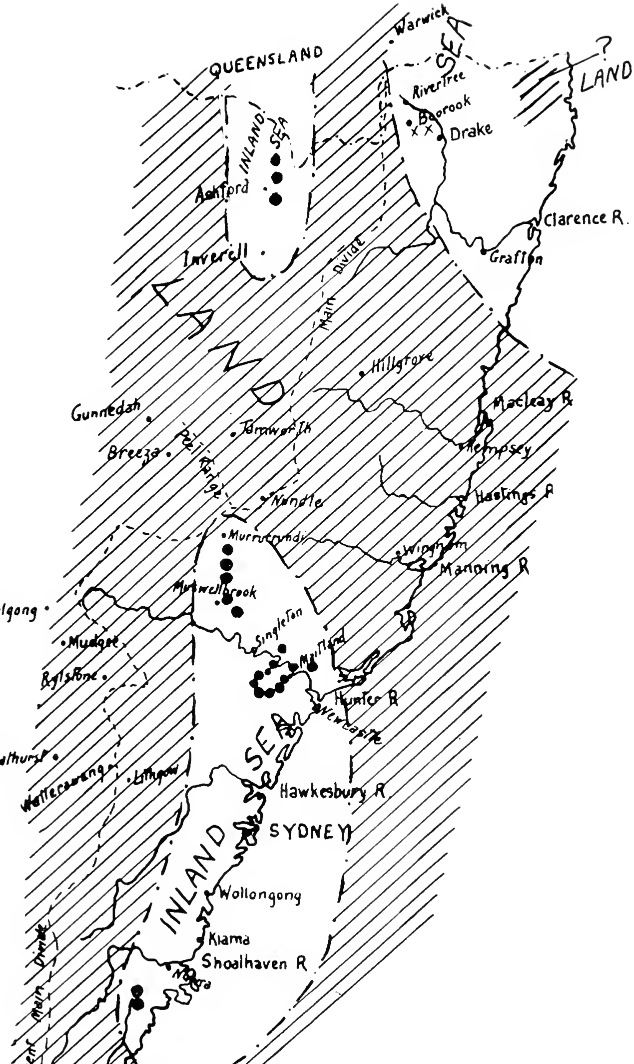
Comparative Series of Sections of Greta Coal-Seams south of Branxton.



GEOLOGICAL MAP
of
PART OF THE HUNTER RIVER DISTRICT
Taken from the map accompanying
Mem. Geol. Survey, N.S.Wales. Geology No 4
with additions by A.B. Walkom B.Sc.
N
Scale
80
160 ch.
UPPER COAL MEASURES
Belford
BELFORD
MINIMBAH
Jump Up Cr.
BRANXTON
Rothbury Cr.
Red Hill
GOSFORTH
Windeis Hill
LOCHINVAR
Blair Duguid
Ravensfield
BISHOPS BRIDGE
Bishops Hill
Black
Swamp Creek
KURRI KURRI
Cessnock
CESSNOCK
Tomalpin
WEST MAITLAND
Oakworth
Pelmore Bridge
NEW ... COAL MEASURES
EAST MAITLAND COAL MEASURES
MULBRING
Range
Wallong
LEGEND
RECENT
Alluvial
PERMO CARBONIFEROUS
UPPER MARINE SERIES
Muree Beds
Branxton Beds
Greta Series
LOWER MARINE SERIES
Farley Beds
Ravensfield Sandstone
Lochinvar Beds
CARBONIFEROUS
Carboniferous Rocks
PRE CARBONIFEROUS

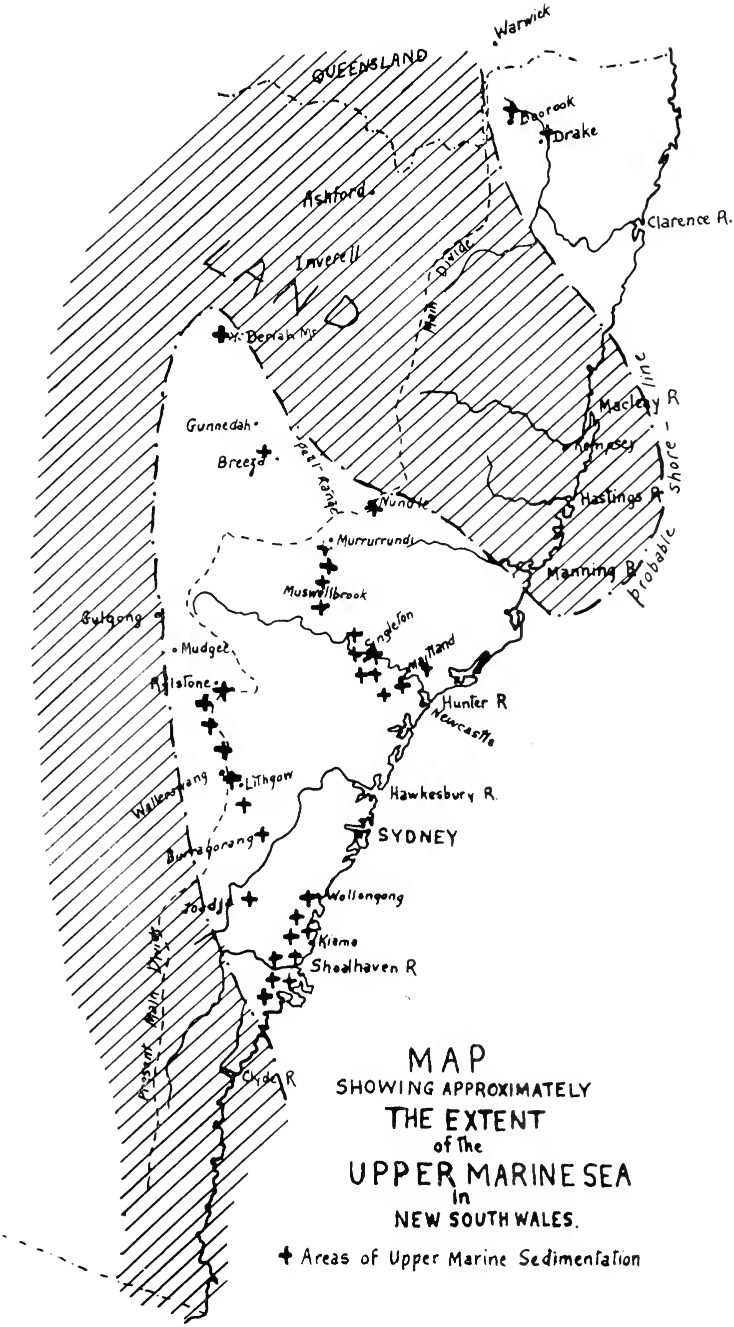


QUEENSLAND
Warwick
LAND
Rivertree
Boorook
Drake
Ashford
Inverell
LAND
Fault
Main Divide
Clarence R.
Grafton
LAND
Hillgrove
Macleay R
Gunnedah
Tamworth
Breeza
Kempsey
Wauchope
Hastings R
Nundle
Kendall
Murrurundi
Gulgong
probable
Wingham
Taree
Manning R
Muswellbrook
Singleton
Mudgee
Maitland
Rylstone
Hunter R.
Newcastle
Bathurst
Wallerawang
Lithgow
Hawkesbury R
SYDNEY
Wollongong
Kiama
Shoalhaven R
Nowra
Present Main Divide
Clyde R.
MAP
SHOWING APPROXIMATELY
THE WESTERN LIMIT
of the
LOWER MARINE SEA
in
NEW SOUTH WALES.
† indicates known Localities of Lower Marine Sedimentation.



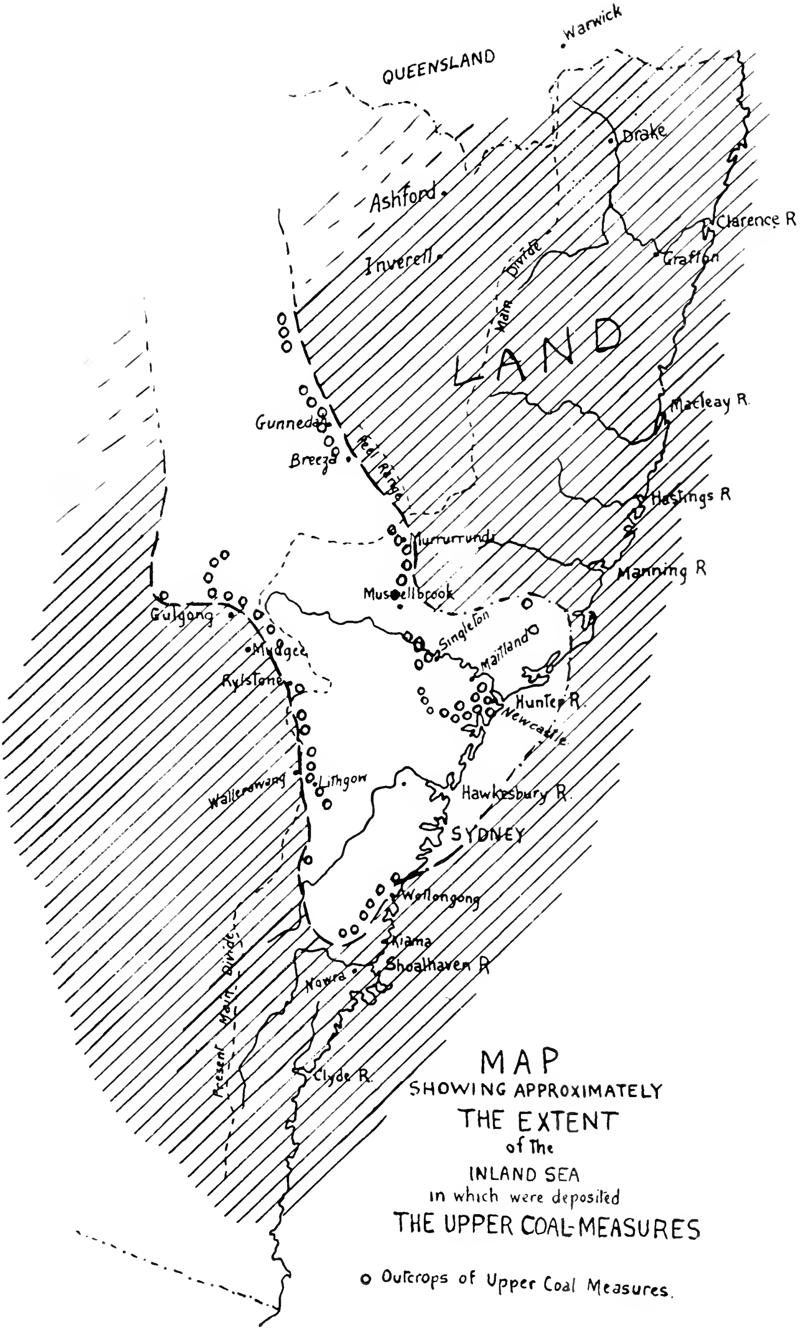
MAP
SHOWING APPROXIMATELY
THE DISTRIBUTION OF LAND AND SEA
during the deposition of the
GRETA COAL-MEASURES
in
NEW SOUTH WALES.

Outcrops of Greta Coal Measures
x Marine deposits



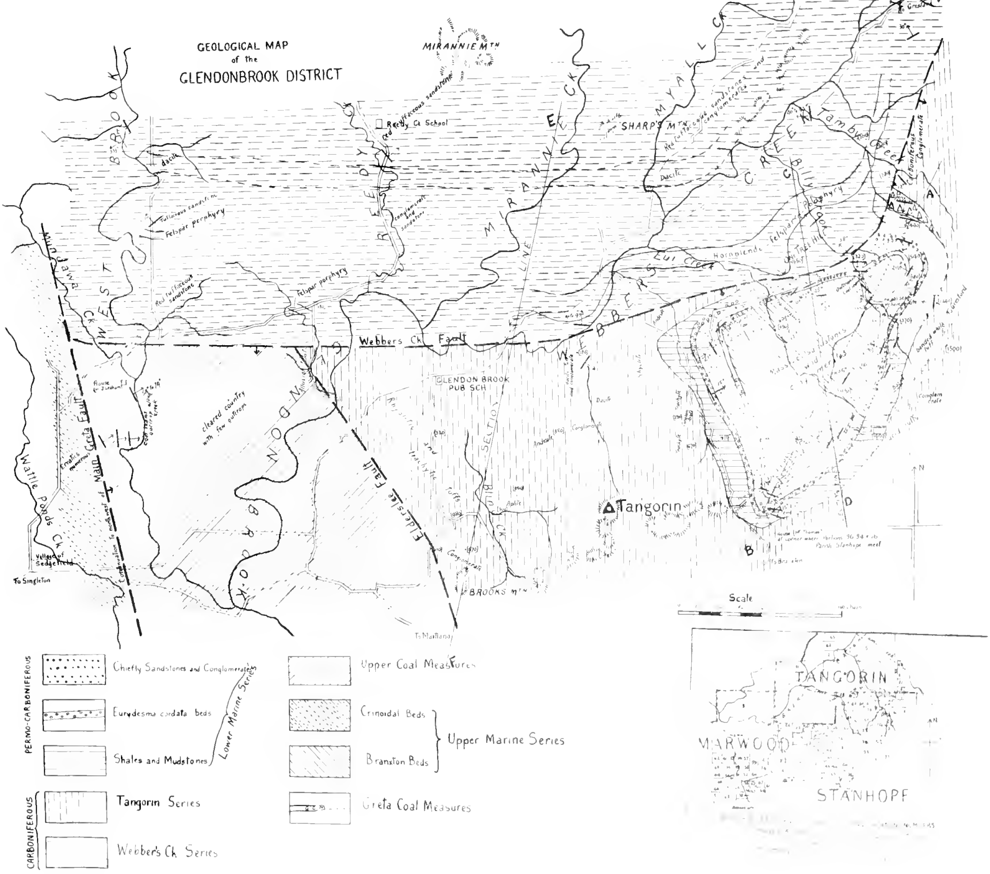
MAP
SHOWING APPROXIMATELY
THE EXTENT
of the
UPPER MARINE SEA
in
NEW SOUTH WALES.

✚ Areas of Upper Marine Sedimentation



MAP
SHOWING APPROXIMATELY
THE EXTENT
of the
INLAND SEA
in which were deposited
THE UPPER COAL-MEASURES

o Outcrops of Upper Coal Measures.


GEOLOGICAL MAP
of the
GLENDONBROOK DISTRICT
MIRANNIE MTN
Reedy Ck School
SHARP'S MTN
MYALL CK
MIRANNIE CK
REEDY CK
WEST BROOK
Mirrdawa CK
Felspar porphyry
Red tuffaceous sandstone
Webbers Ck Fault
WEBBERS
Lui Creek
Tambo Creek
Carboniferous Conglomerate
GLENDON BROOK
PUB SCH
GLENDON BROOK
cleared country with few outcrops
Main Greta Fault
Elderslee Fault
SECTION LINE
Tangorin
BROOKS MTN
Wattle Ponds Ck
Village of Sedgefield
To Singleton
Scale
TANGORIN
MARWOOD
STANHOPE
PERMO-CARBONIFEROUS
Chiefly Sandstones and Conglomerates
Eurydesma cordata beds
Shales and Mudstones
Lower Marine Series
CARBONIFEROUS
Tangorin Series
Webber's Ck Series
Upper Coal Measures
Crinoidal Beds
Branxton Beds
Upper Marine Series
Greta Coal Measures

SOME DESCRIPTIONS OF NEW FORMS OF AUSTRALIAN *ODONATA*.

By R. J. Tillyard, M.A., F.E.S.
(Science Research Scholar of the University of Sydney).

(Plate xv.)

The following new species and subspecies are here recorded and described :—

Pseudocordulia elliptica, n.sp.♂.
Metathemis nigra xanthosticta, n.subsp.,♂♀.
Metathemis guttata melanosoma, n.subsp.,♂♀.
Austrogomphus angeli, n sp.,♂♀.
Diphlebia euphœoïdes cœrulescens, n.subsp., ♂♀.
Diphlebia hybridoïdes Tillyard, ♀(♂ only described already).
Argiolestes chrysoïdes, n.sp.♂.
Synlestes albicauda, n.sp.,♂♀.

1. Pseudocordulia elliptica, n.sp.

♂. *Total length* 49, *abdomen* 37, *forewing* 32, *hindwing* 32 mm. Wings: *neuration* exactly as in *Ps. circularis* Tillyard; a white spot at base of costa in forewing; hindwing saffroned at base. Pterostigma 1·5 mm., black. *Nodal Indicator* $\left\|\begin{matrix}10\text{-}11, & 7\text{-}9\\ 7, & 9\text{-}11\end{matrix}\right|$ Head: *vertical tubercle* fairly large, dark violet; *front* wide, hairy, very deeply cleft medially, dark brown, with deep violet reflections above; *clypeus* and *labrum* dark brown; *labium* medium brown. Thorax: *prothorax* brown, hairy. *Meso-* and *metathorax* deep steely metallic greenish, with light brown hairs. *Legs* black, brownish near coxæ. Abdomen slender; 1-2 rather narrow, 3 pinched in middle, 4-6 widening, 7-8 narrowing, 9-10 cylindrical; 1, with grey hairs above; 2, with dark brown auricles; all the rest jet black without spot. Appendages: *superior* 1·5 mm., black, slightly forcipate; viewed from above, they form a slightly pointed oval; in profile, they are slightly depressed, and carry, on the middle of the lower outer edge, a small obtuse tooth or spine. *Inferior* 1 mm., narrow subtriangular, hollow above; vertex blunt and distinctly bifid, showing two small tubercles (Plate xv., figs.1-2).

♀. Unknown.

Hab.—Kuranda, N. Queensland. Three males, taken by Mr. F. P. Dodd, on January 3rd, 1913, are now in my collection.

Type: ♂, Coll. Tillyard.

This species is very close to *Ps. circularis** Tillyard, the type of the genus, which also comes from Kuranda. The label "Kuranda, F. P. Dodd," covers, however, a large tract of country, so that the two species do not necessarily occur together in the same locality, but are, probably, geminate species separated by a watershed, or inhabiting two different types of creek. The chief differences are:—*Ps. circularis* is smaller than *Ps. elliptica*; its head narrower, and with scarcely a trace of violet; its thorax and abdomen shorter; the wings are also shorter, and less saffroned at bases. The superior appendages are very distinct; those of *Ps. circularis* being very much bent, so as to form a complete circle, the tips much depressed and meeting the tip of the inferior appendage, which is of the same length, and is pointed and scarcely bifid at tip.

2. Metathemis nigra xanthosticta, n.subsp.

Very distinct from the type-form, *M. nigra*† Tillyard (Kuranda, N. Queensland). The chief points of distinction are:—Size somewhat larger; *abdomen*, ♂ 41, ♀ 43·5 mm.; *hindwing*, ♂ 34, ♀ 38·5 mm. *Wings* with slightly thicker and longer pterostigma, ♂ 2·5, ♀ 3 mm. Midlateral bands of *thorax* twice as wide as in type-form. *Abdomen* of male with segments 1-8 spotted with yellow as follows: 1, a dorsal triangle; 2, a transverse basal line; 3, a pair of basal spots, transversely elongate, a pair of conjoined round dorsal central spots; 4 like 3 but basal spots smaller; 5, ditto, but basal spots very small; 6-8 with a pair of nearly central

* These Proceedings, 1908, xxxiii., p.743.
† *Ibid.*, 1906, xxxi., p.489.

dorsal spots, separated by the dorsal ridge. *Appendages* of male similar to those of type-form, but hairier; inferior tubercle of 10 much hairier. *Abdomen* of female spotted with yellow as follows: 1, an oval or subtriangular dorsal spot; 2, a pair of widely separated central spots; 3-6, a pair of subtriangular or semioval basal spots, a pair of oval or diamond-shaped central dorsal spots, crossed by the black line of the carina; 8 with a pair of irregular elongate oval central spots almost touching dorsally; *genitalia* and *appendages* as in type-form; *wings* only slightly suffused, or hyaline (in type-form, they are deeply suffused with orange-brown in ♀).

Hab.—Mount Tambourine, Queensland. December to January. Fairly common. I took a fine series of males, but not many females. The exuviæ were also secured.

3. Metathemis guttata melanosoma, n.subsp.

Very distinct, both from the type-form, *M. guttata* Selys, and from *M. guttata aurolineata* Tillyard, which, however, it occasionally approaches in that one or two specimens possess a trace of the golden dorsal thoracic lines.

The following are the chief differences from the type-form:—Frontal yellow spots rather smaller, more widely separated. *Colouration of abdomen*: ♂, almost completely black; 1 with a large dorsal yellow spot; 2 with two very small flat basal spots and a pair of central spots; 8 with two central spots (occasionally absent). The female has, in addition, 3, a pair of fine short basal transverse lines, a pair of central points; 4, minute vestiges of same; 5-7, sometimes with a suspicion of the central points; but 8, without spot.

Hab.—Mount Tambourine, Queensland, December to January. Rather rare. I captured six males and two females only.

Types: ♂♀, Coll. Tillyard.

It is interesting to note that, of the four species of *Metathemis* known, one only (*M. virgula* Selys) seems to be practically constant in size and colouring throughout its range. The other three show a gradual change from large, much spotted forms in their southern localities, to smaller and much blacker forms at their northern limits. These are shown in the following table:—

	M. guttata Selys.	*M. brevistyla* Selys.	*M. nigra* Tillyard.
Southern Limit	Victoria.	Victoria.	S. Queensland.
Southern (large, spotted) Form..................	*M. guttata* Selys.*	*M. brevistyla* Selys.*	*M. xanthosticta*, n.subsp.
Intermediate Forms	*M. aurolineata*† Tillyard (Dorrigo, N.S.W.). *M. guttata* var. *pallida* Tillyard (Illawarra, N.S.W.).	......	......
Northern Limit	S. Queensland.	Northern N.S.W. (? Queensland).	North Queensland.
Northern (smaller, black) Form	*M. melanosoma*, n.subsp.	*M. subjuncta*‡ Tillyard.	*M. nigra* Tillyard.

* The measurements of de Selys' types show that they are not actually as large as the common southern forms of these two species. I have not, however, given new names to these, as they seem to be typical in all but size. The locality of *M. guttata* type is not known, while the indication, "Port Denison, Q." for *M. brevistyla* type seems to be at least doubtful, and needs further investigation.

† These Proceedings, 1912, xxxvii., p.575. ‡ *Ibid.*, p.574.

At Mount Tambourine, it was interesting to note that the large and handsome *M. nigra xanthosticta*, n.subsp., occurred on the same creek as the small and very dark *M. guttata melanosoma*, n.subsp., the former being at its southernmost, and the latter at its northernmost limit, which coincide.

4. Austrogomphus angeli, n.sp.

♂. *Total length* 39, *abdomen* 29, *forewing* 22, *hindwing* 21 mm. W i n g s saffroned at base for 1·2 mm. (more in immature specimens); *pterostigma* 2·2 mm., black with a brown centre. *Nodal Indicator* ‖ 12, 7-8 | 9, 8 |; *membranule* very small, grey. H e a d: *occiput* black, with a large semioval yellow patch; *vertex* black, with a yellow triangular spot; a broad black band along base of front, and a blackish line (sometimes absent) in suture between front and clypeus; all other parts yellow or greenish-yellow (the green supervening with age), and fairly covered with blackish hairs, except *labium*, which is dirty brownish-yellow, with a few whitish hairs. T h o r a x: *prothorax* black, a wide yellow collar in front; a pair of small round geminate spots on dorsum, and a lateral spot on each side. *Meso-* and *metathorax* black above, with a pair of very distinct and complete yellow "seven-marks," followed by a narrow humeral yellow band much pinched just before its backward end, where each enlarges into a conspicuous yellow spot situated just above the interalar ridge. On the sides, a black band follows the humeral yellow band, and there are two complete lateral black bands; the middle one of these three bands is somewhat irregular in shape, the lower one straight; between them lie two broader areas of yellow; also the large area below the lowest band is yellow (see diagram of thoracic colouring, Plate xv., fig.7). *Underside* dull yellowish. *Notum* black, with conspicuous yellow scuta and scutella, and yellow spots on wing-joins. *Legs* short, black, coxæ and underside of profemora yellow. A b d o m e n: 1-2 swollen, 3-6 very narrow, 7-10 clubbed. *Colour* black, marked with yellow as follows: a cross-bar on 1, and a dorsal stripe on 2, form a large and conspicuous T-mark, from the head of which projects a short yellow line; sides of 1-2, auricles, and genitalia largely yellow; lateral view of segment 2 as shown in fig.5 of Plate xv.; 3-6 with a fine dorsal line, slightly swollen basally; 3 with two large triangular basal sublateral spots; 4-6 with a transverse basal band; 7 with a dorsal basal mark of irregular shape, with its apical point lying nearly at middle of segment, and followed by a remnant of the dorsal line; a yellow transverse line in suture between 7 and 8; large irregular sublateral spots on 7-9; 10, black. Appendages: *superior* 1·8 mm., parallel, straight, cylindrical to near tips, which are sharply pointed; colour yellow, with bases and tips black; underneath, close to bases, each carries a small black hook projecting downwards and curved inwards behind the hooks of the inferior appendage: *inferior* 0·6 mm., black, consisting of two widely separated upturned hooks.(Plate xv., figs.3-4).

♀.*Total length* 42, *abdomen* 31, *forewing* 24, *hindwing* 23 mm.

Differs from the male as follows: *Wings* much saffroned from base to nodus; *pterostigma* 2·7 mm., black line in suture above clypeus generally absent or obsolescent. *Head* and *thorax* marked as in ♂. *Occiput* with two pairs of prominent black tubercles, the outer pair narrow, rather truncate, with a small yellow spot near middle; the inner pair wider, more rounded at tips, slightly hooked (Plate xv., fig.6). Two yellow lines on metafemora. *Abdomen*: 1-2 swollen, 3-10 fairly cylindrical, marked as in ♂, but with dorsal mark of 2 much wider and dorsal lines of 3-6 more distinct; 8 with a basal yellow triangular patch running out apically into a fine dorsal line, on each side a sublateral band; 8-9 black, with sublateral basal spots, lying on the narrow projecting shelves of the two segments, formed by the tergites slightly enfolding the ventral parts; 10 black. *Appendages* 0·8 mm., yellow, subconical.

Hab.—Murray River, at Morgan, South Australia. December. Taken by Messrs. S. and F. Angel, of Adelaide, to whom I am indebted for a series of five males and six females, taken between 1909 and 1912.

Types: ♂♀, Coll. Tillyard (♂, December 28th; ♀, December 27th, 1909).

I know of no other locality for this interesting and very distinct species, which I have much pleasure in naming after its discoverers, who took, at the same locality, the somewhat rare *Austrogomphus* *australis* Selys, also. The appendages of the male of *A. angeli*, n.sp., are very distinct from those of all other species, but come nearest, in form, to those of *A. amphiclytus* Selys. The new species also resembles the latter somewhat by its colour-scheme, but is easily distinguished from it by its much smaller size, by the bicolorous pterostigma, and by the two complete lateral bands of the thorax.

5. Diphlebia euphœoides cœrulescens, n.subsp.

A beautifully marked race, which differs from the type-form, *D. euphoeoïdes** Tillyard (Kuranda), as follows :—

♂. *Wings* slightly narrower, the black clouding not quite so complete, but showing paler spaces in each cellule surrounded by dark pigment. Black bands of *thorax*, slightly thicker. *Abdomen* coloured as follows: 1, black with large central blue patches; 2, blue, with transverse black lines in sutures, a black dorsal line along basal half, enlarging into a large flat spade-shaped dorsal black spot towards apex; 3 as in type-form; 4-7 black *with a pair of conspicuous basal blue spots* (these segments are wholly black in type form); 8, blue, with a narrow elongate anchor-shaped dorsal black mark; 9, blue, with a short dorsal longitudinal black stripe along basal half, and two small central points of black; 10, black, with two round blue spots wide apart (closer in type-form); sutures of 8-10 broadly black.

♀. Very similar to type-form, but with a generally darker colouration and an intensification of the black parts of the epicranial pattern.

Hab.—Mount Tambourine, Queensland. December-January, 1913. Not common; occurs mostly on the rocky creeks half-way down the mountain. I obtained a fair series of males and a smaller number of females.

Types: ♂♀, Coll. Tillyard.

There seems to be an almost exact parallel between the limits of distribution, and resulting variations of colour-scheme between this species and *Metathemis nigra*, already dealt with. In both

* These Proceedings, 1907, xxxii., p.394.

cases, the type-form from the northern limit (Kuranda) is the darker, and at the southern limit (Mount Tambourine) a beautifully spotted form occurs.

6. Diphlebia hybridoides Tillyard.

The male of this species was described by me, These Proceedings, 1911, xxxvi., p. 587.

♀ (unique). *Total length* 52, *abdomen* 39, *forewing* 38, *hindwing* 36·5 mm. Wings: *neuration* black, the whole wing slightly shaded with brown; *pterostigma* 3 mm., dark brown. *Nodal Indicator* $\left\|\begin{array}{ll}6\text{-}7, & 24\text{-}25\\ 5\text{-}6, & 20\end{array}\right|$. Head: *epicranium* black, with three small brown marks near ocelli; *clypeus* jet black; *labrum* black, with two brown spots; *genæ* and inside of *orbits* yellowish-brown; *labium* pale dirty-brownish. Thorax: *prothorax* black, with two reddish-brown touches, and a little brown on posterior border. *Meso-* and *metathorax* very dark brown, with black dorsal and humeral bands; lower part of sides and underside powdered with grey. *Legs* black, undersides of femora powdered with grey. Abdomen: 1-7 quite cylindrical, 8-10 somewhat clubbed. *Colour* jet-black; sides of 1 and underside of 2-8 slightly powdered with grey. *Appendages* 1 mm., sharply pointed, black.

♂. It is necessary to add, to the already published description, the colouration of the thorax and abdomen, since the type-specimen was discoloured. Thorax: *prothorax* black, with two small brown spots well forward, two large central brown spots, and a short transverse brown mark behind. *Meso-* and *metathorax rich brown* (not *blue* as in other species), with black dorsal and humeral bands; sides brownish, shading to dull bluish below, a narrow sublateral black band in suture. Abdomen: 1 brownish, with a rectangular basal black blotch; 2-9 as described; 10 black; *appendages* black.

Note:—This species must not be confounded with the black-tipped form of *D. lestoïdes* Selys. In Victoria and the southern half of New South Wales, *D. lestoïdes* ♂ has a milky bar across the wings, but the tips are quite clear. In the northern half of New

South Wales, and at Mount Tambourine, and other localities, in South Queensland, it has, in addition, in mature specimens, a strong black tip to the wings. In *D. hybridoïdes*, the black is not truly apical, as in this form of *D. lestoïdes*, but it is a broad præ-pterostigmatic band, though, in very mature specimens, a certain amount of obfuscation supervenes between it and the tip of the wing. Both sexes of *D. hybridoïdes* are of much slenderer build than *D. lestoïdes*; the abdomen is longer and narrower; the wings also longer and narrower, and the appendages of the male very different, and easily distinguished by the very sharp upcurved tips, and conspicuous inferior spine of the superior appendages. The female is distinguished also by its very dark head, with scarcely any brown epicranial pattern, and by the very long and slender wings.

Hab.—Kuranda, N. Queensland. I have received a good series of six males and one female, taken by Mr. F. P. Dodd, during December, 1912.

Types: ♂♀,(Kuranda, F. P. Dodd), Coll. Tillyard.

7. ARGIOLESTES CHRYSOIDES, n.sp.

♂ (unique). *Total length* 41, *abdomen* 32·5, *forewing* 26, *hindwing* 25 mm. Wings: *pterostigma* 1·3 mm., black; postnodals 18-19 in forewing, 17 in hindwing. Head: *eyes* black; *epicranium* and *clypeus* dull black; *labrum* dark metallic purple, hairy; a pale yellow patch on genæ, extending to orbits; *labium* dull black. Thorax: *prothorax* black, with a pair of conspicuous dorsal yellow spots. *Meso-* and *metathorax* bright golden-yellow above, except for a narrow black border near prothorax, and a broad black patch above and surrounding interalar ridge; sides dark metallic purplish-black, with the yellow from above forming an irregular humeral band; irregular yellow patches near coxæ and close to abdomen; *notum* black, crossed by a yellow band; scuta and scutella yellow; wing-joins black. *Legs* black, slender, with long slender spines on femora and tibiæ. Abdomen slender, cylindrical, 9-10 enlarged. *Colour* black, the basal half showing deep purplish reflections (1-4 distinctly, 5-6 less so). No spots.

Appendages: *superior* 1·5 mm., forcipate, black; seen from above, the basal two-thirds are thick, the apical third thinner and bent inwards; at the bend, on the inner side, is a slight swelling, and, on the outside, are three small spines; tip rounded; hairs very irregular; in profile, the thickness is almost uniform, the tips rather blunt and decurved; there are two small spines above, at the bend, and a moderately large inferior spine under the bend near the tip. *Inferior* very short, black, subtriangular in profile. (Plate xv., figs.8 and 9).

♀. Unknown.

Hab.—Montville, Blackall Ranges, Queensland. This unique male was taken on a rocky creek in the scrub, on October 6th, 1912, by Dr. A. J. Turner, F.E.S., of Brisbane.

Type: Coll. Tillyard.

This beautiful species is closely allied to *A. aureus** Tillyard, from Kuranda, North Queensland. The chief differences are:—In *A. aureus,* the pterostigma is much shorter (1 mm.); the front, clypeus and labrum are golden, and there are two golden spots on each side of prothorax. The gold markings of the thorax are very different. In *A. aureus,* a wedge of metallic steely black runs in from the interalar ridge along the dorsal ridge, thus cutting the gold in two; on the other hand, the sides of the thorax are nearly all golden in *A. aureus.* The abdomen of *A. aureus* has no purplish colouring, and there are small basal golden spots on 2 and 3. The superior appendages of *A. aureus* are slightly longer, and are without the inferior spine found in *A. chrysoïdes.*

8. Synlestes albicauda, n.sp.

♂. *Total length* 53, *abdomen* 45, *forewing* 29, *hindwing* 28 mm. Wings: *neuration* fine, black; *pterostigma* 1·5 mm., thick, rather convex below, black with brown centre; *quadrilateral* shorter but broader than in *S. weyersi* Selys, ♂; *postnodals* 19 in forewing, 14 in hindwing. Head: *total width* 5·5 mm. *Eyes* rather large, bronze-grey shading to pale grey beneath; *antennae* slender, 3·5

---

* These Proceedings, 1906, xxxi., p.178.

mm., basal joint swollen, whitish, second joint fairly slender, slightly swollen at tip, rather long, whitish shading to brown distally, rest very slender, dark. *Epicranium* metallic green, *clypeus* bronze, *labrum* dark metallic green, *labium* wide, dull, pale dirty straw-colour. Thorax: *prothorax* bronze, with a pale straw-coloured collar, and a thick irregular humeral band on each side, on which is partly isolated a conspicuous bronze point. *Meso-* and *metathorax* bronze above and on sides; a pair of conspicuous slanting posthumeral bands of cream or pale yellow, rather irregular, broadest near wings, and narrowing forwards; also a fine pale line on each side, in the lateral suture; underside and lower part of sides white touched with cream; *notum* dirty pale brownish, glaucous. *Legs* slender, rather long, coxæ whitish, rest pale dirty brownish; elbows black; a black line on distal half of profemora; tibiæ with long slender spines. Abdomen very slender, 1-2 and 8-10 slightly enlarged. *Colour* dark bronze, marked with cream or pale yellow as follows: 1, a dorsal patch, and white underside; 2, lower part of sides, and underside enclosing brown genitalia; 3-7, a pair of basal subtriangular marks extending downwards along the sides to a sharp point apically, and joining one another basally underneath; 8, with same markings very low down, not visible dorsally; 9-10 dark bronze. Segment 10 of remarkable shape, being raised dorsally into two parallel ridges, from which the superior appendages arise; these ridges are concave inwards, and end in a conspicuous spine above; colour black. Appendages: *superior,* 2·7 mm., white, elongate, forcipate, and also bifid at their basal third; the inner forks 0·6 mm., short, straight, sharply pointed, converging to meet or cross inwards, a distinct rounded lobe on outer border; outer forks long, curved, often crossed at tips. *Inferior* reduced to two dull whitish tubercles. Apparently the superior appendages here play the double part of two sets of claspers often allotted to superiors plus inferiors together; or possibly the inferior forks play the part of spines. (Plate xv., figs. 10-11).

♀. *Total length* 49, *abdomen* 39, *forewing,* 30·5, *hindwing* 29 mm. It differs from the male as follows: *pterostigma* slightly larger, paler in centre; *postnodals* 17 in fore, 13-14 in hindwing. *Epicranium, clypeus* and *labrum* bronze. *Thorax* with dull brown overlying the bronze dorsally; markings yellower in mature ♀ than in ♂ both on thorax and abdomen, the usual colour being straw. *Abdomen* cylindrical, thicker than in ♂, except 9, which is much swollen, 10 narrower: 1, with an apical whitish band; 3-8 with yellow markings larger than in ♂, and spreading further apically along underside. *Ovipositor* black; 9, blackish; 10, narrow and short, 1·2 mm., *white or creamy*. *Appendages* 0·6 mm., straight, subconical, creamy; tips with a very fine sharp brownish point.

Hab.—Mount Tambourine, Queensland December-January. Twelve mature males, and three mature females were taken by me, between December 21st, 1912, and January 6th, 1913.

Types: ♂♀., mature, taken *in cop.*, January 2nd, 1913; Coll. Tillyard.

During the latter half of December, I found this insect emerging in large numbers from a deep pool of the creek, near the top of the mountain, in dense scrub. These were nearly all females, and exceedingly weak and flabby. In spite of the abundance of newly-emerged specimens, mature specimens were seldom met with. A large percentage are caught and eaten by birds as they make their way from the pool; many more fall victims to rapacious spiders, both on land and water; and the remnant hide away in the dense scrub, where it is almost impossible to find them. I never caught more than two or three mature specimens in the course of a day's hunt, and only twice found them *in cop.* Their colouration is marvellously protective. When resting on the trunks of palms or tree-ferns, they are practically invisible, and will remain so still that they can be picked off with the hand. Also when flying in the half-light of the scrub, the wings are invisible, and the body nearly so. They are, curiously enough, only betrayed by the distinct white tip of the abdomen, which, I soon convinced myself, is actually necessary to enable the sexes to discover one another. The male, while sitting on a twig or trunk, arches his abdomen outwards, and moves his white appendages to and fro, while I have no doubt that the female uses the white tip of her abdomen in a similar manner.

These movements do not amount to so decided a courtship (as far as I could judge) as in the case of *Hemiphlebia mirabilis**, but are of an exactly similar nature, so that it is interesting to find two similar developments brought about by the same necessity, on two insects so differently coloured, and of so different a habitat.

This species is easily distinguished from *S. weyersi* Selys, the only other known member of the genus, both by its peculiar colouration, and by its remarkable appendages.

EXPLANATION OF PLATE XV.

Fig. 1.—*Pseudocordulia elliptica*, n.sp., ♂, appendages, dorsal view (× 12).
Fig. 2.—*Pseudocordulia elliptica*, n.sp., ♂, appendages, lateral view (× 12).
Fig. 3.—*Austrogomphus angeli*, n.sp., ♂, appendages, dorsal view (× 9).
Fig. 4.—*Austrogomphus angeli*, n.sp., ♂, appendages, lateral view (× 9).
Fig. 5.—*Austrogomphus angeli*, n.sp., ♂, lateral view of 2nd segment (× 5).
Fig. 6.—*Austrogomphus angeli*, n.sp., ♀, occiput, showing hooks (× 12).
Fig. 7.—*Austrogomphus angeli*, n.sp., ♂, thoracic colour-pattern (× 5).
Fig. 8.—*Argiolestes chrysoïdes*, n.sp., ♂, appendages, dorsal view, right half (× 18).
Fig. 9.—*Argiolestes chrysoïdes*, n.sp., ♂, appendages, lateral view (× 18).
Fig. 10.—*Synlestes albicauda*, n.sp., ♂, appendages, dorsal view (× 18).
Fig. 11.—*Synlestes albicauda*, n.sp., ♂, appendages, lateral view (× 18).

* These Proceedings, 1912, xxxvii., p.463.

NOTES FROM THE BOTANIC GARDENS, SYDNEY.

No.18.

By J. H. Maiden and E. Betche.

DILLENIACEÆ.

Hibbertia elata, n.sp.

Wallangarra, New South Wales, on the borders of Queensland, on arid hills (E. Betche; December, 1891; Stanthorpe, Queensland, on the top of a bare hill in the crevices of rocks (J. L. Boorman; July, 1904).

Frutex erectus, circiter 1 m. altus, pilis parce vestitus. Folia angusto-linearia, 2-3 cm. longa, concava, conferta leniter fasciculata. Flores terminales in brevissimis ramulis lateralibus. Sepala ovata, circiter 8 mm. longa, exteriora ciliata. Petala non vidimus. Stamina 15-20, circa carpidia in circulum completum disposita sine staminodiis. Carpidia 3, glabra.

An erect, densely leaved shrub, 4 or 5 feet high, the young branches scantily hairy. Leaves crowded and somewhat clustered, sessile with a slightly enlarged base, and articulate shortly above the base, narrow-linear, concave, 2 to 3 cm. long, hirsute with short soft white hairs, or rarely nearly glabrous. Flowers solitary and terminal on the branches, or apparently axillary, on account of the shortness of the branches. Sepals ovate, about 8 mm. long, with membranous, more or less ciliate edges, the outer ones drawn to a point. Petals not seen. Stamens about 15 or rather more, all round the carpels, without staminodia, though some with smaller barren anthers. Carpels usually 3, glabrous.

The species is closely allied to *H. fasciculata* R.Br., and may perhaps be regarded by some as a tall form of that species, but the aspect of it is very different. It differs from it by the large size, the much longer and less distinctly clustered leaves, larger flowers, ciliate sepals, and more numerous stamens. It is probably the tallest *Hibbertia* in New South Wales, unless *H. saligna* R.Br., occasionally attains a larger size.

Hibbertia Kochii, n.sp.

Lowden, Western Australia (Max Koch; October, 1909).

Frutex erectus, 20-30 cm. altus, pilosus. Folia lineari-lanceolata, 12-15 mm. longa et 2 mm. lata, obtusa, margine revoluta, subtus plana pallidaque. Flores solitarii, pedunculis gracilibus circiter 30 cm. longis. Bracteola sub flore, sepalis brevior. Sepala obtusa, circiter 4 mm. longa, interiora latiora hyalino-marginata, pilosa æque quam pedunculis, foliis et ramulis. Petala flava, biloba, circiter 8 mm. longa. Stamina 10, unilateralia. Staminodia 3, unilateralia. Carpella 2, biovulata, villosa.

A small, much-branched, erect shrub barely 6 inches high in some specimens, and apparently always below one foot high, the young branches, leaves, peduncles and calyces generally loosely covered with rather long spreading hairs. Leaves linear or linear-lanceolate, 6 or 7 lines long, and about one line broad in the upper half, obtuse or with a very small recurved point, the margins revolute but leaving the smooth, somewhat paler undersurface open. Peduncles one-flowered, slender, leaf-opposed on the upper part of the stem, or terminal on short branches, 1 to 1¼ inches long, with a small, leaf-like bracteole close under the calyx, shorter than the sepals. Outer sepals narrow-ovate, the inner ones broader, and with scarious margins, about 2 lines long, all obtuse, the spreading hairs on the midrib and margins. Petals yellow, 2-lobed, about 4 lines long. Stamens 10 or rarely more, all on one side of the carpels in a dense cluster, with three short, narrow staminodia on each side of the fertile stamens and close to them. Carpels 2, villous, 2-ovulate. [Seeds not seen.]

The new *Hibbertia* belongs to the section Hemipleurandra, and is very closely allied to *H. hypericoides* Benth., but differs from it essentially in the indumentum. The stellate hairs of *H. hypericoides* are entirely absent in *H. Kochii,* which has long spreading hairs, and is further distinguished from it by the long slender peduncles; the staminodia are always few, and closely pressed to the edges of the stamens, and not dispersed round the carpels, as frequently in *H. hypericoides.*

In December, 1910, we received from Mr. Koch, from the same locality, almost glabrous specimens of the same species, with the following note:—"This is a form which grows in very moist situations, and is densely branched and prostrate. It is very commonly met with in swamps after the water has gone back a bit." These specimens are identical with the hirsute form in every respect, except that the hairs are so few that they appear glabrous at first sight.

RUTACEÆ.

BORONIA DEANEI, Maiden & Betche.

Swampy flats above Fitzroy Falls, near Moss Vale (Miss Agnes Brewster; September, 1911).

The type of this species was collected, in 1906, by Mr. Henry Deane, on the road from Clarence Siding to Wolgan, in the Blue Mountains, at an altitude of about 3,400 feet (These Proceedings, xxxi., 731, 1906).

The Fitzroy Falls specimens have rather longer and more slender leaves, the stigma is thicker, and there are some slight differences in the stamens and the shape of the petals; but the distinctions are unessential, and are perhaps caused by the difference in altitude of the two localities. These are the only localities recorded so far.

SAPINDACEÆ.

NEPHELIUM FORSYTHII Maiden & Betche.

Top of Mt. Duri, near Currabubula, 3,150 feet high (R. H. Cambage; August, 1912).

A new locality for a rare plant. The tree was described by us in these Proceedings (xxvi., 81, 1901) from specimens collected by the late Mr. W. Forsyth, in the Tia Canyon, in the Walcha district. The new locality (Peel Range) brings the range of the species considerably to the west, since the former locality is east of the Moonbi Range.

Dodonæa hirsuta, n.sp.

Jennings or Wallangarra (New South Wales-Queensland border, and occurring in both States). (J. L. Boorman; October, 1901, and July, 1904).

Frutex erectus, ramosus, $\frac{3}{4}$-$1\frac{1}{2}$ m. altus. Folia ramulique brevibus patentibusque pilis dense vestita, et sine visciditate quæ propria generis est. Folia conferta, cuneata vel fere triangularia, in brevissimum petiolum angustata, apice lato truncato sed distincte 3-denticulato, 5-6 mm. longa, et apice fere æquilata, marginibus recurvatis. Flores axillares plerumque solitares in pedunculis gracilibus foliis leniter longioribus. Sepala lanceolata. Capsulæ grandiusculæ, tota longitudine alatæ, et utrinque æque rotundatæ, rubro-brunneæ, hirtulæ. Flores masculos et semina matura non vidimus.

We described this plant in these Proceedings (xxvii., 57, 1902) as a variety of *D. peduncularis,* but we have since come to the conclusion that the characters separating it from that species are too marked and constant to maintain that view, and that it fully deserves to stand as a distinct species.

It is an erect bushy shrub, 2 to 6 feet high, the leaves and young branches densely covered with short spreading hairs, and without a trace of the viscidity so common in the genus. Leaves crowded, cuneate, or almost triangular in outline, narrowed into a very short petiole, and with a broad, truncate but deeply 3-toothed summit, 5-6 mm. long, and nearly as broad at the top, the margins recurved. Flowers axillary, mostly solitary, on slender peduncles shortly exceeding the leaves. Sepals lanceolate. Capsules rather large, winged from the base to the top, and equally rounded at both ends, of a reddish-brown colour, slightly hirsute, as well as the sepals and peduncles. Flowers of both sexes, and ripe seeds not seen.

LEGUMINOSÆ.

Crotalaria Mitchelli Benth., var. tomentosa Ewart.

Thurlow Downs to Berrawinia Downs in the Paroo River district, New South Wales (J. L. Boorman; October, 1912).

Professor Ewart described this variety in Proc. Roy. Soc. Vict. xix., 37 (1906) from specimens collected between the Finke River and Charlotte Waters, Central Australia. We can now add a second locality, which shows the great extent of its range. The Paroo River specimens agree well with Prof. Ewart's description, except that the leaves are still smaller, not exceeding 2 cm. in all our specimens, while the axis of inflorescence sometimes exceeds 5 cm.

MYRTACEÆ.

KUNZEA PARVIFOLIA Schau., var. ALBA, n.var.

Rockley (J. L. Boorman; November, 1906); near Braidwood (R. H. Cambage; November, 1908).

The colour of the flowers is normally lilac-purple in *K. parvifolia,* but we have two white-flowering specimens in the Herbarium, and we find that the white forms are also always glabrous or nearly so. The glabrous and white form from Braidwood is a heath-like shrub with smaller flowers and leaves, and seemed to us, at first, a well-marked species, but the specimens from Rockley are, in habit and appearance, exactly like the typical *K. parvifolia,* and cannot be separated from it specifically.

Kunzea capitata Reichb.—We may mention here that *Kunzea capitata* Reichb., also seems to have a white-flowered form.

Specimens of a white *Kunzea* from Ulladulla and Milton, collected by Mr. R. H. Cambage, seem to be a form of that species, but the material is at present too imperfect to decide whether it is a distinct species or a variety.

KUNZEA CAMBAGEI, n.sp.

On the plateau east of Mt. Werong, 3,700 feet high (R. H. Cambage; October, 1909); Big Plain, near Mt. Werong, 3,800 feet high (Richard Hind Cambage; December, 1911).

Frutex parvus, $\frac{1}{3}$-1 m. altus. Folia alterna, angusto-obovata, 4-5 mm. longa, brevissime petiolata, margine lanato. Folia matura lævia nitentiaque. Flores 6-8, sericei; in parvis capitibus terminalibus in duabus angustis bracteolis et una lata bractea. Calyx 3-4 mm. longus, breve 5-lobatus. Petala fere orbicularia, alba, calycis lobis circiter bis æquilonga. Stamina circiter 20 in uno ordine. Ovarium biloculare, paucis pendulis ovulis (plerumque duobus) in uno loculamento.

A small shrub up to 3 feet high, or almost prostrate in exposed situations, nearly glabrous in age, the young shoots silky-hairy. Leaves alternate, narrow-obovate, 4-5 mm. long, narrowed at the base into a very short flat petiole, ciliate and sparingly hairy when young, smooth and shining when old. Flowers about 6 to 8, in small heads terminating short lateral branches, each flower between two narrow bracteoles and supported by a broad scale-like bract, all silky with short hairs. Calyx hardly 3 to 4 mm. long, the lobes about one-third as long as the tube. Petals very small, nearly orbicular, white, about twice as long as the calyx-lobes. Stamens about 20, in a single row, very short, the filaments about twice as long as the petals. Ovarium 2-celled, with two pendulous ovules in each cell.

The new species belongs to the section Eukunzea (with few pendulous ovules), which is represented in New South Wales by a single species, *K. Muelleri* Benth.

It is nearest allied to the Western Australian *K. micrantha* Schau., but is easily distinguished from it by the small white flowers and the silky hairs. The flowers are very inconspicuous; it is the least showy of all New South Wales species. Mr. Cambage informs us that the leaves are sweet-scented.

Eugenia Tomlinsii, n.sp.

Alstonville (Dr. W. H. Tomlins; December, 1909, in flower; August, 1912, in fruit).

Arbor multicaulis circiter 12-15 m. alta. Folia ovato-lanceolata, 5-5½ cm. longa et 2½-3 cm. lata, in acumen obtusum angustata, supra atrovirens, subtus pallidiora. Petiola 5 vel 6 mm. longa. Flores numerosi in terminalibus paniculis plerumque 6 in ultimis ramis paniculæ. Calycis tubus turbinatus circiter 2 mm. longus, super ovulum breve elongatus. Lobi 4, persistentes, breve-obtusi. Petala 4 in calyptra parva planaque decidentes. Stamina numerosa triplice ordine, circiter 4 mm. longa. Antheræ loculamenta parallela. Ovulum biloculare. Fructus depresso-globosi 2-2½ cm. in diametro metientes et vix 1½ cm. alti, cœrulei. Semen solitarum.

A middle-sized tree, with a thick stem 65 inches in circumference at a height of 1 yard from the ground, according to Dr. Tomlins' measurements of the type-tree, and with a moderately spreading much-branched crown. Bark of a brownish-white colour, rather rough, easily pulling off in large pieces, leaving a smooth, light-brown surface underneath. Leaves ovate-lanceolate, generally 2 to 2¼ inches long, and 1 to 1¼ inches broad, tapering into an obtuse point, dark green above, paler underneath, finely and irregularly penniveined and loosely reticulate, the oil-dots distinctly visible when dry. Petioles short, about ¼ inch long. Flowers numerous and crowded in terminal thyrsoid panicles, usually six together, shortly pedicellate on the ultimate panicle-branches. Buds clavate. Calyx-tube turbinate, scarcely above a line long, produced above the ovulary, and with four long-persistent shallow obtuse lobes. Petals four, falling off together in a small shallow calyptra. Stamens numerous, in about 3 rows (154 in the flowers counted), about 4 mm. long; anther-cells parallel. Ovulary 2-celled. Fruit depressed-globular, 2 to 2½ cm. in diameter, and not quite 1½ cm. high, of a lilac-pink colour, one-seeded.

The new *Eugenia* belongs to the Section Syzygium, and is closely allied to *E. Ventenatii* Benth., but the general aspect is so different, that we can scarcely regard it as a form of the same species. *E. Tomlinsii* is chiefly distinguished from *E. Ventenatii* by the short and broad leaves, less than half as long as those of *E. Ventenatii*, by the smaller, much more numerous and crowded flowers, and by the bluish fruits. The blue fruits distinguish it from any other Australian *Eugenia* of the Section Syzygium; the only other Australian *Eugenia* with blue fruits, *E. cyanocarpa* F.v.M., belongs to the Section Jambosa.

We do not know, at present, the range of the tree. Dr. Tomlins has seen only a single tree. We have not received it from any other locality, and F. M. Bailey does not record a *Eugenia* from Queensland, answering to the above description.

COMPOSITÆ.

Brachycome iberidifolia Benth. New for New South Wales.

Waverley Downs to Hungerford, Paroo River (J. L. Boorman; October, 1912).

The species is very common in Western Australia, and it is also recorded from North Australia, but from no other State. As our specimens come from the north-west corner of New South Wales, not many miles from the border of Queensland, and also not far from the border of South Australia, it seems likely that both Queensland and South Australia will be added to the range of the species, when the flora of the interior of Australia is better known.

Pluchea baccharoides F.v.M. New for New South Wales.

Waverley Downs to Hungerford (J. L. Boorman; October, 1912).

Previously recorded from Queensland and North Australia.

According to the collector's notes, it is, in the New South Wales locality, a showy shrub of 3 to 5 feet in height, with the aspect of a cultivated *Eupatorium;* the florets are much longer than the involucre, and the tips of the pappus are of a pale purplish colour.

Podolepis cupulata, n.sp.

Wanganella, near Hay (Miss Edith Officer; October, 1903).

Planta annua, erecta, ramosissima, circiter 15 cm. alta, parciter lanuginosa. Folia lanceolata, basi decurrenti amplexantia, inferiora circiter 5 cm. longa, superiora breviora et basi latiora. Florum capita numerosa, in pedunculis brevibus, rigidis et filiformibus. Involucrum cylindricum vel fere campanulatum, circiter 6 mm. longum, squamis lævibus et fimbriatiusculis. Involucri squamæ exteriores, sessiles, latæ et obtusæ, mediæ breve unguiculatæ lamina magna et acuta, interiores unguibus rigidis, erectis, linearibus et laminis parvis. Flosculi circiter 40, omnes fere æquales, exteriores interioribus majores, nulli ligulati. Achenæ planum factæ (maturas non vidimus) circiter 10 pappi setis, basi barbellatis.

An erect annual, much-branched from the root, 5 to 6 inches high and up to 8 inches broad in the specimens seen, very sparingly woolly-hairy, or almost glabrous in age. Radical leaves not seen.

Stem-leaves lanceolate, the lowest rarely 2 inches long and 3 to 5 lines broad, sessile, stem-clasping and shortly decurrent, the upper ones gradually shorter and with a broader stem-clasping base. Flower-heads very numerous, on rigid, filiform, sometimes clustered peduncles rarely above 1 inch long. Involucre shortly cylindrical or almost as broad as long when fully developed, about $\frac{1}{4}$ inch in diameter. Involucral bracts smooth, with somewhat fimbriate margins, the outer ones sessile, broad, obtuse and wholly scarious, the intermediate ones with a short narrow claw and a large heart-shaped scarious lamina, somewhat like the "spade" in playing cards, with the point more drawn out and reflexed, the innermost ones with a broad-linear long erect claw, and a much smaller scarious lamina. The thick and stiff claws of the innermost involucral bracts are slightly connate at the base, and cohere into a solid cup containing the florets. Florets about 40, all nearly equal and none ligulate, the outer ones slightly exceeding the involucre, the inner ones shorter. Achenes compressed; pappus-bristles about 10, very deciduous on the marginal flowers, all barbellate from the base.

The new species is most nearly allied to *P. Lessoni* Benth., which it resembles much in habit and foliage, but from which it differs in the more numerous and smaller flower-heads, and shorter peduncles. It differs from all described species of *Podolepis* by the peculiar cup formed by the stiff, erect claws of the innermost involucral bracts.

GOODENIACEÆ.

Goodenia Havilandi, n.sp.

Shuttleton, Nymagee (W. Baüerlen; September, 1903); Cobar (Archdeacon F. E. Haviland; October, 1911).

Suffrutex multicaulis, caulibus adscendentibus, undique glanduloso-pubescens, $1\frac{1}{2}$-3 dc. altus. Folia radicales linearo-lanceolata, cum petiolo circiter 7 cm. longa et 5-6 mm. lata, integerrima vel remote serrata. Folia caulina pauca, et gradatim minora angustioraque. Flores parvi, plerumque solitares in pedunculis rigidis, filiformibus, sub fructibus patentibusque, 15-20 cm. longi. Bracteolæ desunt. Corolla flava, circiter 6 cm. longa, extus brevissime pilosa. Capsula globosa dissepimento brevissimo. Semina 8-10, plana vel concava, margine pallido cincta.

An ascending perennial with a tufted, somewhat woolly-hairy rootstock, minutely glandular-pubescent all over, about 1 foot high in the fruiting specimens from Cobar, and half as high in the flowering specimens from Shuttleton. Radical leaves linear-lanceolate, about 3 inches long including the long petiole, and not above 3 lines broad, entire or occasionally with one or two remote teeth; stem-leaves few and distant, gradually smaller and reduced to linear or filiform bracts under the peduncles. Flowers small, solitary on filiform rigid peduncles, or clustered at the top of the flowering branches. Peduncles without bracteoles, almost horizontally spreading under the fruit, rarely above $\frac{3}{4}$ inch long. Corolla yellow, scarcely 3 lines long, minutely hairy outside. Capsule globular, with a very short dissepiment, and less than 10 flat or concave seeds, black with a light-coloured border.

The new species belongs to Bentham's Section Pedicellosæ, and is most nearly allied to *G. pusilliflora* F.v.M. It is distinguished from it chiefly by the glandular hairs, and by the entire or almost entire leaves. The glandular-hairy species of Pedicellosæ were previously confined to West Australia. This is the first one described from East Australia.

OLEACEÆ.

JASMINUM SINGULIFLORUM Bailey & F.v.M. New for New South Wales.

Woodburn, Richmond River (Mrs. F. E. Haviland; July, 1886).

Though collected 27 years ago, and sent at the time to Baron von Mueller for determination, it has not been previously recorded from this State. It turns out to be fairly common in the rich brushes on and between the Richmond and Tweed Rivers, but it runs into the forms of *J. didymum* Forst., var. *pubescens*, and does not seem to be a well-defined species. The inflorescence of the pubescent forms of *J. didymum* is often reduced to very few flowers; in the extreme forms, they are reduced to a single flower, and that is *J. singuliflorum*.

We have to thank the Ven. Archdeacon F. E. Haviland for the above specimen.

SOLANACEÆ.

SOLANUM HYSTRIX R.Br. New for New South Wales.

Brindingabba to Arara, and Arara to Lake Eliza in the Cuttaburra Creek (Paroo River) district (J. L. Boorman; October, 1912).

Previously recorded from South and Western Australia.

Our specimens differ from the type in the leaves being sprinkled with stellate hairs underneath, while the type is quite glabrous, but they show distinctly the small spines on the corolla, a character unique in this species; and they agree, in habit, exactly with our South Australian specimens from Mt. Hergott.

The prickles are bright copper-coloured, the fruits yellow when ripe, about ½ inch in diameter.

[I regret to say that, a month after this paper was read, my colleague, Mr. Betche, died, on 28th June, 1913.—J.H.M.]

ORDINARY MONTHLY MEETING.

JUNE 25th, 1913.

Mr. W. S. Dun, President, in the Chair.

Dr. J. R. L. DIXON, University of Sydney, was elected an Ordinary Member of the Society.

The Donations and Exchanges received since the previous Monthly Meeting (28th May, 1913), amounting to 6 Vols., 53 Parts or Nos., 7 Bulletins, 1 Report, and 3 Pamphlets, received from 44 Societies, were laid upon the table.

NOTES AND EXHIBITS.

Mr. Fred Turner exhibited and contributed notes on *Eragrostis laniflora* Benth., one of the "Love-grasses," collected near Byrock, New South Wales. The thick, almost bulbous woolly bases, which are characteristics of this species, were remarkably well developed in the specimens shown; and from long observation of this and other Australian species of Gramineæ with bulbous or thick, knotty bases, he was of the opinion that they were provided by Nature for storing up plant-food to sustain these grasses during periods of very dry weather, and to preserve them from extinction. In the interior, grasses that have developed these characteristics remain green much longer during adverse seasons than those without them, and quickly recover after rainfall. During a prolonged drought, when every vestige of grass-foliage has disappeared, these swollen bases, which are generally enveloped in a woolly substance that prevents the evaporation of moisture, and their strong, long fibrous roots which penetrate deeply into the earth, remain dormant until the condition of the soil and weather is favourable for them to again put forth green stems and leaves. Mr. Turner had exhibited at meetings of the Society, during recent years, all the known Australian grasses with bulbous or thick, knotty leaves. *Eragrostis* *laniflora* is described in Turner's "Grasses of New South Wales," (p.19) published under the authority of the Government of New South Wales, in 1890.

Mr. E. Cheel exhibited a large piece of timber taken from a "Stringy Bark" (*Eucalyptus* sp.) at Hill Top, measuring 18 inches in diameter, showing the heartwood infested with thin sheets of the white leathery mycelium, together with the sporophore *in situ*, of *Polyporus eucalyptorum* Fr., thus confirming a suggestion made in these Proceedings (1910, xxxv., 308), that the white masses of mycelium included under the name of *Xylostroma giganteum* Fr., were the sterile mycelia of *Polyporus*. The following " Rusts " were also exhibited : (*a*) *Uromyces appendiculatus* Link, on leaflets of the French Bean (*Phaseolus vulgaris* Linn.), var. Epicure, and a yellow-seeded form; from Penshurst and Botanic Gardens; and (*b*) *U. striatus* Schrœter, (?) on Lucerne (*Medicago sativa* Linn.); from the Botanic Gardens, collected by the late Mr. A. Grant, in April, 1906; this is difficult to distinguish from *U. trifolii*.—Mr. Cheel said that, since the last Meeting, he had received some fresh specimens of a Clover called Chilian Clover (a form of *Trifolium pratense* Linn.) from the Hawkesbury Agricultural College, infested with the Rust *U. trifolii*.

Mr. A. A. Hamilton showed specimens of three plants: (*a*) *Schkuhria isopappa* Benth., Whittingham (J. H. Maiden; March, 1908). New for Australia; determined at Kew. A little known plant from New Granada, whose properties have probably not been investigated, as it is not mentioned in available works on this subject. (*b*) *Roubieva multifida* Moq., (Syn. *Chenopodium multifidum* Linn.), Waterloo (J. H. Camfield; November, 1906), West Maitland (J. Burgess; January, 1911), Blackwattle Bay (A. A. Hamilton; May, 1913). New for New South Wales. Recorded from Victoria (Proc. Roy. Soc. Vict. N.S. xxii., p.21) Ewart, White and Rees; and from South Australia, (Trans Roy. Soc. S. Aust. xxxv., 1911), J. W. Black. This South American plant has probably been introduced in ballast, as it is usually found near the shipping. It has been observed in the neighbourhood of Moore Park for some years, but has not spread to any appreciable extent. This, in a measure, may be accounted for by the aroma of the plant (which is similar to that of its better known relative, *C. ambrosïoides* Linn., "Mexican Tea, &c.) causing it to be unpalatable to stock. As the seeds may be found in quantity on the ground under the plants, it is evident that they are not a favourite food of birds; and this is another factor in its non-distribution. (*c*) *Chenopodium triangulare* R.Br., Snowy River, Vict.(E. E. Prescott; February, 1901); Geelong coast, Vict.(E. E. Prescott; January, 1902); Jervis Bay (A. H. Lucas; January, 1899), Gudgenby, Queanbeyan, 3,200 ft. (R. H. Cambage; January, 1912), Scarborough, Illawarra(A. A. Hamilton; May, 1913) Recorded in the Flora Austr. from Parramatta to Queensland. As this native species is distributed along the coast as far south as Melbourne, it is somewhat remarkable that it has hitherto escaped notice.

By permission of Professors W. A. Haswell and T. E. David, Mr. North sent for exhibition a skin, and three eggs each of the Antarctic Petrel (*Thalassœca antarctica* Gmelin), and of the Silvery-grey Petrel (*Priocella glacialoides* Smith). These specimens were collected by members of the "Mawson Antarctic Expedition," in Adélie Land, in 1912. The eggs of the Antarctic Petrel vary from oval to pointed-ovals, and an ellipse in form, the shell being coarse-grained, or having numerous irregularly shaped pittings over its surface, which is dull white and lustreless: Length: (A), 2·77 × 1·83; (B), 2·8 × 1·87; (C), 2·65 × 1·82 inches. The eggs of the Silver-grey Petrel are somewhat similar, the shell being rather finer-grained, and the specimens larger: Length: (A),3·03 × 1·9; (B),2·97 × 1·95; (C),1·78 × 1·82 inches.

Mr. Hedley showed some very tastefully got up souvenir post-cards and a box of bonbons, of conchological import, sent out with the invitations to attend the opening ceremonies of a museum in Japan.

On the conclusion of the formal business, the President invited The Hon. Sir Normand MacLaurin, on behalf of Miss Ethel

Stephens, the artist and donor, to unveil a portrait in oils of her father, the late Professor W. J. Stephens, M.A., Oxon., who actively co-operated with Sir William Macleay in the inauguration and development of the Society, from its foundation in 1874, up to the time of his death in 1890.

Sir Normand MacLaurin gave an outline of Professor Stephens' career, and referred to his long and fruitful connection with higher education in New South Wales, from 1856 for the rest of his life – as Head Master of the Sydney Grammar School for ten years, then as Principal of his own school, The New School, afterwards called Eaglesfield, and from 1882 onwards as Professor of Natural History, or, later, Professor of Geology and Palæontology, in the University of Sydney. Professor Stephens was Fellow and Tutor of his College; he was a sound classical scholar whose tastes and sympathies subsequently broadened and led him to take up the study of natural history, geology and botany particularly; he was an inspiring teacher, and a singularly genial and attractive man. He was one of those who took a very active part in the initiation of the Linnean Society of New South Wales, and one of the most enthusiastic coadjutors of Sir William Macleay in making it a success. All through its earlier years, Professor Stephens held some official position or other, notably the Presidency in 1877 and 1878, and from 1885 to the close of his life. Miss Stephens' gift was at once a tribute to her father's memory, and an offering which she hoped would serve to remind Members of a later generation, of his long and happy association with the Society.

The President, in accepting the portrait on behalf of the Society, said that, in addition to the reasons given by Sir Normand MacLaurin, there were some others of a special character, why Miss Stephens' gift was a most acceptable one. The Society's early records were destroyed by fire; but from such sources of information as are available, there is reason to think that Prof. Stephens was largely or entirely responsible for the choice of the Society's name. Doubtless the founders hoped that, in the fulness of time, the Society would do for New South

Wales and for Australia what the Linnean Society of London has done or is doing for Great Britain and the British Empire. But an unlooked for benefit had been the kindly interest which some of the scientific compatriots of Carl von Linné had manifested in more than one way. Another reason was, that without making any invidious distinctions, Professor Stephens' niche in the Society's history was quite obvious—he was Sir William Macleay's trusty right-hand man. And still a third reason was the Society's indebtedness to him as President for his tact and delicacy in handling a difficult matter on two special occasions, when it became necessary to make public reference to Sir William's munificence to the Society, in his presence.

Professor David, in moving that the very cordial thanks of the Society be tendered to Miss Stephens for her most welcome gift; and to Sir Normand MacLaurin for his great kindness in acting as Miss Stephens' representative on the occasion of this pleasant interlude in the Society's ordinary work, said that it was particularly gratifying to him, as Professor Stephens' successor in the Chair of Geology in the University of Sydney, not only to have the privilege of moving the resolution, but of bearing testimony to Professor Stephens' worth as a man of wide and sound culture, and a successful teacher whose influence, especially at the particular period when it became operative, was wholly for good.

Mr. Maiden, speaking with knowledge of Prof. Stephens as a teacher, as President of the Society, and in other ways, warmly seconded the resolution.

On being put to the Meeting, the motion was carried by acclamation.

The President having formally offered the heartiest thanks of the Society to Miss Stephens, who was present, and to her able representative; Sir Normand MacLaurin, in reply, said that, as he was the senior, as well as the only original, Member of the Society present, and Prof. Stephens had been his old and valued friend, it had afforded him special pleasure to take part in the evening's proceedings.

STUDIES ON AUSTRALIAN MOLLUSCA. Part XI.

By C. Hedley, F.L.S.

(Plates xvi.-xix.)

(Continued from Vol. xxxiii., p.489.)

Notes in Museums abroad.

During last year (1912), I enjoyed an opportunity of visiting several important conchological collections in Europe and America. At intervals, from May to October, I spent ten weeks in study at that of the Natural History Museum, South Kensington. To its genial custodian, Mr. E. A. Smith, D.S.O., I am greatly indebted for facilitating my work, and for aid in difficulties of nomenclature.

Some impressions of the Conchological department of the British Museum were published in an American Conchological Journal.*

Here, I examined almost every Australian marine gastropod and pelecypod in the collection. Beneath the tablets are valuable notes on synonymy, habitat, and so forth, chiefly the work of Mr. Smith. By his permission, I am enabled to transfer, from this source, much important information to these pages.

Time did not allow me to complete my studies in London. On assembling my notes in Sydney, many points arise which now I should like to re-examine, but for which the opportunity has passed. I was fortunately able to obtain the services of Mr. A. H. Searle. A series of his beautiful drawings, now presented, illustrate thirty hitherto unfigured species, from the types in the British Museum.

For the most part, the present paper is a category and correction of mistakes and confusion. Had the locality been given,

* Hedley, Nautilus, xxvi., 1912, pp.85-90.

and a good illustration appeared as each name was introduced, few of the synonyms noted in the following pages would have occurred; and most of those that did, would have been readily detected.

Australian writers have frequently been misled by Tryon, who hastily united species which, though then indefinite in literature, were distinct in nature.

Study on the spot intensified my impression of the damage done to science by the conchological organisation of Hugh Cuming. It is difficult to understand how this illiterate sailor, by mere force of character, could have controlled the leading conchological writers of his time. But that he did so control and debase them, is clear. It is evident that Deshayes, in dealing with material sent by Cuming, surrendered his own clear judgment, exercised no discrimination, and confined himself to "describing" what species Cuming desired to be named as new. Reeve's sweeping criticism of the work of Deshayes on the genus *Terebra*,* explains this. The treatment of Pfeiffer was apparently similar.

Tracing the work of Arthur Adams, with his actual specimens in hand, one is the more impressed by his slovenly and unscientific methods. His papers correct an unusual number of his own clerical errors. He frequently ascribed foreign species to Australia, and Australian species to other continents.

In the Hancock Museum, Newcastle, England, I found an extensive series of Australian shells. George French Angas, the author of so many papers on Australian conchology, who died in London, 4th October, 1886, was the eldest son of George Fife Angas, of Newcastle-on-Tyne.† Most of the types of Australian marine shells described by Angas, or from his collection by Crosse, were given to the British Museum during his lifetime. But at his death, his land-shells were bequeathed to the Museum of his native city. Here I observed the following forty species,

---

* Reeve, Proc. Zool. Soc., 1860, p.448.

† For an autobiographical sketch, see "The Little Journal," London, May, 1884, Vol. i., No.3, pp.230-234.

described either by himself or in conjunction with A. Adams or by Dr. L. Pfeiffer, from the Angas Collection. All these were marked "type."

Bulimus angasianus Pfeiffer, Port Lincoln, S.A.
Helix carcharias Pfr., Shark Bay, W.A.
H. cassandra Pfr., Murray Cliffs, S.A.
H. curtisiana Pfr., Port Curtis, Queensland.
H. cyrtopleura, Pfr., Arrowie, Lake Torrens, S.A.
H. evandaleana Pfr., South Australia.*
H. lincolnensis Pfr., Port Lincoln, S.A.
H. perinflata Pfr , McDonnell Ranges, Centr. Austr.
H. stutchburyi Pfr., Port Elliot, S.A.†
H. zenobia Pfr., "on trees," New Georgia, Sol.
H. anadyomene A.Ad. & Ang., Guadalcanar, Sol.
H. flindersi A.Ad. & Ang., Flinders Range, S.A.
H. patruelis A.Ad. & Ang., Port Lincoln, S.A.
Bulimus brazieri Angas, Sinclair Range, K. G. Sound.
Helix adonis Angas, Bougainville Is., Sol.
H. beatrice Angas, Florida Is., Sol.
H. broughami Angas, Port Lincoln, S.A.
H. cærulescens Angas, Guadalcanar, Sol.
H. coxiana Angas, Ysabel Is., Sol.
H. deidamia Angas, Ysabel Is., Sol.
H. deiopeia Angas, Guadalcanar, Sol.
H. eros Angas, Ysabel Is., Sol.
H. eyrei Angas, Lake Eyre, S.A.
H. forrestiana Angas, N. W. Australia.
H. hermione Angas, Bougainville Is., Sol.
H. howardi Angas, Interior of S. Australia.
H. juanita Angas, Solomon Is.
H. kooringensis Angas, Interior of S.A.
H. lyndi, Angas, Port Essington, N.T.
H. malantensis Angas, Malanta Is., Sol.

* Angas notes that *Helix induta* Tate, (Proc. Linn. Soc. N. S. Wales, ii., p.290) from Kaiserstuhl, is identical with *H. evandaleana* Pfr.

† In the British Museum, a different species from Queensland is marked as type of *H. stutchburyi*.

Helix mendana Angas, Bougainville and Stephens Is., Sol.
H. moresbyi Angas, Port Denison, Qsld.
H partunda Angas, Gatera or Russell Is.
H. philomela Angas, Ysabel Is., Sol.
H. phillipsiana Angas, Interior of S.A.
H. psyche Angas, New Georgia, Sol.
H. ramsdeni Angas, Solomons.
H. rossiteri Angas, Ysabel, Sol.
H. rhoda Angas, San Christoval, Sol.
H silveri Angas, Eastern Plains, S.A.

So many Australian shells were named by Lamarck, that his collection has a special interest for us. The Lamarckian types are divided between two cities. Some are contained in the collection of the Museum of the Jardin des Plantes, once under his official care. These are now gathered together, in a room apart, in the Paris Museum.*

The others, included in Lamark's private collection, had a more eventful history. At the sale of Lamarck's books and specimens in 1830, the shells were purchased by the Prince Massena, duc de Rivoli. Afterwards these were transferred to Baron Benjamin Delessert, a wealthy Parisian merchant. It is recorded that Lamarck's conchological collection contained 13,288 species, represented by about 50,000 specimens.†

Baron Delessert enlarged his collection by other acquisitions,‡ and appointed first Kiener, and then Chenu as Curator. From the Delessert Museum, a series of monographs, embracing the whole conchological field, was projected, commenced by Kiener, and, after his death, continued by Chenu. But this magnificent scheme collapsed in 1854, after the issue of a number of broken parts.§

Upon the death of the owner, his brother, Baron F. Delessert, inherited the Collection. At his decease, the heirs presented the

* Joubin, Bull. Mus. Hist. Nat. x., 1904, p.459.

† Chenu, Notice sur le Musée Conchyliologique de M. le Baron Delessert. Paris, 1849.

‡ Dumeril, Compt. Rend., xi., 1840, pp.385-390.

§ Sherborn & Smith, Proc. Malac. Soc., ix., 1911, pp.264-267.

Delessert Collection, in 1869, to the city of Geneva, the native town of the Delesserts.*

When Drs. Quoy and Gaimard referred to the Lamarckian Collection† for the purpose of naming the shells gathered by the Astrolabe Expedition, it was the property of "M. le prince d'Essling."

Deshayes complained that while writing the second edition of the *Animaux sans vertèbres*, he was at first unable to refer to the Lamarckian specimens.‡ But on p.214 of the ninth volume (1843), he remarked that, by the kindness of the new owner of the Collection, Baron B. Delessert, he was then able to consult them.

Davidson acknowledged the generous assistance he received in his study of the Lamarckian brachiopods.§ When he wrote, the Collection had been purchased from Prince Massena by Baron Delessert, and Chenu was then Curator of this "extensive and celebrated Museum."

To examine this celebrated Collection, I visited Geneva, in October, 1912. Dr. M. Bedot, the Director of the Museum, received me most hospitably, and afforded facilities for study. It is pleasant to record how the Lamarckian Collection is held in trust for science, not only in safety but in veneration. It is preserved apart, locked up in four cabinets, and only shown with due precautions. The shells are gummed to wooden tablets, the margins of which are coloured to indicate geographical distribution. Blue, yellow, red, green, and violet indicate, respectively, an European, Asiatic, African, American, or Oceanic habitat. This mounting was probably done by Chenu.|| Frequently a label in Lamarck's own writing is attached to the tablet. It is intended that photographs of all Lamarck's species will be published by the Museum.

* Crosse, Journ. de Conch., xvii., 1869, p.208; Gray, Ann. Mag. Nat. Hist., April, 1869, pp.319 and 396.

† Quoy & Gaim., Zool. Astrolabe, ii., 1833, p.444.

‡ Deshayes, Journ. de Conch., i., 1850, p.418.

§ Davidson, Ann. Mag. Nat. Hist., June, 1850, p.434.

|| Chenu died at an advanced age, in 1879. Journ. de Conch., xxviii., 1880, p.106.

In the United States, I was most hospitably entertained by American conchologists. At Washington, in the National Museum, Dr. P. Bartsch kindly assisted me to trace the unfigured Australian, or reputed Australian, species described by Dr. A. A. Gould.

The following are detailed notes, mostly from South Kensington :—

NUCULA CONSOBRINA A. Adams & Angas.

(Plate xvi., figs.1, 2, 3.)

Nucula consobrina A. Adams & Angas, Proc. Zool. Soc., 1863, p.427.; *Id.*, Angas, Proc. Zool. Soc., 1867, p.932.

An illustration is here presented of this hitherto unfigured species, reported by its junior author from the Parramatta River and Port Stephens. It is drawn from the type in the British Museum, presented by G. F. Angas, which is 8·5 long, and 7 mm. high.

NUCULA SIMPLEX A. Adams.

(Plate xvi., figs. 4, 5, 6.)

Nucula simplex A. Adams, Proc. Zool. Soc., 1856, p.52; *Id.*, Sowerby, Conch. Icon., xviii., 1870, Pl. iii., f.21; *Id.*, Hanley, Thes. Conch , iii., 1860, p.158, Pl.229, f.137; *Id.*, Angas, Proc. Zool. Soc., 1877, p.193.

Nucula strangei A. Adams, in Hanley, Thes. Conch., iii., 1860, p.158, Pl.229, f.125; *Id.*, Angas, Proc. Zool. Soc., 1867, p.932; *Id.*, Smith, Ann. Mag. Nat. Hist., (6) xvi., 1895, p.16.

Nucula antipodum Hanley, Thes. Conch., iii., 1860, p.159, Pl. 230, f.155.

This species was described as found by F. Strange at Sydney The figures of it are not good, so I present a drawing of a specimen from the Cuming Collection, labelled *N. simplex*, and probably a type, though not distinguished as such, in length 9·5, in height 7 mm.

After careful examination of the series at South Kensington, I am satisfied that neither *Nucula strangei* nor *N. antipodum* can be separated from *N. simplex*. On the tablet of *antipodum* is written "common in mud at 3 fms., Port Stephens."

NUCULA CUMINGII Hinds.

(Plate xvi., figs.7, 8, 9.)

Nucula cumingii Hinds, Proc. Zool. Soc, 1843, p.97; *Id.*, Hanley, Thes. Conch., iii., 1860, p.157, Pl.229, fig.117.

N. loringi Ad & Angas, Proc. Zool. Soc., 1863, p.427.

It recently occurred to me* that perhaps the unfigured *Nucula loringi* might be an earlier name for *N. superba*. At the British Museum, I found not only that it was quite distinct, but that *N. loringi* had been determined by Mr. Smith to be a synonym of *N. cumingii* Hinds. Under this prior name, the species has not yet been reported from Australia. The type of *N. loringi*, from Keppel Bay, is here figured. It is in length 18, height 12, and diameter of single valve 4 mm

ARCA PISTACHIA Lamarck.

Arca pistachia Lamarck, Anim. s. vert, vi., 1819, p.41; *Id.*, Smith, Journ. of Malacol., xii., 1905, p.27; *Id.*, op. cit., liii., 1906, p.303; *Id.*, Lamy, Journ. de Conch., lii., 1904, p.134.

In these Proceedings (xxix, p.202), I suggested that the description of *A. pistachia* agreed with the subsequent *A. radula* Smith, from the same locality; and hence that the latter should be suppressed as a synonym. Mr. Smith dissented from this conclusion. Dr. Lamy has failed to find an example of *A. pistachia* in the Lamarckian Collection of the Paris Museum. I searched, in vain, for a representative of *A. pistachia* in the Lamarckian Collection of the Geneva Museum. Though my interpretation of *A. pistachia* still seems to me a reasonable one, yet, on the grounds that the species has never yet been figured, and that the type has disappeared, I recommend that *Arca pistachia* be written off as a lost species.

GLYCYMERIS FRINGILLA Angas

Axinæa fringilla Angas, Proc. Zool. Soc., 1872, p.612, Pl.40, f.10; *Id.*, Lamy, Journ. de Conch., lix., 1912, p.111, footnote.

In the British Museum, I discovered, what I presume is the type of this species, concealed under the label of "*emberiza*

* Hedley, Rec. Austr. Mus., viii., 1912, p.131.

Angas, type, Port Curtis, G. F. Angas, Esq., Pres." The author apparently exchanged one bird-name for another, when the paper was in course of publication.

GLYCYMERIS HOYLEI Melvill & Standen.

Pectunclus hoylei Melv. and Stand., Journ. Linn. Soc. Zool. xxvii., 1899, p. 187, pl. xi., p. 24.

I have suggested in These Proceedings (xxxi., p. 470) that *G. hoylei* was a synonym of *G. cardiiformis* Angas. Comparing the type of Angas, in the British Museum, with my shell from Mast Head Island, I find them specifically different. *G. cardiiformis* has a finer concentric sculpture, is more inflated, and has a more prominent umbo than my Queensland shell. Dr. E. Lamy considers that *G. cardiiformis* is the Californian *G. multicostatus* Sowerby.*

MODIOLA PULEX Lamarck.

Modiola pulex Lamarck, Anim. s. vert. vi., 1819, p. 112.

Mytilus crassus Tenison-Woods, Papers and Proc. Roy Soc. Tasm., 1876 (1877), p. 157.

In the Lamarckian collection of the Geneva Museum, I noted the types of this species, being four shells labelled in Lamarck's writing: "Modiola pulex nouv. hollande." Small initials were used by Lamarck for place names. Subsequently M. Bedot kindly sent me photographs and comparative notes. By their help, I can identify Lamarck's species with *M. crassus* Ten.-Woods. This latter is generally, but I suggest improperly, united to *M. confusa* Angas. The two have different stations, *M. confusa* occurring in sheltered swamps, but *M. pulex* on exposed beaches. They also have a different contour. *M. confusa* is narrower in proportion to its length, is broader at the umbonal end, is more inflated, and has a longer hinge-line. Again *M. pulex* is bare, and *M. confusa* is meshed in a byssus-web. In New Zealand, there is a corresponding pair of species, *M. ater* Dunker and Zelebor, and *M. fluviatilis* Hutton.

POROMYA ILLEVIS, *nom.mut.*

Ectorisma granulata Tate, Trans. Roy. Soc. S. Aust. xv., 1892, p. 127, pl. i., fig. 3, 3a.

---

* Lamy, Journ. de Conch. lix. 1912, p.95.

It has already been observed that Tate's species is to be transferred to *Poromya*, in which genus the specific name is preoccupied by Nyst.* As the species appears distinct from any I found in the British or other Museums, it now becomes necessary to impose on it a new name.

THRACIA CULTRATA Gould.

Thracia cultrata Gould, Proc. Boston Soc. Nat. Hist. viii.. 1861, p. 14.

This unfigured shell is said to have been taken by W. Stimpson, in 8-15 fathoms, in Port Jackson. I searched in vain for an example of this species in various museums. It is likely that all the specimens gathered were lost in 1871, when Dr. Stimpson's collection, numbering about 8,000 specimens of marine shells, was destroyed in the great fire of Chicago. It is recommended that the name be abandoned as unrecognisable.

CŒLODON AVERSUS, n.sp.

Cœlodon elongatus Hedley (*non* Carpenter), These Proceedings, xxxi., 1906, p. 473, Pl. xxxvii., fig. 16.

From Mast Head Island, I described and figured a shell, which I supposed to be *Cœlodon elongatus* Carpenter, under the impression that no illustration of that species had appeared. This identification was doubted by Dr. H. Lynge,† who also pointed out that Carpenter's shell had been figured by Sowerby as *Pandora elongata.*‡

I can only agree with my critic, that the shell from Mast Head is quite unlike *C. elongatus*. The name of *C. aversus* is accordingly now proposed for it.

MYRTÆA VENUSTA Philippi.

(Plate xvi., fig. 10.)

Lucina venusta Philippi, Abbild. Beschr. ii., March, 1847, p. 206, pl. 1, f. 2.

---

* Hedley, Rec. Aust. Mus. vi. 1907, p.302.

† Lynge, D. Kgl. Danske Vidensk. Selsk. Skrifter, 7, l. v., 1909, p.287.

‡ Sowerby, Conch. Icon. xix. 1874, Pandora, Pl. i., f.4.

Lucina strangei A. Adams, Proc. Zool. Soc., 1855 (March, 1856), p. 226.

The accompanying figure is drawn from Adams' type of *Lucina strangei* in the Cuming Collection, gathered by F. Strange, in Moreton Bay. It is a single specimen, with both valves, length 14, height 23, depth of single valve 7·5 mm. Beneath the tablet is a note by Mr. E. A. Smith, declaring it a synonym of *L. venusta* Phil.

Lucina (Codakia) munda A. Adams.

Lucina munda A. Adams, Proc. Zool. Soc., 1855 (1856), p. 225.

I failed to find, in the British Museum, the type or other example of this unfigured species, said to have been taken in Moreton Bay, by F. Strange. It is recommended that the name be rejected as unrecognisable.

Diplodonta globulosa A. Adams.

Diplodonta globulosa A. Adams, Proc. Zool. Soc., 1855, p. 226.

In the Natural History Museum, I failed also to find a specimen of this unfigured species. It is recommended that this name be written off as unrecognisable.

Joannisiella moretonensis Deshayes.

(Plate xvi., figs. 11, 12, 13, 14, 15.)

Cyrenella moretonensis Deshayes, Proc. Zool. Soc., 1854 (1855), p. 341.

An illustration is here presented of the type, in the Natural History Museum, of *C. moretonensis* from Moreton Bay. In length, it is 33·5; in height, 30; and in depth of single valve, 11 mm. In London, it is labelled *Diplodonta*, but *Joannisiella* is here suggested as more appropriate. *J. moretonensis* is also represented by specimens sent from Sarawak, Borneo, by Mr. E. Bartlett.

Lepton cumingii A. Adams.

Pythina cumingii A. Adams, Proc. Zool. Soc., 1856, p. 47; *Id.* Smith, Ann. Mag. Nat. Hist., 1891, p. 233.

Rochefortia excellens Hedley, Rec. Aust. Mus., viii., 1912, p. 134, Pl. xl., f. 5-8.

In the British Museum, the species I lately described as *R. excellens,* from Queensland, is displayed as *Lepton cumingii.*

CYAMIOMACTRA BALAUSTINA Gould.

Kellia balaustina Gould, Proc. Bost. Soc. Nat. Hist. viii., 1861, p. 33.

Cyamiomactra nitida Hedley, These Proceedings, xxxiii., 1908, p. 477, Pl. ix., figs. 19, 20.

This species was collected by W. Stimpson, in Sydney Harbour. I was pleased to find the type, a single valve (Reg. No. 305) in the U.S. National Museum, in July, 1912. I recognised, in it, my *Cyamiomactra nitida.* Not to rely on memory, I later sent examples of my species to Washington. Dr. Bartsch replies, 21/5/13, "*Cyamiomactra nitida* Hedley is *Lasœa balaustina* Gld., absolutely."

SOLECARDIA STRANGEI Deshayes.

(Plate xvi., figs. 16, 17, 18, 19.)

Scintilla strangei Deshayes, Proc. Zool. Soc., 1855, (1856), p. 181; *Id.,* Sowerby, Conch. Icon., xix., 1874, Pl. ii., fig. 13.

As the previous illustration of this species is unsatisfactory, I now present a drawing of the type-shell in the British Museum, which is 16.5 long, and 19 mm. high.

CARDIUM PRODUCTUM Deshayes.

(Plate xvi., figs. 20, 21, 22.)

Cardium productum Deshayes, Proc. Zool. Soc., 1854, (1855), p. 333.

This unfigured species was reported from Torres Straits. Subsequent writers have not dealt with it. The accompanying figure is taken from a Cumingian specimen, probably the type, 15 mm. long; 23 mm. high, and 20 mm. across the conjoined valves. I suggest that *C. productum* is a synonym of *Cardium dionœum* Sowerby.

DOSINIA TUMIDA Gray.

Artemis tumida Gray, Analyst, viii., 1838, p. 309.

Even with the large series of the British Museum at my disposal, I found difficulty in arriving at the proper titles of Australian

Dosinia. The species resembles one another so closely, that discrimination is unusually difficult. A considerable proportion remain unfigured. The genus has never been properly revised, and its nomenclature has suffered ill-usage from the associates of Cuming.

Deshayes reduces* *Artemis lamellata* Reeve, 1850, to a synonym of *Dosinia tumida* Gray, 1838. But from Deshayes' type, I consider that *D. nobilis* Deshayes, 1853, is also a synonym of *D. tumida.* Again, *Artemis incisa* Reeve, 1850, seems to me inseparable.

Dosinia cærulea Reeve.

Artemis cærulea Reeve, Conch. Icon., vi., 1850, Pl. iv., fig.25.

In the original account of this species, the locality is given as "Raines Island, Torres Straits." I am convinced that this locality is wrong, and that Tasmania is the proper habitat of this species. The survey ships then, as now, retired from Torres Straits to Tasmania during the hurricane season. From the cruise of the "Rattlesnake," a parcel of Tasmanian shells, *Fissurella scutella, F. lineata, Cominella maurus, Ziziphinus nebulosus,* etc., were misreported from Torres Straits *D. cærulea* has not been found in Queensland, but the types agree with examples from Tasmania.

By comparison of types, I consider *Dosinia diana* A. Adams and Angas,† from Hardwick Bay, Spencer's Gulf, S.A., a synonym of *D. cærulea,* not as Tate and May place it, with *D. sculpta* Hanley

Again, the type of another unfigured species, *D. cydippe* A. Adams, 1856, sent by Mr. Gunn from Van Diemen's Land, appears to me a young specimen of *D. cærulea* Reeve, not as Tate and May, Pritchard and Gatliff class it under *D. circinaria.*

Dosinia tenella Römer.

(Plate xvi., figs. 23, 24.)

Dosinia tenella Römer. Proc. Zool. Soc., 1860, p. 118.

As this has never been figured, I now offer an illustration from the British Museum specimen, presumably the type, which is 20

* Deshayes, Cat. Conch. Brit. Mus. 1853, p.15.

† Adams & Angas, Proc. Zool. Soc. 1863, p.424.

mm. high, 21·5 mm. long, and 5 mm. depth of single valve. It is labelled "tenella, Römer, Australia, M.C."

Dosinia subrosea Gray.

Artemis subrosea Gray, Analyst, viii., 1838, p. 309; *Id.*, Reeve, Conch. Icon., vi., 1850, Pl. iv., fig. 9.

Dosinia coryne A. Adams, 1856, another unfigured species, has been reduced by Tate and May to a synonym of *D. sculpta* Hanley, 1845. But careful study of the type of *D. coryne* in the British Museum, led me to regard it as a young specimen of *D. subrosea* Gray. This New Zealand species is not included in Tasmanian catalogues, but it was independently reported by Legrand* from Tasmania.

Again, I saw, at South Kensington, two specimens, evidently the types, but not so marked, of "*Dosinia crocea* Deshayes, Flinders Island, Joseph Milligan, Esq." Except that *O. crocea* is yellow on the lunule and escutcheon, and *D. coryne* is there uncoloured, the two shells are alike. *D. grata* Deshayes, as Tate mentioned,† has much coarser sculpture than *D. crocea*.

Macrocallista planatella Lamarck.

Cytherea planatella Lamarck, Anim. s. vert. v., 1818, p. 565.

To this name is attached a long history of error. It is curious that none of the European authors, who have dealt with the species, should have consulted the type.

In the Lamarckian collection of Geneva are still preserved three specimens, types, with the author's label. On seeing these, it was at once clear to me that *M. planatella* is not *Cytherea diemenensis* Hanley, as has been frequently stated, following the suggestion of Mr. E. A. Smith.‡

The real *planatella* is not even a Tasmanian shell, as Lamarck's habitat, "Terre de Van Diemen," indicates. But the collectors of Baudin's Expedition misreported, besides this, a number of tropical West Australian species (probably from Shark Bay) as Tas-

* Von Martens, in Hutton, Manual N. Z. Mollusca, 1880, p.202.

† Tate, Trans. Roy. Soc. S.A. xxxi. 1897, p.47.

‡ Smith, Chall. Exped. Zool. xiii. 1885, p.136.

manian. These are *Cantharidus baudini, Clanculus ringens, Conus pontificalis, Chloritis prunum, Arca semitorta, Arca trapezina, Crenatula modiolaris,* and *Metis umbonella.*

A general idea of the size and shape of the type of *C. planatella* is conveyed by Römer's figure of it—Monogr. Venus, 1869, Pl. xix., fig. 2—but this is quite misleading as to sculpture. *C. planatella* has broad, spaced, corrugated, concentric sculpture, exactly that of *C. costata* Römer, op. cit., Pl. xviii., fig. 3, a, b, c. Indeed so well does it agree, that, when in the Swiss Museum, I confronted Lamarck's own shell with this illustration, I was satified that Römer here represented the adult form of Lamarck's species. On revising my notes in Australia, it appeared to me that the *costata* of Römer differed from the *costata* of Chemnitz, which it was supposed to represent. And as Dillwyn says, the "*V. costata* of Gmelin is an extremely obscure species," Lamarck's name may yet find an opportunity for legitimate service.

Venerupis planicosta Deshayes.

(Plate xvi., figs. 25, 26.)

Venerupis planicosta Deshayes, Proc. Zool. Soc., 1853 (1854), p. 4; *Id.,* Sowerby, Conch. Icon., xix., 1874, Pl. iv., fig. 29.

This figure is taken from a specimen in the Cuming Collection marked type, and labelled "planicosta, Desh., P.Z.S., 1853, p. 4. Hab. Swan River." Length, 18; height, 13; depth of single valve, 4 mm.

Venerupis subdecussata Deshayes.

(Plate xvi., figs. 27, 28.)

Venerupis subdecussata Deshayes, Cat. Conchif. Brit. Mus.,1853, p.196; *Id.,* Sowerby, Conch. Icon. xix., 1874, Pl. iv., f.26.

This species is represented in the British Museum by two specimens, probably types, but not so marked. These are labelled "Venerupis subdecussata, Deshayes. Van Diemen's Land, R. Gunn, Esq." One of these, here figured, is in length, 23; height, 15; and depth of single valve, 6 mm.

Tellina ticaonica Deshayes.

This name was entered in Australian lists by Angas, who stated* that it was "Dredged at Lane Cove," Sydney Harbour. In the British Museum are the specimens presented by Angas, on which this record was based. I find that these are not *T. ticaonica* Deshayes, but that they are *T. brazieri* Sowerby. The real *T. ticaonica,* by comparison of types, is larger, the dorsal and ventral margins more nearly parallel, and the shorter side more produced. *Tellina ticaonica* is unknown from Australia, and, therefore, to be expunged from our list.

Tellina recurva Deshayes.

Tellina recurva Deshayes, Proc. Zool. Soc., 1854 (1855), p. 361.

After special search, I failed to find this unfigured Australian species in the British Museum. It is recommended that the name be treated as lost and unrecognisable.

Tellina quoyi Deshayes.

Tellina quoyi Deshayes, Proc. Zool. Soc., 1856, p. 130; *Id.,* Sowerby, Conch. Icon., xvii., 1868, Pl. liii., fig. 314.

In literature, the locality given is merely "N. Australia." But two specimens in the British Museum, probably types though not so marked, are labelled "quoyi, Desh., Cape York, Jukes." Another tablet carries a note that *quoyi* is a synonym of *T. lata* Quoy and Gaimard (not *T. lata* Gmelin), and that both should be subordinated to *T. chloroleuca* Lamarck. Under the latter name are examples gathered by Jukes at Darnley Island. Mr. Sowerby told me that his father had accidentally transposed, in the Thesaurus, the figures of *T. chloroleuca* and of *T. sowerbyi* Hanley.

Strigella sincera Hanley.

Tellina sincera Hanley, Proc. Zool. Soc., 1844, p. 68; *Id.,* Thes. Conch., i., 1846, p. 261, Pl. 60, fig. 144.

Strigilla grossiana Hedley, These Proceedings, xxxiii., 1908, p. 474, Pl. ix., fig. 21.

---

* Angas, Proc. Zool. Soc. 1867, p.919.

In the British Museum, I found two unnamed *Strigilla* labelled "Moreton Bay, Mr. Strange." I had no specimen of the species for actual comparison, but, by recollection and by the published drawing, I recognised the Moreton Bay shells as my *S. grossiana*. With the shells of Strange, Mr. E. A. Smith and I agreed to identify the type of Hanley's *Strigilla sincera,* described from an unknown locality

Prof. C. B. Adams* reported that he personally procured *S. sincera* at Panama. Afterwards Carpenter† noted that while he considered *S. sincera* identical with *S. disjuncta,* H. Cuming regarded these two as "quite distinct." This contradiction agrees with the hypothesis that the Panama record by Adams and Carpenter was based on *disjuncta,* not on *sincera.* In various collections in the United States, I saw specimens, from Central America, of *S. disjuncta,* but none of *S. sincera.*

Confusion of names or localities has occurred in the literature of *S. sincera,* for it is incredible that it exists both at Panama and Moreton Bay. It seems to me probable that the American records are erroneous.

Semele ada Adams and Angas.

(Plate xvii., figs. 29, 30, 31, 32, 33.)

Semele ada A. Adams and Angas, Proc. Zool. Soc., 1863, p. 426; *Id.,* Tate, Trans. Roy. Soc. S.A., ix., 1887, p. 85, Pl. v., fig. 8.

I have derived a figure from a specimen in the British Museum, marked type, which is 12 mm. long, and 10 mm. high.

Semele duplicata Sowerby.

Semele duplicata Sowerby, Spec. Conchyl., 1830, fig. 14, 15; *Id.,* Melvill and Standen, Journ. Linn. Soc. Zool., xxvii., 1899, p. 201.

Amphidesma zebuense Hanley, Proc. Zool. Soc., 1844, p. 17.

In the British Museum, "Antigua," the original locality, is crossed out, and "Torres Straits," perhaps on the record by Melvill and Standen, is substituted. The name of this species does not

* Adams, Ann. Lyceum Nat. Hist. New York, v., 1852, p.285.
† Carpenter, Rept. Brit. Assoc. 1863, p.554.

seem to have appeared in American literature. *Amphidesma zebuense* Hanley, seems to be to me indistinguishable from *S. duplicata.*

SEMELE EXARATA Adams & Reeve.

(Plate xvii., figs. 34, 35, 36, 37.)

Amphidesma exarata Adams and Reeve, Voy. Samarang, Moll., 1850, p. 81, Pl. 24, fig. 9.

Figures are here presented of a specimen in the British Museum, dredged in 7 fathoms, fine sand, near Singapore, by H. Cuming. It is 28 mm. long, 22·5 high, and 6 mm. in depth of single valve.

PSAMMOBIA SQUAMOSA Lamarck.

Psammobia squamosa Lamarck, Anim. s. vert., v., 1818, p. 514; *P. rugulosa* Adams and Reeve, Voy. Samarang, Moll., 1850, p. 81, Pl. 24, fig. 4; *P. palmula* Deshayes, Proc. Zool. Soc., 1854 (1855), p. 325.

Study of the series in the British Museum induces me to regard *P. rugulosa* as a synonym of *P. squamosa*, and with these to unite *P. palmula*, the latter only differing from the rest by being white and smaller. One specimen, apparently the type of *P. palmula*, is marked "Sydney." But this is an error, for the species does not ascend to so high a latitude.

DONAX STRIATELLUS Deshayes.

(Plate xvii., figs. 38, 39.)

Donax striatellus Deshayes, Proc. Zool. Soc., 1854,(1855), p. 352

This unfigured species was reported from "Australia." No further information about it has been contributed by subsequent writers. The present illustration is taken from a specimen, which is apparently the type of Deshayes, but not so marked, in the British Museum, which measures, height, 17; length, 30; and depth of conjoined valves, 10·5 mm.

DONAX VERUINUS, *nom.mut.*

Donax nitida Reeve, Conch. Icon., viii., 1854, Pl. vi., fig. 34; *Id.*, Deshayes, Proc. Zool. Soc., 1854,(1855), p. 350; *Id.*, Smith, Chall. Rep. Zool., xiii., 1885, p. 112; *Id.*, Melvill and Standen, Proc. Zool.

Soc., 1906, p. 826. *Not Donax nitidus* Lamarck, Ann. du Mus. vii., 1806, p. 231 and xii., 1811, Pl. 41, fig. 6.

The name proposed by Reeve and Deshayes for a recent Australian Donax was already given by Lamarck to a Parisian fossil. A new epithet, *D. veruinus,* is therefore here proposed. The range of the species has been recently extended to the Persian Gulf by Melvill and Standen.

Solen vagina Linné.

Solen vagina Linné, Syst. Nat. x., 1758, p. 672; *Id.,* Hanley. Ips. Linn. Conch., 1855, p. 29.

Solen truncatus Mawe, Linn. Syst. Conchol., 1823, p. 19, Pl. v., fig. 2.

Solen brevis Gray, MSS., in Hanley, Recent Shells, 1842, p. 12, Pl. xiii., fig. 42.

Solen fonesii Dunker, Proc. Zool. Soc., 1861, p.419; *Id.,* Bloomer, Proc. Malac. Soc., vii., 1906, p. 18.

Solen jonesii Conrad, Am. Journ. Conch., iii., 1867, suppl. p. 28; *Id.*, Sowerby, Conch. Icon., xix., 1874, Pl. iii., fig. 11.

On the tablet of the type of *S. fonesii* in the British Museum, is a note, "Compare with *brevis* Gray." On making the comparison, the two appeared, to me, to be the same. Hanley has already shown that the Linnean species is identical with *S. brevis.* This seems to be the common North Queensland species.

Solen aspersus Dunker.

Solen aspersus Dunker, Proc. Zool. Soc., 1861, p. 420; *Id.,* Sowerby, Conch. Icon. xix., 1874, Pl. vii., fig. 33.

A specimen evidently type, but not so marked, in the British Museum, is labelled "*aspersus* Dkr., Sydney, Australia, M.C., P.Z.S., 1861, p. 420." This is identical with *S. vaginoides* Lamk., but the locality is erroneous.

Cryptomya elliptica A. Adams.

(Plate xvii., figs. 40, 41, 42, 43, 44.)

Sphaenia elliptica A. Adams, Proc. Zool. Soc., 1850, (1851), p. 88; *Id.,* Ann. Mag. Nat. Hist. (2) vii., 1851, p. 421; *Id.,* Smith, op. cit. (6) xii., 1893, p. 278.

Cryptomya elliptica A. Adams, Ann. Mag. Nat. Hist. (4) ii., 1868, p. 366; *Id.*, Tryon, Am. Journ. Conch iv., suppl., 1868, p. 68; *Id.*, Angas, Proc. Zool. Soc., 1871, p. 99; *Id.*, Dunker, Moll. Jap., 1882, p. 178, Pl. vii., figs. 17-19; *Id.*, Lynge, D. Kgl. Danske Vidensk. Selsk. Skrifter, 7, v., 1909, p. 273.

Mya elliptica Sowerby, Conch. Icon., xx., 1875, Pl. i., fig. 2.

Cryptomya truncata Gould, Proc. Boston Soc. Nat. Hist. viii., 1861, p. 24; *Id.*, Gould, Otia Conch., 1862, p. 163.

This species was originally described from "Sydney, 4 fms., mud (F. Strange)." In the British Museum, I found three specimens, evidently the types, but not so marked. As the existing illustrations are either obscure or not easily accessible to local students, a drawing is supplied of one of these types, which measured 15 mm. in length, and 10 in height.

EMARGINULA BAJULA, sp.nov.

Emarginula dilecta Hedley (not A. Adams), These Proceedings, xxx., 1906, p. 521, Pl. xxxiii., figs. 37, 38.

In the British Museum, I saw a tablet of four specimens marked on the under surface "*E. dilecta* A. Ad., Thesaurus, iii., p. 211, Pl. 245, fig. 5., King George's Sound, M.C." Though not so marked, these appear to be the types of the species. There is another series once marked "dilecta, A. Ad. M.C.," but now corrected to "not dilecta, A.Ad." This latter is the species I figured as *dilecta.* Finding now that it is distinct and unnamed, I propose to call it *E. bajula*, having for type the Maroubra specimen figured. Both have the fasciole a furrow. But *E. dilecta* is elevated more regularly oval, with a subcentral apex, and fine interstitial riblets. *E. bajula* —a porter bent under a load—is much depressed, broader behind and tapering anteriorly, without interstitial riblets.

FISSURIDEA CORBICULA Sowerby.

Fissurella corbicula Sowerby, Thes. Conch., iii., 1862, p. 200, Pl. 242, fig. 180. *Fissurella lanceolata* Sowerby, Thes. Conch., iii., 1862, p. 200, Pl. 242, fig. 182.

In the British Museum, I found a tablet with four specimens, probably types, labelled "corbicula, Sow, Australia," on the under surface "Compare lanceolata, M.C." Again, four specimens, probably types, but not so marked, labelled "lanceolata, Sowb., Moreton Bay," and beneath "Compare corbicula, M.C." On contrasting the specimens, I think that both names relate to one species.

Fissuridea jukesii Reeve.

Fissurella jukesii Reeve, Conch. Icon., vi., 1849, Pl. vii., fig. 45. *F. similis* Sowerby, Thes. Conch., iii., 1862, p. 194, Pl. 241, fig. 143.

In the British Museum are two specimens, perhaps types but not so marked, labelled "similis, Sowb., Fiss., Australia." These I consider identical with *F. jukesii* Reeve.

Haliotis funebris Reeve.

Haliotis funebris Reeve, Conch. Icon., iii., 1846, Pl. xii., fig. 38. *H. diversicolor* Reeve, op. cit., Pl. xii., fig. 39. *H. tayloriana* Reeve, op. cit., Pl. xiii., fig. 43.

From an examination of Reeve's originals in the British Museum, I am unable to distinguish the above three as valid species. Page-precedence of the aggregate was given by our negligent author to *H. funebris,* and this, the most frequently used name, is accordingly advanced for employment. The preliminary descriptions, to which reference is made in the Iconica, were not published by the Zoological Society until two months after the other account had appeared.

A tablet of *H. funebris* in South Kensington is marked "Swan River, Dr. Bacon." Other specimens referred to *funebris* were collected by Prof. J. B. Jukes, at Oomaga, or Stephen's Island, and Bramble Cay in Torres Strait. Schepman has reported *H. funebris* from Malaysia, but it does not occur in Port Jackson, as he supposes.*

Clanculus jucundùs Gould.

(Plate xvii., fig. 45.)

Clanculus jucundus Gould, Proc. Boston Soc. Nat. Hist., viii., 1861, p. 14.

The locality ascribed by its author to this hitherto unfigured species is "Sydney, N.S.W.," but no one has since found it in Aus-

* Schepman, Rhipidoglossa Siboga Exped., 1908, p.76.

tralia. Specimens are not extant in either the Washington or Albany Museums, but, in London, I had the good fortune to find a single faded specimen labelled "Sydney," which Mr. E. A. Smith regarded as authentic, perhaps sent by Gould to Cuming, and which is here illustrated. At South Kensington there is also a series of *C. jucundus* from Nui or Savage Island; these are brightly coloured, and differ slightly from the cotype by fewer spirals. I conclude that *C. jucundus* is not a member of the Australian fauna.

Clanculus conspersus A. Adams.

(Plate xvii., fig. 46.)

Clanculus conspersus A. Adams, Proc. Zool. Soc., 1851, (1853), p. 163; *Id.,* Angas, Proc. Zool. Soc., 1865, p. 178; *Id.,* Tenison-Woods, Proc. Roy. Soc. Tasm., 1877, p. 40; 1879, p. 69; *Id.,* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p. 119.

There are, in the British Museum, two specimens, perhaps types but not so marked, labelled "conspersus, A. Adams, M.C." There is no other information. As the species has not been illustrated, and has been ascribed to South Australia and Tasmania, a figure is presented of one of these London shells.

Alcyna exigua Gould.

Elenchus exiguus Gould, Proc. Bost. Soc. Nat. Hist., viii., 1861, p. 18.

In the U. S. National Museum at Washington (July, 1912), I saw the type of *Elenchus exiguus,* reported by its author from Sydney. It is an *Alcyna,* and has, apparently, not been figured under that or any other name. In the original register of the Smithsonian Institute, it is recorded as C. 378 from "China Seas." It can, therefore, be struck off the Australian list as an exotic.

Thalotia tricingulata A. Adams.

Thalotia tricingulata A. Adams, Proc. Zool. Soc., 1851 (1853), p. 173; Id., Pilsbry, Man. Conch., xi., 1889, p. 153.

This species has been traditionally reported from Queensland. No authentic specimen, figure, or satisfactory description exists.

It is, therefore, recommended that *T. tricingulata* be written off as unrecognisable.

Ziziphinus fragum Philippi.

The original of Reeve's Conch. Icon. Ziziphinus, fig. 49, intended for *Z. fragum* Philippi, is marked in the British Museum as not that species. This specimen is perhaps an unnamed Australian *Calliostoma*, and resembles *C. scobinatus* Adams, from Bombay.

Ziziphinus monile Reeve.

Ziziphinus monile Reeve, Conch. Icon., xiv., 1863, Pl. vi., sp.39.

In the British Museum is one specimen probably the type, but not so marked, labelled, "monile, Reeve, Port Curtis," and underneath the tablet "Compare with millegranus." On making the comparison suggested, and allowing that the superficial sculpture has been obliterated with acid, I find that Reeve's shell answers in size, shape, colour, and sculpture to *Trochus millegranus* Philippi, from Sweden. What I had identified from Mast Head Island as *C.* monile* proves to be *C. polychroma* A. Adams. The conclusion is that *Z. monile* Reeve should be rejected from the Australian record.

Ziziphinus bicingulatus Lamarck.

Ziziphinus bicingulatus Lamk., A. Adams, Proc. Zool. Soc., 1851 (1853), p. 166.

In the above reference Adams reports the species from "Rains (sic!) Island, Ince." The species is South African according to the British Museum collection, and the Queensland locality necessarily false.

Calliostoma comptum A. Adams.

Ziziphinus comptus A. Adams, Proc. Zool. Soc., 1854 (1855), p. 38.

Calliostoma purpureocinctum Hedley, these Proceedings, xix., 1894, p. 35, text-fig.

Trochus (*Calliostoma*) *Adamsi* Brazier, op. cit., 1895, p. 568; not *Calliostoma adamsi,* Pilsbry, 1889.

* Hedley, These Proceedings, xxxii., 1907, p.479.

This species was reviewed and renamed by Mr. J. Brazier. His conclusions are involved. For *Z. comptus* A. Adams he proposed a new name, for the reason that it was preoccupied by Philippi. This new name was already used in the genus by Pilsbry. In a footnote Brazier reverses the decision of the text by adopting the view of Mr. E. A. Smith, that the specific name of Adams should be maintained, because that of Philippi was published one year later.

Six months previous to Mr. Brazier's paper, accepting the statement that *Z. comptus* was New Caledonian and was synonymous with *Z. poupineli* Montrouzier, I proposed to call the Sydney shell *Calliostoma purpureocinctum.*

On re-examining the question I find that in the first place the names proposed by Philippi and by Adams are spelled differently, and may both be maintained. The dates supplied to Brazier are wrong, and the precedence reversed. For Philippi's name appeared thus:—"*Trochus comtus* Philippi, Zeit. f. Malak., viii., 1851, p. 42" (July, 1851), and that of Adams thus:—"*Ziziphinus comptus* A. Adams, Proc. Zool. Soc., 1854, p. 38" (Jan. 10th, 1855).

From an inspection of the type in the British Museum of *Z. comptus,* I recognised it as the Sydney species. I have been unable to see *Trochus poupineli* Montrouzier, but I accept Brazier's statement that it is distinct from *C. comptus,* and that Adams erred in assigning *comptus* to New Caledonia. This error was repeated in the same volume when Adams described the Australian *Pisania reticulata* as from New Caledonia.

In conclusion, I consider that *Calliostoma comptum* A. Adams should be restored for the Australian shell I described and figured as *C. purpureocinctum,* and which Brazier renamed *Trochus adamsi.*

Calliostoma punctulosum A. Adams.

(Plate xvii., fig. 47.)

Cantharidus punctulosus A. Adams, Proc.,Zool.Soc. 1851 (1853), p. 169. *C. articularis* A. Adams, *loc. cit.*

In the British Museum are three *punctulosus,* perhaps types, but not so marked, obtained at the Swan River by Mr. Jukes. One of these is shown by the present figure. Other examples are from the Monte Bello Islands.

Apparently identical are specimens in the same collection labelled "*articularis* A. Ad., Swan River, G. B. Sowerby, Esq." Probably the earliest name for this shell is *Trochus lepidus* Philippi.*

Cantharidus cingulatus A. Adams.

(Plate xvii., fig. 48.)

Leiopyrga cingulata A. Adams, Proc. Zool. Soc., 1863, p. 507; *Id.,* Smith, Zool. Coll. Alert, 1884, p. 76; *Id.,* Tate, Trans. Roy. Soc. S.A., xiv., 1891, p. 260.

The present figure, the first of the species, is taken from a specimen in the British Museum. It is perhaps a type, but is not so marked.

Cantharidus pallidulus A. Adams.

(Plate xvii., fig. 49.)

Cantharidus pallidulus A. Adams, Proc. Zool. Soc., 1851 (1853), p. 170; *Id.,* Ann. Mag. Nat. Hist. (2), xii., 1853, p. 202.

An illustration of this hitherto unfigured species is based on the single specimen, perhaps type, but not so marked, in the British Museum.

Cantharidus fournieri Crosse.

Trochus fournieri Crosse, Journ. de Conch., xi., 1863, p. 180, Pl. vi., fig. 5; *Id.,* Smith, Proc. Malac. Soc. ii., 1897, p. 232.

The type specimens in the British Museum of *C. fournieri* Crosse exactly correspond to shells labelled "*Calliostoma oberwimmeri* Preston (cotype), N. Queensland." This unpublished name was injudiciously and unfortunately introduced into literature by Dr. J. Shirley.†

---

* Philippi, Conch. Cab. ii., 1846, p.84, Pl.15, f.4.

† Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p.96.

Turbo militaris Reeve.

Turbo militaris Reeve, Conch. Icon., iv., 1848, Pl. ix., fig. 40.

In the British Museum is a single specimen, apparently the type of *Turbo militaris,* but not so marked, which is labelled "I. of Anaa." Accompanying this is a series from Port Curtis, Queensland, and New South Wales, embracing a smooth and a thorny variety. Contrary to the suggestion of the name, the smooth is typical. The Paumotuan locality, unsupported by further evidence and incongruous with Australian records, appears to be an error.

This is the species which Angas, to the misleading of Australian conchologists, has recorded as *Turbo imperialis* from Watson's Bay and Moreton Bay.* But *Turbo imperialis* Gmelin does not exist in Australasia.

The *Turbo* from the coral reef of Lord Howe Island, determined by Mr. Brazier† as *T. imperialis,* is really as I ascertained by examination of the type in London, *Turbo cepoides* Smith.‡ The habitat of *T. cepoides* is here first announced. Brazier's misidentification was continued by Whitelegge, who called a new hermit crab *Calcinus imperialis,* because of its occupation of the empty *Turbo* shell.

There are in the British Museum three, apparently types, of *Turbo speciosus* Reeve. These confirmed me in the recognition (antea xxxii., p. 479) of this previously unlocalised species from Mast Head Island.

Leptothyra crassilirata Preston.

(Plate xvii., fig.50.)

Leptothyra crassilirata Preston, Proc. Malac. Soc. viii., 1909, p. 377, text-figure.

The published figure of this species is so vague that it might as well represent a finger print from a police record. It is curious that in London where good figures could be so easily obtained, con-

---

* Angas, Proc. Zool. Soc. 1871, p.96.

† Etheridge, Mem. Austr. Mus., ii., 1889, pp.24, 29.

‡ Smith, Ann. Mag. Nat. Hist.(5), vi., 1880, p.397; *Id.*, Sowerby, Thes. Conch. v., 1886, p. 193, Pl. 499, f.65.

tributors and editors should be content with some of the worst in the world. From the type in the British Museum I now offer another illustration of *L. crassilirata*. It is larger and has heavier spirals than *L. armillata* Sowerby* from the same region.

Turbo sirius Gould.

Turbo sirius Gould, Proc. Bost. Soc. Nat. Hist. iii., 1849, p. 83; *Id.,* Am. Expl. Exp. Moll., xii., 1852, p. 173, Pl. xii., fig. 203.

In the British Museum there is a single specimen labelled "sirius Gould, N. Holland, M.C." This I identified as a juvenile example of *Astralium tentoriforme* Jonas, which has priority.

Petterdiana paludinella Reeve.

Littorina paludinella Reeve, Conch. Icon. x., 1857, Pl. xvi., fig. 84.

Ampullaria tasmanica Tenison-Woods, Proc. Roy. Soc. Tasm., 1876, p. 117; 1878, p. 72.

Braziera tasmanica Petterd, *op. cit.,* 1888 (1889), p. 76, Pl. i., fig. 1.

I found in the British Museum a series of fourteen specimens labelled "paludinella Rve., V.D. Land." Though the actual specimen figured by Reeve is not among them, this series is approved as authentic by Mr. E. A. Smith. By comparison with specimens determined for me by Mr. W. F. Petterd, Reeve's species proves to be the Tasmanian fluviatile shell subsequently described by the Rev. J. E. Tenison-Woods, as *Ampullaria tasmanica.*

It follows that the record by Pritchard and Gatliff† of *L. paludinella* as a marine shell from several localities on the Victorian coast, is erroneous, being, I think, based on the young of *Melaraphe praetermissa* May. By Tate and May (antea xxvi., p. 388) it was unfortunately included in the synonymy of *M. mauritiana.*

Littoridina gunnii Frauenfeld.

(Plate xvii., fig. 51.)

Hydrobia gunnii Frauenfeld, Verhandl. Zool. Bot. Gesell. Wien. xiii., 1863, p. 1025; xv., 1865, p. 526, Pl. viii. (2 figs.).

---

* Sowerby, Thes. Conch. v., 1886, p.211, Pl. 500, f.93.

† Pritchard & Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p.92.

In the British Museum are a series of this and of the following species, which are probably the types or cotypes. There are in Australia few copies of the work in which it is described, and perhaps none in Tasmania. So I present drawings of the London specimens. These Tasmanian species have not been recognised locally, and have probably been redescribed. Perhaps *L. gunnii* is *Potamopyrgus woodsii* Petterd.

LITTORIDINA DIEMENSIS Frauenfeld.

(Plate xvii., fig. 52.)

Amnicola diemense Frauenfeld, Verhandl. Zool. Bot. Ges. Wien, xv., 1865, p. 529, Pl. x. (2 figs.) ; *Id.,* Petterd, Proc. Roy. Soc. Tas mania, 1888 (1889), p. 81.

This is also drawn from a specimen in the British Museum Petterd suggests that *Amnicola diemense* will prove to be *Beddomeia launcestonensis* Johnston.

IRAVADIA CLATHRATA A. Adams.

(Plate xvii., fig.53.)

Pyrgula clathrata A. Adams, Proc. Zool. Soc., 1853 (1855), p. 185.

In the original description this hitherto unfigured species is cited from "North-east Australia (Jukes)." But specimens in the British Museum, possibly types, but not so marked, are labelled "Baclayon, Philippines." Because of this casual and perhaps erroneous reference to Australia I present a figure of the British Museum example. And as *Pyrgula,* Christofori and Jan,* is usually included in the Hydrobiidæ I transfer the species to *Iravadia.*

OBTORTIO Hedley.

Finella A. Adams, Ann. Mag. Nat. Hist.,(3) vi., 1860, p. 336; err. type for *Fenella* A. Adams, Ann. Mag. Nat. Hist. (3) xiii., 1864, p. 39; *Id.,* Crosse, Journ. de Conch. xvi., 1868, p. 46. Not *Fenella* Westwood, Synopsis of Genera of British Insects, 1840, p. 54.

Obtortio Hedley, Mem. Austr. Mus. iii., 1899, p. 412.

* Stimpson, Smithsonian Miscell. Coll., 201, 1865, p.47.

The first form of Adams' name was "Finella"; this he afterwards corrected as a printer's error for "Fenella," a name taken from a character in one of Sir Walter Scott's novels. At first he considered it a Pyramellid, and later "found it to possess all the characters of a Rissoid." He gave no figures. Writers like Watson and Melvill, who had access to Adams' specimens, ignored *Fenella*, distributing the species dealt with in *Alaba* and *Rissoa*. So that it was hardly possible, from literature alone, for any one out of Europe to recognise it. Under these circumstances I proposed for a true *Fenella*, the genus *Obtortio*, placing it, as Adams had done, in the Pyramidellidæ. I now accept Adams' reference of the genus to the Rissoidæ. From an inspection of the collection at South Kensington, I am satisfied that *Obtortio* is an absolute synonym of *Fenella*. But on pursuing the subject further it appears that Fenella was already appropriated by an entomologist before Adams proposed it in conchology.

DIALA SUTURALIS A. Adams.

(Plate xviii., fig.54.)

Monoptygma suturalis A. Adams, Proc. Zool. Soc., 1851 (1853), p. 224; *Id.*, Thes. Conch. ii., 1854, p. 819, Pl. 172, figs. 31, 32. *Diala suturalis* A. Adams, Ann. Mag. Nat. Hist. (3) x., 1862, p. 298; *Id.*, Angas, Proc. Zool. Soc., 1865, p. 173.

In the British Museum this species is represented under the genus *Leucotina* by one marked type, and, again, by two under *Diala*. The habitat of both is given as the Philippines. Further evidence seems necessary before the species is credited both to that archipelago and to South Australia.

DIALA PICTA A. Adams.

(Plate xviii., fig.55.)

Diala picta A. Adams, Ann. Mag. Nat. Hist. (3) viii., 1861, p. 243; x., 1862, p. 295; *Id.*, Angas, Proc. Zool. Soc., 1878, p. 867; *Id.*, Tate and May, These Proceedings xxvi., 1901, p. 388; *Id.*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 61.

In the British Museum are five specimens, probably types, but not so marked, two being from the collection of Henry Adams.

These are labelled "*Diala picta* A. Ad., Annals, 1861, viii., p. 243. Annals, 1862, x., p. 295. Hab., Takano Sina, M.C." These Japanese shells are very like my *Diala translucida* in general appearance, in translucent substance, and in a band of opaque white spots on the body whorl. But *D. translucida* differs by being more globose, and by lacking the spiral rufous lines of *D. picta*. As the species has not yet been illustrated, one of these British Museum shells is here shown. It is doubtful if *D. picta* or *varia* are Australian.

Diala varia A. Adams.

(Plate xviii., fig.56.)

Diala varia A. Adams, Ann. Mag. Nat. Hist. (3), viii., 1861, p. 248; *Id.*, Angas, Proc. Zool. Soc., 1878, p. 867; *Id.*, Cooke, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 268; *Id.*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p. 89.

In the British Museum, this species is shown from China and Japan, but not from Australia. One, which appears to be a cotype, is here figured.

Diala pulchra A. Adams.

(Plate xviii., fig.57.)

Alaba pulchra A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 296; *Id.*, Angas, Proc. Zool. Soc., 1865, p. 173.

Diala pulchra Pritchard and Gatliff, Proc. Roy. Soc. Victoria, xiv., 1902, p. 89.

My figure represents one of two specimens in the British Museum, probably types, but not so marked, labelled, "pulchra A. Ad., P. Adelaide, M.C."

Diala lauta A. Adams.

(Plate xviii., fig.58.)

Diala lauta A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 298; *Id.*, Angas, Proc. Zool. Soc., 1865, p. 173; *Id.*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p. 88.

Litiopa lauta Tryon, Man. Conch., ix., 1887, p. 282, Pl. 53, fig. 83.

Alaba lauta Henn and Brazier, these Proceedings (2), ix., 1894, p. 172.

Figured from one of ten specimens in the British Museum, probably types, but not so marked, labelled "lauta A. Ad., Port Adelaide, M.C."

Diala monile A. Adams.

(Plate xviii., fig.59.)

Alaba monile A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 296.

Diala monile Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p. 87; *Id.*, Hedley, These Proceedings, xxx., 1906, p. **523**, Pl. 33, fig. 36.

Here is figured one of two specimens in the British Museum, probably types, but not so marked, and labelled, "*A. monile* A. Ad., Annals, 1862, x., p. 296, Hab., Port Lincoln, M.C."

Diala pagodula A. Adams.

(Plate xviii., fig.60.)

Alaba pagodula A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 297; *Id.*, Angas, Proc. Zool. Soc., 1865, p. 173; *Id.*, Tate, Trans. Phil. Soc. Adelaide, ii., 1879, p. 137.

A figure is supplied of one of two specimens in the British Museum, probably types, but not so marked, labelled "*A. pagodula* A. Ad., Ann. and Mag. N. Hist., 1862, x., p. 297. Hab., St. Vincent's Gulf, S. Australia, M.C."

Diala imbricata A. Adams.

(Plate xviii., fig.61.)

Alaba imbricata A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 397.

Diala imbricata Angas, Proc. Zool. Soc., 1878, p. 867; *Id.*, Tate, Trans. Phil. Soc., Adelaide, 1879, p. 137.

This illustration represents one of two specimens in the British Museum, apparently types, but not so marked, labelled "*Alaba imbricata* A. Ad., Annals, 1862, x., p. 397, Port Lincoln, M.C."

ALABA VIBEX A. Adams.

(Plate xviii., fig.62.).

Alaba vibex A. Adams, Ann. Mag. Nat. Hist. (3), x., 1862, p. 296; *Id.*, Smith, Proc. Zool. Soc., 1875, p. 538.

Litiopa vibex Tryon, Man. Conch., x. 1887, p. 282.

My figure is drawn from one of two in the British Museum, apparently types, but not so marked, labelled "*A. vibex* A. Ad., Annals, 1862, x., p. 296. Hab., Sharks Bay, West Australia. Pres. Mrs. de Burgh."

CALYPTRÆA CALYPTRÆFORMIS Lamarck.

Trochus calyptraeformis Lamk., Anim. s. vert., vii., pt.i., Aug., 1822, p. 12.

In the Museum at Geneva I saw the type, a single specimen marked in Lamarck's own writing "*Trochus calyptraeformis.*" This tablet has been re-labelled by a later hand, perhaps that of Chenu, "*Galerus lamarcki* Deshayes." In a recent review of this subgenus, *Sigapatella*, Dr. E. Lamy* also prefers the name of Deshayes.

It is important for Australian conchologists to decide which name for this common shell is correct. The subject is complicated, in the first instance, Lamarck described a French tertiary fossil as *Calyptræa trochiformis.*† Subsequently he proposed the name *Trochus calyptraeformis* for a recent shell, collected at Maria Island, Tasmania, by Péron, which resembled this fossil. Finally he revised the tertiary fossil under the name of *Trochus calyptraeformis.*‡

At this time the unfortunate savant had become totally blind, so that this last volume was completed from dictation by his devoted daughter Rosalie.§ This sad circumstance probably caused the name of the fossil to be exchanged from *Calyptraea trochiformis* to *Trochus calyptraeformis* by merely accidental inversion.

The simplest correction of the error seems to be to restore to each, the fossil and the recent, its earlier name. The second part of vol.

* Lamy, Bull. du Mus, d'hist. nat., 1911, p.318.

† Lamarck, Ann. du Mus. i., 1802, p.385.

‡ Lamarck, Anim. s. vert., vii., pt.2 (? date) suppl., p.558.

§ Landrieu, Mém. Soc. Zool. France, xxi., 1909, p.100.

vii., of the Hist. Anim. s. vert., has neither title-page nor date, but the citation in the index of Parts One and Two is evidence of separate publication, and hence of definite priority of name for the recent Tasmanian shell. In that case Deshayes was not entitled to alter the name.

He, however, took the view that as the name was twice used by Lamarck one should be changed, and he renamed the Tasmanian shell *Calyptraea lamarckii.** Shortly afterwards the same species from Western Port, 14 fathoms off Cape Dromedary and Jervis Bay was described as *Crepidula tomentosa* Quoy & Gaim.†

Tryon‡ considered that *C. comma-notata* Sowerby,§ was a synonym, but as that was described from the Guinea coast, the reference is improbable. But Gray transferred the name *comma-notata* to a shell from New Zealand.||

CALYPTRÆA TENUIS Gray.

Galerus pellucidus Angas, Proc. Zool. Soc., 1867, p. 211.

Clypeola tenuis Gray, Proc. Zool. Soc., 1867, p. 735.

Calyptraea pellucida Tate, Trans. Roy. Soc. S.A., xvii., 1893, p. 199; *Id.*, Tate and May, These Proceedings, xxvi., 1901, p. 376.

Calyptraea scutum Gatliff and Gabriel, Proc. Roy. Soc. Victoria, xxii., 1909, p. 38.

In the British Museum a series from St. Vincent's Gulf, presented by Dr. J. C. Verco are thus identified. From these and from Gray's types it appears that the species determined as *Galerus pellucidus* by Angas from Port Jackson, by Tate from St. Vincent and Spencer's Gulfs, and by Tate and May from Frederick Henry Bay, Tasmania, is properly *C. tenuis*. Hutton has stated¶ that *Sigapatella scutum* Lesson is synonymous with *C. tenuis*. Under Lesson's name the present species is reported from Victoria by Gatliff and Gabriel. The identity of Lesson's unfigured species is

* Deshayes, Encycl. Méth. vers., ii., 1832, p.170.

† Quoy & Gaim., Zool. Astrolabe, iii., 1835, p.419, Pl.72, f.1-5.

‡ Tryon, Man. Conch., viii., 1886, p.122.

§ Sowerby, Cat. Tankerville Coll. 1825, p.33 and append. vii.

|| Gray, Proc. Zool. Soc., 1867, p.736.

¶ Hutton, These Proceedings, ix., 1885, p.938.

obscure, but I observe that the shell known to New Zealand collectors as *C. scutum* differs by its hollow axis from *C. tenuis.*

Trochita pellucida Reeve is shown at South Kensington from the Philippine Islands. It is smaller than the S. Australian shell, with which it has been confused, and the interior process ends in a point.

CERITHIUM POLYGONUM Sowerby.

Cerithium polygonum Sowerby, Thes. Conch. ii., 1855, p. 854, Pl. 178, fig. 46.

C. opportunum Bayle, Journ. de Conch., xxviii., 1880, p. 248.

This species was described from Port Essington. Bayle altered the name to *Cerithium opportunum,* because Sowerby's name had been used already in 1844 by Leymerie. Here, as in other cases, Bayle's industry was superficial and abortive. The type of *C. opportunum,* in the British Museum, was familiar to me as the young of *Clava nodulosa* Bruguière. For the juvenile form of this I have already recorded other names(antea xxxiv., p. 439).

CERITHIUM NOVÆ-HIBERNIÆ A. Adams.

Cerithium novæ-hiberniæ A. Adams, Thes. Conch. ii., 1855, p. 357, Pl. 180, fig. 85.

In the British Museum is the type of this species from the Hanley Collection, the original of Sowerby's figure. The locality of this is given as Florida, and it is mentioned by Dr. W. H. Dall as a synonym of *C. eburneus* Say.* So it is unlikely that the record by Melvill and Standen of this species from Murray Island, Torres Strait, is correct.†

CLAVA BITUBERCULATA Sowerby.

Cerithium semigranosum Lamarck, Anim. s. vert., vii., 1822, p. 72; *Id.,* Ency. Méth., Pl. 443, fig. 1; *Id.,* Kiener Cerite, 1843, p. 26, Pl.21, fig.2. Not *Cerithium semigranosum* Lamarck, Ann. du Mus. iii., 1804, p. 437.

---

* Dall, Bull. U. S. Geol. Survey, No. xxiv., 1885, p.64.

† Melvill & Standen, Journ. Linn. Soc. Zool., xxvii., 1899, p.167.

Vertagus bituberculatus Sowerby, Conch. Icon., xv., 1865, Pl. iv., fig. 7; *Id.,* Thes. Conch. iii., *Cerithium* suppl., 1866, Pl. 290, fig. 324.

Cerithium cordigerum Bayle (*nom. mut.*), Journ. de Conch., xxviii., 1880, p. 249.

In the British Museum there are two specimens, apparently types of *bituberculatus,* which drew my attention to this novel synonymy. Had Bayle examined the subject carefully, he would have found that the renomination of Lamarck's species had already been effectively, if unconsciously, accomplished.

The habitat has not hitherto been announced more definitely than "New Holland" or "Australia." Specimens sent to me by Mr. F. H. Moore show it to be plentiful at the entrance of the Irwin River, West Australia.

Plesiotrochus unicinctus A. Adams.

(Plate xviii., fig. 63.)

Ziziphinus unicinctus A. Adams, Proc. Zool. Soc., 1851 (1853), p. 167.

Four specimens in the British Museum are evidently, though not so marked, the types of this species, described as "On pearl oysters, 8 to 10 fathoms, Lord Hood's Island," or Marutea, Paumotus. It has never been figured, redescribed, or properly classified. Study of these types enables me to pronounce *Z. unicinctus* an absolute synonym of *Trochus exilis* Pease, from the same place, and of *Plesiotrochus souverbianus* Fischer from the Loyalty Islands. Hence it will stand as the type of the genus. To support this conclusion I now offer a figure of one of the original specimens of Adams.

In these Proceedings (antea xxxii., p. 498), I lately reviewed the genus *Plesiotrochus,* since when it has been reported from the Indian Ocean by Mr. E. A. Smith in the person of *Plesiotrochus fischeri.**

---

* Smith, Proc. Malac. Soc., viii., 1909, p.370, text-fig.

TRIPHORA SCITULA A. Adams.

Triphoris scitulus A. Adams, Proc. Zool. Soc.,1851(1854), p.278.
Triphoris pfeifferi Crosse and Fischer, Journ. de Conch., xiii., 1864, p. 47, Pl. i., figs. 14, 15.

In the British Museum, I found a tablet with seven specimens labelled "scitulus A. Ad., Adelaide, S. Australia." Five of these, as is noted on the under side, are *T. pfeifferi*. Again there is a tablet from the Cumingian Collection, with three specimens marked "scitulus A. Ad., M.C."; these are all *T. pfeifferi*. This evidence indicates, as I have already suggested (antea xxvii., p. 616), that *pfeifferi* should give place to *scitulus*. One specimen of *T. pfeifferi* is marked type, and was presented to the British Musum by G. F. Angas.

A tablet was also found, not marked type, bearing three shells labelled "festivus A. Ad., S. Australia." Two of these are a species subsequently described, and the third is different, and also subsequently described. Under these circumstances I suggest that *T. festivus* A. Ad. be abandoned as unintelligible.

TURRITELLA CARLOTTÆ Watson.

Turritella carlottae Watson, Chall. Exp. Zool. xv., 1886, p. 478, Pl. xxx., fig. 5.

On the tablet in the British Museum of *Turritella carlottae,* are two distinct species. Though all are labelled "10 fm. Queen Charlotte Isl.," it is probable that a pair are from New Zealand, and a pair from Bass Straits. The Museum label admits the identity of *T. carlottae* with *T. vittata* Hutton. Under the circumstances, this synonymy should, I think, stand, but it should be appreciated that while Watson gave a second name to the New Zealand shell, he gave none to the Bass Straits one. To express it otherwise, this datum does not justify the admission of *T. vittata* Hutton to the Australian list by Pritchard and Gatliff.*

---

* Pritchard & Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p.54.

Cæcum bimarginatum Carpenter.

(Plate xviii., figs.64, 65, 66.)

Cæcum bimarginatum Carpenter, Proc. Zool. Soc., 1858, pp.431, 442.

This unfigured species was recorded from "Australia," because it was found on the shell of *Petaloconchus nerinaeoides.* In the British Museum, there is preserved one specimen, probably type, but not so marked, on a slide in a corked tube, "27, *Caecum bimarginatum,* Cpr., Singapore, Revd. P.P. Carpenter"; again, one specimen on a glass slide in a corked tube, labelled "27 *Caecum* (?) *bimarginatum,* jun., Australia, Rev. P. P. Carpenter." (My fig. 64.)

To assist in the recognition of these, figures are now presented.

Cæcum subquadratum Carpenter.

(Plate xviii., fig.67.)

Cæcum subquadratum Carpenter, Proc. Zool. Soc., 1858(1859), p. 433.

An illustration is here given of a specimen in the British Museum, perhaps a type, but not so marked, mounted alone on a glass slide in a corked tube, and labelled, "33 *Caecum subquadratum,* Cpr., Australia, W. Bean." But the published reference is "Port Elizabeth (Bean)."

Cæcum regulare Carpenter.

(Plate xviii., figs.68, 69, 70.)

Cæcum regulare Carpenter, Proc. Zool. Soc., 1858, p.428.

This species was reported by its author to have been found on the Australian shell *Petaloconchus nerinaeoides.* In the British Museum, I found the following series, one shell to each tablet, mounted on a labelled glass slide in a corked tube, "22 *Caecum regulare,* Carp., Singapore, Rev. P. P. Carpenter," "*Caecum* (?) *regulare* Cpr., Australia, Rev. P. P. Carpenter," "22 *Caecum regulare,* Cpr., W. Indies, S. P. Woodward." There is also one specimen, *Caecum regulare* Carp. from the Challenger Station 122, in 350 fathoms off Pernambuco.

This evidence seems opposed to the occurrence of this species in Australia. The Australian shell doubtfully referred to *C. regulare* by Carpenter is here illustrated fig. 70.

Bivona constrictor Mörch.

(Plate xviii., fig. 71.)

Bivona constrictor Mörch, Proc. Zool. Soc., 1862, p. 63.

In the British Museum is a single specimen, perhaps type, but not so marked, labelled, "Bivona constrictor, Mörch, Australia, M.C." This is illustrated in the accompanying figure.

Stephopoma tricuspe Mörch.

(Plate xix., figs. 72, 73, 74.)

Stephopoma tricuspe Mörch, Proc. Zool. Soc., 1861, p,150, Pl. 35, fig. 1.

In the British Museum are two tablets, perhaps types, but not so marked, labelled "Stephopoma tricuspe, Mörch, c.operc. et foeti, Australia, M.C." From these have been derived figures of a mass of tubes (fig. 72), and of the operculum (figs. 73-74). No habitat for the species has been published; it lives in Sydney Harbour.

Naricava, gen.nov.

A genus related to *Vanikoro,* but differing by smaller and thinner shell, by fewer, more depressed and rapidly increasing whorls, and by the last whorl being expanded horizontally. *Naricava* holds somewhat the relation to *Vanikoro,* that *Sigaretus* does to *Eunaticina.* Type, *Adeorbis angasi* A. Adams, 1863. Other Australian species are, *Adeorbis vincentiana* Angas, 1880; *Adeorbis angulata* Hedley, 1905; and *Adeorbis kimberi* Verco, 1907. Probably *Adeorbis platymna* Tomlin, 1913, from Singapore, belongs here.

Naricava is perhaps related to *Laciniorbis,** but that does not seen to have the peculiar apex of *Naricava,* nor is it referred to the Vanikoridæ. It has been indicated by Iredale,† that *Adeorbis* may be replaced by *Tornus,* but this is not established. Verril classifies *Adeorbis* near *Rissoa.*

* v. Martens, Archiv Naturg., lxiii.,(1) 1897, p.175.
† Iredale, Proc. Malac. Soc., ix., 1911, p.259.

LEIOSTRACA ACUTISSIMA Sowerby.

Leiostraca acutissima Sowerby, Conch. Icon., xv., 1866, Pl. ii., fig. 10; *Id.,* Tryon, Man. Conch., viii., 1886, p. 281, Pl. 70, figs. 89, 90.

Leiostraca lesbia Angas, Proc. Zool. Soc., 1871, p.91, Pl. i., fig.14.

In the British Museum, I compared one shell marked as the type of *L. acutissima* Sowerby, with an example of *L. lesbia,* presented by Angas, and, therefore, probably type, but not so marked. These two have already been united by Tryon. To me, *L. lesbia* seemed the adult form of *L. acutissima.*

EULIMA PROXIMA Sowerby.

Eulima proxima Sowerby, Conch. Icon., xv., 1866, Pl. vi., sp. 48.

The late Prof. R. Tate concluded,* from a study of the British Museum series, that *Eulima proxima* of Sowerby was the same as *E. augur* Angas. I found, in the South Kensington collection, one specimen marked type, of *E. proxima* Sowerby, from Port Jackson, presented by G. F. Angas. Again, there are two specimens marked types, *E. augur* Angas, from St. Vincent's Gulf, also presented by G. F. Angas. These seems to me to be different species. *E. proxima* is shorter and broader, with flatter sides, and more sharply angled periphery than *E. augur.* *E. proxima* has the aperture angled in front, where in *E. augur* it is rounded. All three types have imperfect tips. That of *E. proxima* has eleven whorls remaining; there are very faint lateral varices. There are, in the same collection, three specimens of *E. subangulata* Sowerby,† marked "Indian Seas, from the Old Humphries Collection, M.C." These may possibly be the adult form of *E. proxima.*

EULIMA CONSTELLATA Melvill.

Leiostraca constellata Melvill, Ann. Mag. Nat. Hist. (7), i., 1898, p. 200, Pl. xii., fig. 6.

Subularia piperita Sowerby, Proc. Malac Soc., iv., 1901, p. 209, Pl. xxii., fig. 5.

---

* Tate, Trans. Roy. Soc. S.A., xxii., 1898, p.80.
† Sowerby, Thes. Conch., ii., 1854, p.794, Pl.169, figs.11, 12.

Eulima piperita Hedley, Proc. Linn. Soc. N. S. Wales, xxxiv., 1909, p. 451, Pl. xliii., fig. 85.

Types in the British Museum of *L. constellata* appeared to me like the species I described from the Hope Islands, and now record from Mast Head Reef and Caloundra. Not trusting to my memory for the identification, I afterwards sent specimens for comparison to its author. Conjointly, Mr. J. C. Melvill and Mr. E. A. Smith compared the Queensland *piperita* with the Aden *constellata* and the Philippine *piperita*. The Australian shells are rather smaller than the others, but my friends pronounce the three to be identical. The repetition of the second and third synonyms is a coincidence.

Stilifer marginata Tenison-Woods.

Eulima marginata Ten.-Woods, Proc. Roy. Soc. Tasm., 1878, (1879), p. 40.

Stilifer lodderæ Petterd, Journ. of Conch., iv., 1884, p. 140; *Id.*, Hedley, Proc. Linn. Soc. N. S. Wales, xxv., 1900, p. 92, text-figure.

Stylifer crotaphis Watson, Chall. Zool., xv., 1886, p. 525, Pl. 37, fig. 10.

In the British Museum is a single specimen, evidently the type but not so marked, of *Stilifer crotaphis* Watson. This I recognised as a young specimen of the previously described *S. marginata* Ten. Woods.

Dr. Boog Watson was unfortunately possessed by a zealous but mistaken anxiety to exhaust his material. He was thus led here and elsewhere to found, on immature, imperfect and single specimens, species already named, such as *Alaba sulcata* for *Strombus campbelli; Trochus tinctus* for *Calliostoma allporti; Turritella phillipensis* for *Turritella gunni;* and *Murex cordismei* for *Murex angasi.*

Stilifer guentheri Angas.

Apicalia guentheri Angas, Proc. Zool. Soc., 1877, p. 35, Pl. 5, fig. 6.

Stilifer guentheri Sowerby, Thes. Conch., v., 1884, p. 160, Pl. 479, fig. 1; *Id.*, Boettger, Nach. Malak. Gesell, xxv., 1893, p. 166.

Eulima guentheri Tryon, Man. Conch., viii., 1886, p. 283, Pl. 70, fig. 100.

In the British Museum, I saw one specimen, marked type "Apicalia guentheri, Angas, N.S.W., Pres. Dr. J. G. Jeffreys"; and again, two "? guntheri, Angas, Mauritius, Robillard, Parasite on Holothuria." I have seen several specimens of *S. guentheri* from Lifu, Loyalty Islands, and I am satisfied that this species is not, as stated, a native of New South Wales.

CYMATIUM DOLIARIUM Linné.

Murex doliarium Linné, Syst. Nat., xii., 1767, p. 1223.

Tritonium doliarium Angas, Proc. Zool. Soc., 1867, p. 189.

Cymatium doliarium Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p. 98.

This species has been reported by Angas from New South Wales, and by Shirley from Torres Straits. All the specimens in the British Museum collection are from South Africa. There can be no doubt that these Australian records are fictitious.

CYMATIUM BOLTENIANUM A. Adams.

Triton boltenianus A. Adams, Proc. Zool. Soc., 1854 (1855), p.311; *Id.*, Angas, *op. cit.*, 1867, p.188.

This species was originally recorded from Australia, and Angas afterwards reported it from Long Bay, near Sydney. No other collector has met with this unfigured species. In the British Museum, I found a specimen labelled "Triton spengleri, Lamk., Red Sea," which corresponded well to two shells in the same collection ticketed "Triton boltenianum, A. Adams, N. S. Wales, Pres. G. F. Angas." I now conclude that the Red Sea is the right locality for this form, which should be excluded from Australian lists.

ARGOBUCCINUM TUMIDUM Dunker.

Ranella tumida Dunker, Proc. Zool. Soc., 1862, p.239,

Bursa tumida Dunker, Novit. Conch., 1864, p.56, Pl.xviii., f.8,9.

Ranella vexillum Menke, Moll. Nov. Holl. Spm., 1843, p.24; *Id.*, Tenison-Woods, Proc. Roy. Soc. Tasm., 1877 (1879), p.28.

Apollo argus Tate and May, These Proceedings, xxvi., 1901, p.356.

Ranella argus Hutton, These Proceedings, ix., 1885, p.933; *Id.*, Verco, Trans. Roy. Soc. S.A., xix., 1895, p.104.

Lotorium argus Pritchard and Gatliff, Proc. Roy. Soc. Victoria, x., 1898, p.267.

Under the names of *Ranella argus* and *R. vexillum*, this species has been identified by Menke from West Australia, by Verco from South Australia, by Pritchard and Gatliff from Victoria, by Tenison-Woods from Tasmania, and by Hutton from New Zealand. According to the British Museum Collection, *A. argus* is a distinct species from South Africa. While *A. vexillum*, which is more nearly related to *A. tumidum* than to *A. argus*, is from South America. In London, there are three specimens, types of *A. tumidum* Dunker, labelled "Nova Seelandia." This appears to me the correct name of the species, extending from New Zealand to Tasmania and Australia. Tryon presented a whole austral group of *argus*, *vexillum*, *tumidum*, *proditor*, etc., as a single species. The earliest name for the South American form is not *Ranella vexillum* Sowerby, 1835, but *Triton ranelliformis* King, 1831.

NATICA GUALTERIANA Recluz.

Natica gualteriana Recluz, Proc. Zool. Soc., 1843(1844), p.208; *Id.*, Journ. de Conch., i., 1850, p.396; *Id.*, Philippi, Conch. Cab. ii.,(1) 1852, p.71, Pl. xi., f.8; *Id.*, Reeve, Conch. Icon., ix., 1855, Pl. xxv., fig.114.

Natica marochiensis Angas, Proc. Zool. Soc., 1867, p.197, and 1877, p.236; *Id.*, Brazier, These Proceedings, i., 1877, p.236; *Id.*, Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p.98.

In the British Museum, at least two species are exhibited as "maroccana Chemnitz," or "maroccana var." There is a tablet with five specimens labelled "maroccana, Chemnitz, Cape York, N. Australia, J. B. Jukes, Natica marochiensis, Lamk. Voy. Ast. t.66, f.16." This has a low spire, radial furrows on the shoulder, and the operculum of Cochlis, *i.e.*, with a single marginal sulcus. Again, there are three specimens from Senegal, and three from the River Gambia, (the latter alternatively marked "Gambiæ, Reeve") which, though called by the same name as the Cape

York series, differ by having a higher spire, finer shoulder-wrinkles, and the operculum of *Natica*, i.e., spirally sulcate. Again, another form which I need not discuss, appears under this name from Demerara and Mazatlan. Specimens obtained at Aden by Major Yerbury agree with the Cape York shells.

With the Cape York shells, there also agrees a set of three, labelled "Gualteriana, Pet., from Isle of Bohol, M.C." Though these are not marked types, I have some confidence in regarding them as the originals of Reeve's figure, and of the second description of Recluz, which differs in minor details from the first. Even the error of Cuming's clerk, in misquoting the editor for the author of the species, supports their authenticity.

Granting this, "maroccana" or "marochiensis" may be reserved, as the name implies, for an African species; while the Australian shell thus miscalled by Angas, Brazier, and Shirley should be referred to *gualteriana*. Misquoting the species as of Petit, Melvill and Standen have noticed *N. gualteriana* from Boydong Cays, near Cape York. I have catalogued it from Mast Head Island.

Philippi's account of *Natica avellana* suggests to me that it is closely related to *N. gualteriana*.*

Natica vitellus Linné.

Nerita vitellus Linné, Syst. Nat. x., 1758, p. 776, for Rumphius, Pl. xxii., fig. D, fide Hanley, Ips. Linn. Conch., 1855, p. 394.

Nerita rufa Born, Index Caes. Vind., 1778, p. 413; *Id.,* Test. Mus. Caes. Vind., 1780, p. 398, Pl. 17, figs. 3, 4; *Id.,* Brauer, Sitz. Akad. Wiss., lxxvii., 1878, p. 70.

Nerita fasciata Martyn, Univ. Conch., iii., 1786, Pl. 110, right fig.

Not *Natica vitellus,* of Lamarck and of authors generally, which is *Nerita stellatus* Martyn, Univ. Conch., iii., 1786, Pl. 110, left fig.; *Id.,* von Martens, Mal. Blatt., xix., 1872, p. 45.

Hanley shows that the *Nerita vitellus* of Linné is not the *Natica vitellus* of other writers, but is the *Nerita rufa* of Born. The shell universally but erroneously called *Natica vitellus* must now take

* Phillipi, Conch. Cab., ii.,(1) 1852, Pl. xi., fig.14.

the name of *Natica stellatus* Martyn. Three specimens of *N. vitellus* (so-called) in the British Museum, from Ticao, have the operculum of Cochlis. The real *N. vitellus* has not hitherto been reported from Australia, but I have found it at the Palm Islands, Queensland. And I have gathered *N. stellatus* Martyn, on Murray Island, Torres Straits.

Polinices conicus Lamarck.

Natica conica Lamarck, An. s. vert., vi., 1822, p. 198.

Natica pyramis Reeve, Conch. Icon., ix., 1855, Pl. 21, fig. 93.

In the British Museum are two specimens, apparently types, but not so marked, labelled "pyramis, Reeve, from Swan River, Australia, found in sandy mud, 10 fms., Lt. Collie, R.N., M.C." These specimens are certainly a white form of *conicus,* but their identity has never been recognised. In the Geneva Museum, two types of *N. conica* bear Lamarck's autograph label.

Polinices aulacoglossa Pilsbry and Vanatta.

Natica chemnitzii Reeve, Conch. Icon., ix., 1855, Pl. 2, fig. 7; (not *Natica chemnitzii* Pfeiffer, Krit. Register Conch. Cab., 1840, p. vii., for Chemnitz, Conch. Cab., v., 1781, p. 270, Pl. 188, fig. 1905-6); *Id.,* Angas, Proc. Zool., Soc., 1867, p. 198; *Id.,* Adams, Genera of Recent Mollusca, Pl. xxii., fig. 3 (animal).

Polinices aulacoglossa Pilsbry and Vanatta, Proc. Acad. Nat. Sci. Philad, lx., 1908, p. 558, Pl. xxix., fig. 1, 2, 3.

Cyclostrema kingii Brazier Mss., Tenison Woods, Proc. Roy. Soc. Tasm., 1877, p. 39.

Under the name of *Natica didyma* Bolten, several related species, representing one another in different seas, were lumped together by Boog Watson, Tryon and other authors. That from the Peronian region is an elevate, globose and narrowly perforate form called *N. chemnitzii* by Reeve. The locality, unknown to its author, was supplied by Angas. The bare name of *Cyclostrema kingii,* which recurs at intervals in the literature of Tasmanian shells, refers to the youngest growth-stage of this species. As Reeve's name was spoilt by an earlier one of Pfeiffer's, Pilsbry and Vanatta have lately redescribed the Australian shell as *Polinices aulacoglossa*

In the British Museum, a Tasmanian example of *P. aulacoglossa* is misnamed *tasmanica* Woods, an error supported by Pritchard and Gatliff.* But Tenison Woods, well acquainted with the identification of *chemnitzii* by Angas, would not have considered it as new. Then *tasmanicus* is present as described from the south of Tasmania, where *aulacoglossa* is absent; it is said to be 16 mm. across, but *aulacoglossa* is twice or thrice as much; *tasmanicus* has a spiral groove on the pad, running along the edge, the transverse furrow of *aulacoglossa* would not be so described; *tasmanicus* has the umbilicus partly filled up, "obtecte," but that of *aulacoglossa* is open. Then *aulacoglossa* would not be mistaken for a small form of *baconi* or *plumbea,* while these comparisons are natural for *tasmanicus.*

In the Solanderian region, a variety occurs of the *didymus* group, which, in the British Museum, is shown as *N. bicolor* Phil,† from Torres Strait. I find it to range south to Port Curtis.

POLINICES NUXCASTANEA Martyn.

Nerita nuxcastanea Martyn, Univ. Conch., iii., 1786, Pl. 106.

Natica maura Lamarck, Encycl. Méth., 1816, Explanations of Pl. 453, fig. 4.

Polinices maura Shirley, Proc. Roy. Soc. Queensland, xxiii.,1911, p. 98.

As "*Mammilla maura* Lamarck," three specimens, taken by Jukes on Darnley Island, are shown in the British Museum. Unfamiliar with synonymy, Shirley has mentioned it as new to Queensland, under Lamarck's name. But, by the prior name of Martyn, it was already included in the catalogue of marine mollusca of Queensland.

ANCILLA CINGULATA Sowerby.

Ancillaria cingulata Sowerby, Species Conch. i., 1830, Ancillaria, p. 6, figs. 36, 37.

Ancillaria tricolor Gray, Append. Voy. Fly, ii., 1847, p. 357, Pl. i., fig. 4; Not *A. tricolor* Sowerby, Thes. Conch. iii., 1859, p. 63, Pl.

* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiii., 1900, p.191.

† Philippi, Conch. Cab., ii., 1852, p.43, Pl.vi., f.4.

211, figs. 9, 10; Nor *A. tricolor* Reeve, Conch. Icon. xv., 1864, Pl. xi., fig. 48.

Five shells in the British Musuem are labelled, "tricolor Gray, Voy. Fly, ii., 357, Pl. i., 4, enlarged, Cape York, M.C." They were about half an inch in length, solid, highly polished, ovate-acuminate, with a faint umbilical furrow. The colour is buff, with white on the base and on a subsutural band, the latter succeeded by an orange thread.

Notes on the tablet indicate that these five are identical with *A. novaezelandiae* Sowerby, and with *A. nana* Watson.

In every particular, these five fail to agree with Gray's account, and I regard them as wrongly determined. But Gray's figure and description agree precisely with *A. cingulata* Sowerby, which I have collected just where the original *A. tricolor* was taken. Sowerby and Reeve evidently derived their information about *A. tricolor* from a substitute, not from authentic material. By a further complication, *A. bicolor,* meaning *A. tricolor* Sowerby, not *A. tricolor* Gray, is reported from New Zealand in place of *A. novæzelandiæ.**

Tryon erred in uniting *A. novæzelandiæ* to *A. sinensis* Sowerby, and *A. inornata* Smith.† The London collection shows these to be distinct species. *Ancilla obesa* Sowerby, and *A. mauritiana* Sowerby, have been reported as Australian, but such references are apparently erroneous.

Marginella translucida Sowerby.

Marginella translucida Sowerby, Thes. Conch., i., 1846, p. 376, Pl. 75, figs. 62, 63.

M. volutiformis Reeve, Conch. Icon. xv., 1865, Pl. 24, fig. 31.

From the Cuming Collection are three poor specimens, which, if not types, are yet probably authentic specimens, labelled "*M. translucida* Sow., Thesaurus i., p. 376, Pl. 75, fig. 62-3, Hab. Australia," but on the face of the tablet "W. Indies." Again there is a single specimen marked type, labelled, "volutiformis, Rve. Conch. Icon., f.

* Hutton, Index Faun. Nov. Zealand, 1904, p.74.

† Tryon, Man. Conch., v., 1883, p.95.

131, Hab. —?, Pres. Mrs. T. Lombe Taylor." This is 8 mm. long, and 4·5 broad. It agrees with the three *translucida*.

The habitat is fixed by a series labelled "translucida Sowerby" from J. Brazier, collected near the mouth of the Richmond River, N. S. Wales. These are a little smaller than Reeve's type. Angas had already reported *M. translucida* from Middle Harbour.*

The synonymy of this species has been much abused by authors. Weinkauff erroneously unites *M. strangei* Angas to *M. translucida*,† which is accepted by Tryon. In his turn, Tryon considers *M. volutiformis* to be a variety of *M. turbinata* Sowerby. Also that *M. pygmaea* Sowerby is the same as *M. translucida*, in which he was followed by Pritchard and Gatliff.

Marginella attenuata Reeve.

Volvaria secalina Philippi, Enum. Moll. Sicil., ii., 1844, p. 197, Pl. 27, fig. 19.

Marginella nitida Hinds, Proc. Zool. Soc. 1844, p.75; *Id.*,Sowerby, Thes. Conch. i., 1846, p. 389, Pl. 76, fig. 131.

Marginella attenuata Reeve, Conch. Icon. xv., 1865, Pl. xxii., fig. 116.

Marginella paxillus Reeve, Conch. Icon. xv., 1865, Pl. xxiv., fig. 133.

In London, it was pointed out to me, by Mr. J. R. Le B. Tomlin, that *M. attenuata* was founded on a Mediterranean shell, and that the Australian and South African localities assigned to it are false. Reeve's statement that Strange gathered *M. attenuata* at Sydney, induced local collectors to try to fit some Port Jackson species, such as *M. translucida*, to it.

But Reeve's species was first described from Sicily by Philippi as *Volvaria secalina*. A note on the under-side of the Museum tablet unites this to *M. nitida* Hinds. Again, *M. paxillus* Reeve is, according to the type, identical.

So *Marginella attenuata*, a weary record of the carelessness and incapacity of Lovell Reeve, may now disappear from lists of the Australian fauna.

* Angas, Proc. Zool. Soc., 1867, p.196.

† Weinkauff, Jahrb. Deut. malak, Gesell., vii., 1880, p.47.

CANCELLARIA AUSTRALIS Sowerby.

Cancellaria australis Sowerby, Conch. Illust., 1832, fig. 23.

C. undulata Sowerby, Proc. Zool. Soc., 1848, p. 136; *Id.,* Sowerby, Thes. Conch., 1849, Pl. 92, fig. 12, Pl. 95, fig. 79.

The types of *Cancellaria* described by Sowerby are not available at South Kensington. From that collection, it appears that *C. undulata* is identical with *C. australis;* that Tryon erred* in uniting a Japanese species, *C. spengleriana* Deshayes, to *C. undulata;* and that *C. granosa* Sowerby, from Tasmania, is a geographical race separable varietally, if not specifically, by the grains on the ribs.

TEREBRA BREVICULA Deshayes.

Terebra brevicula Deshayes, Proc. Zool. Soc., 1859, p. 296; *Id.,* Reeve, Conch. Icon., xii., 1860, Pl. xxii., fig. 119.

In the British Museum, I found a shell marked type, labelled, "*T. brevicula,* Desh., P.Z.S., 1859, p.296, Van Diemen's Land," and another, the original of Reeve's figure, and again another. These are in poor condition, and appear to have been bathed in acid. What is left of them answers fairly to half-grown shells of *T. albocincta* Carpenter, from California.

This name, which has long been a nuisance to Australian conchologists, can now be definitely rejected from our catalogues.

TEREBRA BUCCINULUM Deshayes.

Terebra buccinulum Deshayes, Proc. Zool. Soc., 1859, p. 282; Id., Reeve, Conch. Icon., xii., 1860, Pl. xx., fig. 101.

This species was described from "East Australia," but it apparently does not occur here. In the British Museum, under the genus *Leiodomus* of Swainson, are two specimens marked "type Bullia turrita Gray, Zool. Beechey's Voy., Reeve Conch. Icon. sp. 16." Except in colour, these are identical with one marked "type, Terebra buccinulum Deshayes, East coast of Australia, Journ. de Conch., 1857, vol. vi., f. 9."

---

* Tryon, Man. Conch., vii. 1885, p.67.

Terebra fenestrata Hinds.

Terebra fenestrata Hinds, Proc. Zool. Soc., 1843, p. 153; *Id.*, Thes. Conch., i., 1844, p. 176, Pl. 44, fig. 86.

T. cœlata Adams and Reeve, Voy. Samarang, Moll., 1850, p. 30, Pl. 10, fig. 22; *Id.*, Brazier, These Proceedings, i., 1877, p. 255.

It is suggested beneath the tablet of one, perhaps type, but not so marked, labelled, "T. cœlata Ad. & Reeve, China, Voy. Samarang, M.C.—compare with fenestrata—." On making the comparison with three marked as types of *T. fenestrata*, I considered the names synonymous. As *T. cœlata*, Brazier has recorded the species from 20 fms., Darnley Is., Torres Straits.

Terebra turrita Smith.

Terebra turrita Smith, Ann. Mag. Nat. Hist. (4), xi., 1873, p. 266; Id., Watson, Chall. Zool., xv., 1886, p. 381, Pl. xiv., fig. 8.

The type of *T. turrita* figured in the Challenger Expedition Report, illustrative of a species found in Torres Straits, is so distinguished at the British Museum. This has the aperture broken back for a quarter of a whorl, hence the figure of the mutilated specimen is a misleading representation of the species. In the same collection, *T. textilis* Hinds is represented by three marked "type *textilis* Hinds, P.Z.S., 1843, p. 156, 6 fath., Manila Bay, M.C." Between these and *turrita*, I see scarcely enough difference for specific separation. Indeed, *T. textilis* and *T. fenestrata* Hinds are not far apart, the latter being proportionately broader, and having coarser sculpture. Comparing *T. turrita* and *T. exigua* Deshayes, I notice that, between the subsutural nodules, *exigua* is spirally striated and *turrita* smooth.

Terebra polygyrata Deshayes.

Terebra polygyrata Deshayes, Proc. Zool. Soc., 1859, p. 301; *Id.*, Reeve, Conch. Icon., xii., 1860, Pl. xxvi., fig. 146.

T. subtextilis Smith, Proc. Zool. Soc., 1879, p. 185, Pl. xix., fig. 3; *Id.*, Shirley, Proc. Roy. Soc. Qsland, xxiii., 1911, p. 100.

Mr. E. A. Smith described *T. subtextilis* from Japan, and Dr. J. Shirley records it from Bowen, Queensland. *T. polygyrata* was dredged by the Challenger Expedition in 25 fathoms, west of Cape York. On comparing examples of these two in the British Museum, I am unable to distinguish specific differences.

TEREBRA FLAMMEA Lamarck.

Terebra flammea Lamarck, Anim. s. vert., vii., 1822, p. 284; *Id.,* Reeve, Conch. Icon., xii., 1860, Pl. iv., fig. 13; *Id.,* Reeve, Proc. Zool. Soc., 1860, p. 450.

Reeve has recorded *T. flammea* from Moreton Bay, Australia. Material in the British Museum indicates that this species, and its variety, *T. incomparabilis* Deshayes, inhabit the West Indies. The Australian habitat is therefore a mistake. It does not appear to have been remarked that *Epitonium feldmanni* Bolten, 1798, is an earlier name for Lamarck's species.

DUPLICARIA VALLESIA Hedley.

Duplicaria vallesia Hedley, Rec. Austr. Mus., viii., 1912, p. 147, Pl. 43, fig. 31.

This species closely resembles, but is specifically distinct from, *T. geminata* Deshayes.* A Natal specimen, in the British Museum, of *T. geminata* is more tapering, has a more twisted columella, and its ribs continue on the base, whereas *D. vallesia* has a smooth base. The median groove is a broader and deeper in *geminata,* and the nodules above alternate with the ribs instead of continuing them, as in *vallesia.*

DUPLICARIA ADDITA Deshayes.

Terebra addita Deshayes, Proc. Zool. Soc., 1859, p. 293.

This species was originally described from Tasmania, but, like *Terebra brevicula,* it has been sought for in vain by local collectors. The species is evidently foreign. One in the British Museum is marked "type T. addita Desh., P.Z.S., 1859, p. 293, V. Diemen's Land, M.C." This, I consider conspecific with three, perhaps type but not so marked, labelled, "*T. spectabilis* Hinds, P.Z.S., 1843, p. 150—Thesaurus, fig. 88 & 89. Guinea on the sands and Ceylon, E. Layard, Esq. = gracilis, Gray."

---

* Deshayes, Proc. Zool. Soc. 1859, p. 296; *Id.,* Reeve, *op. cit.,* 1860, p. 450.

T. spectabilis has already been reported from New South Wales by Angas, and from Torres Straits by Brazier. Perhaps these reports refer to *D. vallesia.*

Conus anemone Lamarck.

Conus anemone Lamarck, Ann. du Museum, xv., 1810, p. 272.

C. maculosus Sowerby, Conch. Illus.; Conus, 1833, Pl. i. fig. 3.

C. jukesii Reeve, Conch. Icon., i., Conus Suppl., 1848, Pl. ii., fig. 278.

C. novæhollandiæ A. Adams, Proc. Zool. Soc. 1853 (1854), p. 119; *Id.,* Thes. Conch., iii., p. 31, Pl. 199, fig. 298-9.

C. maculatus Sowerby, Thes. Conch., iii., 1858, Pl. 199, fig. 296.

C. rossiteri Brazier, Proc. Zool. Soc., 1870, p. 109.

There is no general agreement on the treatment of this common and variable shell. From Lamarck's phrase "tenuissime striata," and from Kiener's figure of a Lamarckian specimen, I suppose that the typical form of *C. anemone* is the variety with coarse revolving threads, called by A. Adams, *C. novæhollandiæ.* This is represented, in the British Museum, from Port Essington, coll. Capt. Wickham, and from Tasmania, coll. R. Gunn. To my knowledge, it is absent from the east coast of Australia.

Conus maculosus Sowerby, was described from the Philippine Islands, and is asserted by Hidalgo* to exist there. Probably no type is extant. Sowerby's figures and description are hardly enough for exact determination. If tradition, as embodied in the British Museum collection, can be trusted, *C. maculosus* is not a Philippine shell, but a native of New South Wales. It is thinner, smoother, more inflated, and with a lower spire than *C. novæhollandiæ.*

C. jukesii, which also occurs in New South Wales, is a smooth, short, broad, form, with a low spire. Of this, *C. rossiteri* is a trivial colour-variation.

These expressions of *C. anemone* may be summed up thus:—

Var. *novæhollandiæ* A. Adams. Tall, solid, with raised close revolving threads, spire elevated. North, West, and South Aus-

* Hidalgo, Cat. Molus. Test. islas Filipinas, 1905, p. 101.

tralia. Kiener, Conus, Pl. 46, fig. 3; Conch. Icon., Pl.25, fig. 139b; Thes. Conch. iii., Pl. 199, figs. 298-299.

Var. *maculosus* Sowerby, = *maculatus* Sowerby. Thin, smooth, inflated, of medium height. New South Wales and Lord Howe Island. Conch. Ill., fig. 3; Conch. Icon., Pl. 25, fig. 139a; Thes. Conch. iii. Pl. 13, fig. 264.

Var. *jukesii* Reeve. Thin, smooth, short, broad, spire depressed. Colour disposed in large masses. New South Wales. Conch. Icon., suppl., Pl. 2, fig. 278.

Tryon, followed by Watson, Pritchard, Gatliff, etc., included among the synonymy of *C. anemone* the name of *C. ardisiacus* Kiener. But according to the British Museum collection, *C. ardisiacus* is the South African shell otherwise known as *C. tinianus* Hwass, varieties of which are *C. rosaceus* Chemnitz, and *C. scutor* Crosse. The African and Australian shells are much alike. *C. anemone* differs in being more solid, more angled at the shoulder, and deeply grooved on the summits of the whorls.

Perhaps it was a form of *C. anemone,* which Angas* found in Middle Harbour, Sydney, and misreported as *C. grayi* Reeve. On a series in the British Museum, marked as types of *C. grayi* Reeve, it is noted that it is a West African species allied to *C. portoricanus* Hwass. *C. grayi* is extremely like a form of *anemone,* but has a roundly bevelled shoulder, which the Australian species has not.

Weinkauff, of course, erred† in associating *C. cabriti* Bernardi (= *taylorianus* Smith), *C. borneensis* Sowerby, and *C. compressus* Sowerby, with *C. anemone.*

Conus aplustre Reeve.

Conus aplustre Reeve, Conch. Icon., i., 1843, Pl. xxx., fig. 170; *Id.,* Smith, Proc. Malac. Soc., v., 1903, p. 361.

C. neglectus A. Adams (non *C. n. Pease,* 1860 = *C. peasei* Brazier, 1877), Proc. Zool. Soc., 1853 (1854), p. 117.

C. cookii Brazier, Proc. Zool. Soc., 1870, p. 109.

---

* Angas, Proc. Zool. Soc. 1867, p.205.

† Weinkauff, Jahrb. malak. Gesell. i., 1874, p.277.

This is the eastern analogue of *C. rutilus* Menke. No locality was given in the original description of this species. By an odd error, the type in the British Museum is now labelled "Cape of Good Hope," the Australian localities quoted by Brazier, Angas, Bergh, Pritchard and Gatliff, being overlooked.*

The type of *C. neglectus* A. Adams is noted, at South Kensington, as being equivalent to *C. aplustre*. *C. cooki* Brazier is a variety of *aplustre* in which the interrupted spiral lines have coalesced into ziczac radials. Smith has remarked† that Tryon erred in uniting *C. multicatenatus* to *aplustre*.

Conus cyanostoma A. Adams.

Conus cyanostoma A. Adams, Proc. Zool. Soc., 1853, (1854), p. 116; Id., Sowerby, Thes. Conch., iii., 1858, p. 19, Pl. 4, fig. 304.

Conus coxeni Brazier, Proc. Zool. Soc., 1875, p. 34, Pl. 4, fig. 4; Id., Hedley, Proc. Linn. Soc. N. S. Wales, xxx., 1906, p. 535.

Conus innotabilis Smith, Proc. Zool. Soc., 1891, p. 487, Pl. xl., fig. 1.

In error, Arthur Adams reported *Conus cyanostoma* from West Africa, instead of from East Australia. By this hitherto uncorrected mistake, the name has been lost to Australian conchology. The type, marked as such, is preserved in the British Museum, and is noted by Mr. E. A. Smith as conspecific with *C. coxeni*. The typical form is nearer *innotabilis*, while *coxeni* is a variety. J. B. Jukes dredged this species off Sandy Cape, Queensland.

Conus tasmaniæ Sowerby.

Conus tasmaniæ Sowerby, Thes. Conch., iii., 1866, p. 328, Pl. 288, fig. 636.

This species, as the name implies, was alleged by its author to be from Tasmania, but local naturalists have failed to find it there. A single specimen of the South Kensington collection, in a poor state of preservation, is marked, "Type, Conus tasmaniæ, Sow.,

---

* Brazier, Proc. Zool. Soc. 1869, p.562; Angas, *op. cit.*, 1871, p.93; Bergh, Nov. Act. Ksl. Leop.-carol. Deut. Akad. lxv., 1895, p.131; Pritchard and Gatliff, Proc. Roy. Soc. Vict., 1906, p.52.

† Smith, Proc. Zool. Soc. 1891, p.400.

Thesaurus, f. 636, Pres. G. F. Angas." An examination of this induces me to add *C. tasmaniae* to the already extensive synonymy of the common tropical *C. magus* Linné. Sowerby's locality is, of course, false.

DRILLIA VEXILLUM Reeve.

Pleurotoma vexillum Reeve, Conch. Icon. ii., 1845, Pl. xxix., fig. 264; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 203.

This was reported by Angas from Middle Harbour, near Sydney. In the British Museum, a specimen labelled *Pl. vexillum*, Rve., is marked "St. Vincent's, West Indies." This, and the fact that no other observer has found it in Australia, cause the record of Angas to be distrusted.

MANGELIA MITRALIS Adams and Angas.

(Plate xix., fig. 75.)

Bela mitralis Adams and Angas, Proc. Zool. Soc., 1863, p. 420.

The present figure is derived from one of two in the British Museum, marked as types of *Bela mitralis*.

MANGELIA AUSTRALIS Adams and Angas.

(Plate xix., fig. 76.)

Bela australis Adams and Angas, Proc. Zool. Soc., 1863, p. 420; *Id.*, Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 173; *Id.*, Verco., Trans. Roy. Soc. S.A., xxxiii., 1909, p. 311.

M. australis has not been previously figured. The type in the British Museum is here illustrated. By Pritchard and Gatliff, it is united to *M. mitralis*, and Verco further links it to *M. tasmanica* and to *M. jacksonensis*.

MANGELIA NASSOIDES Reeve.

Pleurotoma nassoides Reeve, Conch. Icon., ii., 1845, Pl. xxix., fig. 259.

Clathurella zonulata Angas, Proc. Zool. Soc., 1867, p. 113, Pl xiii., fig. 17.

In the British Museum are two specimens marked, "Clathurella zonulata Angas. Type, Pres. G. F. Angas." Beneath this tablet is a note, "allied to nassoides Gray." Five worn specimens, about half an inch long, perhaps Reeve's types, but not so marked, represent *nassoides;* they are labelled "Conch. Icon. i., f. 259. Hab. West Indies." These, I consider, can be definitely united to *C. zonulata*. The name *nassoides* does not seem to have appeared in American literature, which suggests that the West Indian habitat is erroneous, and agrees with the suggestion that this name should be adopted for the Sydney shell.

Clavatula quisqualis Hinds.

Clavatula quisqualis Hinds, Proc. Zool. Soc., 1843, p. 44; *Id.*, Brazier, These Proceedings, i., 1877, p. 157.

Brazier has recorded this from Darnley Island, Torres Straits. But, in the British Museum, two, perhaps types but not so marked, are labelled, "W. coast of Central America, Sir E. Belcher Coll." These two habitats are incompatible. An Oriental representative of *C. quisqualis* was described by Nevill as *Drillia lucida*.*

Clathurella peregrina Gould.

Clathurella peregrina Gould, Proc. Boston Soc. Nat. Hist., 1861, p.337; *Id.*, Tenison-Woods, These Proceedings, ii., 1878, p.258.

This species was described as from Sydney Harbour. It has never been figured. I was unable to find a specimen in any of the Museums I visited. Tenison-Woods hints that it may be *C. brenchleyi* Angas, but it had best be written off as unrecognisable and lost.

Drillia æmula Angas.

(Plate xix., fig. 77.)

Drillia æmula Angas, Proc. Zool. Soc., 1877, p. 36, Pl. v., fig. 4.

A study of the series in London leads me to consider that this species should be rejected as Australian, and that it is a native of New Zealand, where it was previously described as *Pleurotoma trailli* Hutton. In the British Museum is a specimen of *D. æmula* marked as the type, and labelled as from Port Jackson, which is here figured. No subsequent collector has found it in New South

* Nevill, Journ. Asiat. Soc. Bengal, xliv., 1875, p.84, Pl. viii., f.15.

Wales. It was also reported in Victoria as from "Portland (Mrs. A. F. Kenyon), one specimen." So many exotic species, such as *Murex endivia*, *Drillia crenularis*, *Lotorium australe*, *Cassis fimbriata*, and *Euchelus atratus* have been noted thus, that the association does not inspire confidence.

A related form is *D. harpularia* Des Moulins, which differs by the radial riblets being more in number, oblique instead of vertical, and by the interspaces being smooth instead of deeply grooved, as in *D. æmula*.

Drillia exarata Reeve.

Pleurotoma exarata Reeve, Conch. Icon., i., 1845, Pl. xxiii., fig. 201; *Id.*, Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 296.

In the British Museum, this species is represented by three lots; first, a single specimen marked as type; secondly, another labelled "exarata, Reeve, (?) Panama, Jewett from the Smithsonian Inst. 65/11/12"; thirdly, two from St Vincent's Gulf, presented by Dr. Verco. The type, which is worn, differs decidedly from Dr. Verco's shells. Both are the same general size and shape, but Dr. Verco's are a little broader at the last whorl, and have raised spiral threads cut into beads by radial grooves, whereas the type has no spirals. The Jewett shell is a mere wreck, though as far as it goes it agrees with Reeve's type. But I can find no note on *D. exarata* in American literature.

No definite conclusions are offered on this subject, but the facts above recited, suggest that further enquiry is desirable, and that the Australian habitat may be impugned.

Mitra carbonaria Swainson.

This species has already been discussed, and at some length, in these Studies (*antea*, xxxiii., p. 461), where it is shown to be what in Australia has been commonly but erroneously called *M. melaniana* Lamarck. In the British Museum, I examined the unique type of *M. digna* A. Adams, and was satisfied that, as has been stated already, it should be included in Swainson's species.

I also found, in the same case, one specimen marked type, and labelled, "M. badia Rve., Conch. Icon., ii., f. 157, Hab. ? M.C."

This I recognised as an immature individual of *M. carbonaria.* This species presents two variations, perhaps of sexual dimorphism; the first, *badia,* shorter, stouter and darker; the second, *digna,* longer, more slender and paler. The orange line below the suture, and the microscopic punctate striæ are common to both.

It was a mistake of Tate and May* to unite *M. badia* Reeve to *M. rosettæ* Angas. The British Museum has three marked types labelled "Mitra rosettæ, Angas, Encounter Bay, South Australia. Pres. G. F. Angas, 70/10/26." A clear distinction between the two lies in the sculpture. The spiral grooves of *M. rosettæ* are widely spaced, like those of *M. solida,* but the grooves of *badia* are very fine and crowded.

Mitra rhodia Reeve.

Mitra rhodia Reeve, Conch. Icon., ii., 1845, Pl. xxviii., fig. 225; *Id.,* Marrat, Journ. of Conch., i., 1877, p. 244; *Id.,* Watson, Chall. Zool., xv., 1886, p. 246; *Id.,* Brazier, Journ. of Conch., vi., 1889, p. 67.

In the British Museum are two shells marked "Type Mitra rhodia Reeve, Sydney, M.C. Mr. Strange, Sydney, under stones." This species is like *M. carbonaria,* but is smaller, more slender, and lacks the orange sutural line. The types of *rhodia* and *badia* are nearly the same length, but *rhodia* has two more whorls, and two-thirds the breadth of *badia.* The spiral incised lines of *badia* are much closer. *M. rhodia* is smaller than *M. cookii,* and, apart from difference in colour, *cookii* is more contracted at the base.

Brazier has noted that Angas mistook *M. badia* for *M. rhodia,* which explains the omission of this species from the latter's lists of Port Jackson mollusca. The original habitat was confirmed by the Challenger Expedition. There are, in London, two examples of *M. rhodia* from the Tamar Heads, Tasmania. But Marrat's record of this species from West Africa, needs only be mentioned for rejection.

---

* Tate and May, These Proceedings, xxvi., 1901, p. 360.

MITRA COOKII Sowerby.

Mitra cookii (Hanley, MS.) Sowerby, Thes. Conch., iv., 1874, p. 7, Pl. 354, fig. 228.

This shell has not been localised hitherto more exactly than "Australia," and the name has escaped the attention of local collectors. It is, however, common about Sydney, and is evidently the species erroneously recorded by Angas* as *Mitra variabilis* Reeve. It also occurs at Caloundra, Queensland. In the British Museum are two, marked "type, cookei, Sowerby, Australia." These are slender, 35 mm. long, encircled with fine punctate striæ, colour chocolate-ochraceous with a pale median zone.

MITRA LEGRANDI Tenison-Woods.

Mitra legrandi Ten.-Woods, Proc. Roy. Soc. Tasm., 1875, p. 140; *Id.,* Hedley, Rec. Austr. Mus, iii., 1900, p. 219, text-fig.

It has been considered by Tate, May, Pritchard, and Gatliff,† that *M. legrandi* Ten.-Woods is identical with *M. schomburgki* Angas. As *M. legrandi* dates from 21st March 1876, and *M. schomburgki* from 1st August, 1878, the name of Tenison-Woods should take precedence were they united. But, for the following reasons, I consider them distinct.

In the British Museum are two, marked "Types, Mitra schomburgki, Angas, South Australia and Port Phillip. Pres. G. F. Angas, 78/4/10." Again, in the same collection, is one marked "Type Mitra legrandi T. Woods, Tasmania." The latter agrees exactly with my figure, and differs from *M. schomburgki* in form, colour, and sculpture. *M. schomburgki* is more contracted at the base, has more ribs, and wants the peripheral colour-line of *M. legrandi.*

Three specimens from South Australia, presented to the British Museum by G. F. Angas, are determined as *M. analogica* Reeve,‡

* Angas, Proc. Zool. Soc. 1871, p.89.

† Tate and May, These Proceedings, xxvi., 1901, p.361; May, Proc. Roy. Soc. Tasm., 1902(1903), p.108; Pritchard and Gatliff, Proc. Roy. Soc. Vict., xi., 1899, p.189.

‡ Reeve, Conch. Icon. ii., 1845, Mitra, Pl.35, fig.293.

These agree with two specimens, subsequently presented by Angas, being the actual types of *Mitra tatei* Angas. I did not see the type of *M. analogica*, and am not prepared to reduce *tatei* to a synonym of that species. Attention is drawn to the subject for future examination.

Mitra sculptilis Reeve.

Mitra sculptilis Reeve, Conch. Icon. ii., 1845, Pl. xxxv., fig. 290.

Mitra delicata A. Adams, Proc. Zool. Soc., 1852, (1853), p. 137; *Id.*, Hedley, These Proceedings, xxxiii., 1908, p. 484, Pl. vii., fig. 1.

In his original description, Adams reported *M. delicata* as dredged by Jukes in 8 fathoms, off Cape York. The Challenger Expedition reported *M. sculptilis* from 3-12 fathoms, off Cape York. In the British Museum, *M. sculptilis* is represented by two, probably types but not so marked. These are identical with the shell I figured for *delicata*, which name should be dropped in synonymy.

Mitra scitula A. Adams,* has similar sculpture, but is smaller and more fusiform. Another relation is *M. obeliscus* Reeve.

Mitra hebes Reeve.

Mitra hebes Reeve, Conch. Icon., ii., 1845, Pl. 35, fig. 292; *Id.*, Brazier, These Proceedings, i., 1877, p. 209.

Mitra hamillei Petit, Journ. de Conch., ii., 1851, p. 259, Pl. vii., fig. 9.

In the British Museum are three types, so marked, of *M. hebes.* Beneath this tablet is noted "= M. hamillei, Petit, Journ. Conch. ii., 1859, t. 7, f. 9. Cape Verd Is., Petit, 1851: Whydah, N.C. of Africa, Capt. Knocker; Angola, Ausorge." In view of this statement, it appears as if the ascription, by Brazier, of *M. hebes* from Darnley Island, was wrong, and that the mention of "Mitra hainillei Petit" by Shirley from Cardwell, Queensland, was also an error,† as was afterwards acknowledged.

---

* Schepman, Siboga Prosobranchiata, 1911, p.285, Pl.xxii., fig.8.

† Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p.101; xxiv., 1913, p.56.

Cantharus subrubiginosus Smith.

Tritonidea subrubiginosa Smith, Proc. Zool. Soc., 1879, p. 206, Pl. xx., fig. 40; *Id.,* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxi., 1908, p. 371.

Pisania bednalli Sowerby, Proc. Mal. Soc., 1895, p. 215, Pl. xiii., fig. 6.

Tritonidea fusiformis Verco, Trans. Roy. Soc. S.A., xx., 1896, p. 219, Pl. 6, fig. 1

From comparison of the types, in the British Museum, of *Tritonidea subrubiginosa* Smith, and of *Pisania bednalli* Sowerby, I find but slight difference, the latter being apparently a geographical race of the former. The Japanese form is a little more coarsely sculptured, and a little larger than the West Australian *bednalli.* There are two species, reported from Australia, but not recognised by subsequent authors, *Purpura glirina* Blainville, and *Buccinum discolor* Kiener, which seem suspiciously like the above.*

Pisania delicatula Sowerby.

Pisania delicatula Sowerby, Journ. of Malac., viii., 1901, p. 101, Pl. 9, fig. 2.

This was described as from "Bird Island, South Pacific." To show how insufficient a direction this is, I remark that there are no less than ten Bird Islands off the Australian coast. From the type of *P. delicatula* in the British Museum, I matched the species as a rare shell from East Australia. I suppose that the type-locality is Bird Island, near Newcastle, N. S. Wales, in S. lat. 33° 15′. It also occurs at the Bunker Group, South Queensland.

Phos terebra Sowerby.

Phos terebra Sowerby, Thes. Conch., iii., 1859, p. 92, Pl. 222, figs. 28, 29.

This species was originally described from Sydney, but has never been seen by any subsequent collector, and should be rejected as exotic. In the British Museum there are two, probably types, but

*Blainville, Nouv. Ann. Mus. i., 1832, p.254, Pl. xii., fig.9; Kiener, Coq. Viv., Buccinum, 1834, p.28, Pl. ii., fig.39.

not so marked, labelled "terebra, Sowb., Sydney, M.C." These I identify as the young of *Phos roseatus* Hinds.

Mörch regards *P. roseatus* Hinds, as *Triton turritus* Menke.*

NASSARIA CURTA Gould.

Nassaria curta Gould, Proc. Boston Soc. Nat. Hist., vii., 1860, p. 328.

No figure of this has appeared. Subsequent literature consists of references to, or repetitions of the above. The type, said to have been gathered by W. Stimpson in Port Jackson, is apparently lost, and I, therefore, recommend that the name be abandoned as unrecognisable. This must not be confused with *Nassa curta* Gould, 1850, acknowledged to be a synonym of *N. horrida* Dunker.

NASSA DECUSSATA Kiener

Buccinum decussatum Kiener, Coq. Viv., Buccinum, 1841, p. 109, Pl. xxx., fig. 3.

Nassa decussata A. Adams, Proc. Zool. Soc., 1851, (1852), p.111; *Id.*, Reeve, Conch. Icon., viii., 1853, Pl. xviii., fig. 121; *Id.*, Angas, Proc. Zool. Soc., 1877, p. 180.

In the British Museum are two specimens, labelled, "decussata Kien., Brisbane Water;" and beneath the tablet is added "Atlantic shores of Africa, Kiener, Coq. Viv." As the species has not again been reported from Australia, it is likely that the statement of Adams, repeated but not confirmed by Reeve and Angas, that Strange obtained *N. decussata* in New South Wales, is without foundation.

ARCULARIA COMPACTA Angas.

Nassa compacta Angas, Proc. Zool. Soc., 1865, p. 154.

In the British Museum are four marked types of "compacta, Angas, S. Australia, G.F. Angas, pres., 70/10/26." The locality is supported by four shells from Adelaide, presented by Mrs. Bowyer. This species of Angas has been, in error, reduced to a synonym of *N. paupera* Gould, by Tate and May; and of *N. rufocincta* A.

---

* Mörch, Malak. Blatt., xviii., 1871, p.126; Menke, Verzeichn. Conch. Malsburg, 1828.

Adams, by Pritchard and Gatliff.* The type of *N. rufocincta* A. Adams, in the British Museum, is thrice as long, and more coarsely sculptured than *A. compacta,* and the locality given for it is Honduras. Brazier has already pointed out that Angas made a mistake in recording *N. rufocincta* from Sydney.† Angas was followed by Tenison-Woods, who mentioned *N. rufocincta* from Bass Straits.‡ Dr. Shirley has ascribed *compacta* to Bowen, Queensland, where it is unlikely to occur.§ This locality provided the same writer with several fictitious records.

I now regret that I did not obtain a drawing of the type of *compacta.*

Nassa reposta Gould.

Nassa reposta Gould, Proc. Boston Soc. Nat. Hist., vii., 1860, p. 323.

I failed to find an example of this in any Museum. The species has not been figured or recognised by any subsequent writer. It is suggested that the name can be abandoned as that of a lost character.

Pyrene peroniana *nom.mut.*

Columbella bicincta Angas, Proc. Zool. Soc. 1871, p. 89, Pl. i., fig. 3; Not *C. bicincta* Gould, Proc. Bost. Soc. Nat. Hist., vii., 1860, p. 335, = *C. planaxiformis* Sowerby, Proc. Malac. Soc., i., 1894, p. 153, Pl. xii., fig. 1.

In the British Museum are two, marked as types of *Columbella bicincta* Angas. These do not support the assertion by Tryon, Kobelt, and others that this Sydney shell should be called *C. eximia* Reeve. This latter has been recognised by Hervier from Lifu, and differs by smaller size and orange ground-colour. The two species

* Tate and May, These Proceedings, xxvi, 1901, p.359; Pritchard and Gatliff, Proc. Roy. Soc. Vict., x., 1898, p.280.

† Brazier, Journ. of Conch., vi., 1889, p.66; and These Proceedings, xii., 1888, p.996.

‡ Tenison-Woods, Proc. Roy. Soc. Tasm., 1877, p.29.

§ Shirley, Proc. Roy. Soc. Q'land, xxiv., 1913, p.56.

are alike in having a pair of snow-flake rings, but *eximia* has flat whorls and a straight or concave spire, whereas *peroniana* has a convex profile and rounded whorls. *P. peroniana* has a peculiar epidermis frilled in thin radial lamellæ, at the rate of about forty to a whorl. *Columbella nycteis* Chenu,* a smaller form, rather differently coloured, from an unknown locality, makes a near approach to the Sydney shell. *P. peroniana* extends to Lord Howe Island. As the species proves to be distinct, and the name to have been pre-occupied by Gould, the choice of a new name becomes a necessity.

PYRENE FILMERÆ Sowerby.

Columbella filmeræ Sowerby, Proc. Malac. Soc., iv., 1900, p. 3, Pl. i., fig. 8; *Id.*, Shirley, Proc. Roy. Soc. Q'sland, xxiii., 1911, p. 101.

This African shell was reported by Dr. J. Shirley from Torres Strait. With the type in the British Museum, I identified a specimen taken by Mr. J. Brazier at the entrance of the Nambuccra River, N.S.Wales.

PYRENE ACUMINATA Menke.

Buccinum acuminatum Menke, Moll. Nov. Holl., 1843, p. 20.

Columbella menkeana Reeve, Conch. Icon., xi., 1858, Pl. xiv., fig. 69.

Pyrene menkeana Verco, Trans. Roy. Soc. S.A., xxxiv., 1910, p. 128.

Reeve replaced Menke's name by another, on the ground that it was preoccupied. But this was not the case, and Menke's prior name should be restored.

PYRENE DUCLOSIANA Sowerby.

Columbella duclosiana Sowerby, Proc. Zool. Soc., 1844, p. 48; *Id.*, Thes. Conch., i., 1844, p. 113 bis, Pl. xxvi., figs. 15, 16; Not *C. duclosiana* D'Orbigny, in Sagra, Hist. Isla Cuba, v., 1845, p. 232, Pl. xxi., fig. 31-3.

---

* Chenu, Illustr. Conch., Columbella, 1846, Pl.17, figs.5-6.

Except in my catalogue of the marine mollusca of Queensland, this species has not been reported as Australian. A specimen, which I took at Mapoon, in the Gulf of Carpentaria, is inseparable from a series from Singapore, kindly sent to me by Mr. J. R. Le B. Tomlin.

Dr. W. H. Dall remarks that *C. duclosiana* was proposed by Sowerby for an Oriental species, and by D'Orbigny for an American species. Giving the date for the former as 1847, and for the latter as 1845, he suggests that the Oriental species requires a new name. Pace, however, has shown, that the Malayan dates from 1844 and that consequently it is D'Orbigny's name which is latest.*

PYRENE TAYLORIANA Reeve.

Buccinum parvulum Dunker, Zeitschr. f. malak., 1847, p. 64; *Id.*, Philippi, Abbild. Beschr., iii., 1849, p. 65, Pl. ii., fig. 7; Not *Buccinum parvulum* Grateloup, 1833.

Columbella tayloriana Reeve, Conch. Icon. xi., 1859, Columbella, Pl. 35, fig. 225.

C. albomaculata Angas, Proc. Zool. Soc., 1867, p. 111, Pl. 13, fig. 5; Id., Watson, Chall. Rep. Zool., xvi., 1886, p. 234.

In the British Museum are two shells, marked type, labelled "tayloriana Reeve, C.I. f. 225a, b. N.W. Australia. Pres. Mrs. T. Lombe Taylor, 74/12/11." With these agree exactly nine, marked type, "albomaculata, Angas, Port Jackson, Pres. G. F. Angas, 70/10/26." In view of the close correspondence between these sets, I judge that the locality of N.W. Australia is false, and that all came from Sydney. Besides Gaskoin, the former owner of the *tayloriana* types, has misreported some New South Wales *Marginella* as from N.W. Australia. Watson's remarks on this species, in the Challenger Report, seem to me to be quite erroneous. Dunker, who obtained several unlocalised Sydney shells, has evidently figured this as his *B. parvulum*, but as that was preoccupied, his name has but an historical interest.

---

* Dall, U.S. Fish Commission, Bulletin, 1901, p.405; Pace, Proc. Malac. Soc., v., 1902, p.77.

PYRENE ALIZONÆ Melvill & Standen.

Columbella (Mitrella) alizonæ Melvill & Standen, Proc. Zool. Soc., 1901, p. 402, Pl. xxi., fig. 5.

This species has not hitherto been recognised in Australia. By comparison with authentic specimens from the Persian Gulf, I have identified two specimens collected by myself on the western beach at Dunk Island, Queensland; and one from the Six-mile beach, Port Stephens, N. S. Wales, received from Mr. J. Brazier.

PYRENE BEDDOMEI Petterd.

Columbella attenuata Angas, Proc. Zool. Soc., 1871, p. 14, Pl. i., fig. 4; Not *Columbella attenuata* Beyrich, 1854, Pace, Proc. Malac. Soc., v., 1902, p. 57.

Terebra beddomei Petterd, Journ. of Conch., iv., 1884, p. 142.

In the British Museum are five *attenuata* from Sydney, presented by Angas in 1871, and, therefore, probably types, but not so marked. Pace shows that this name was previously used by Beyrich in 1854, so it becomes necessary to revive Petterd's name, *T. beddomei*, generally acknowledged as a synonym.

PYRENE ACLEONTA Duclos.

Columbella acleonta Duclos, Monog. Columbella, 1840, Pl. xi., fig. 3, 4; *Id.,* Chenu, Illust. Conch. Columbella, Pl. xi., fig. 3, 4, (length mark added), 1846; *Id.,* Pace, Proc. Mal. Soc., v., 1902, p. 48.

Columbella jaspidea Sowerby, Proc. Zool. Soc., 1844, p. 50; *Id.,* Thes. Conch., i., 1844, p. 132 bis, Pl. xxxix., fig. 125; *Id.,* Reeve, Conch. Ic., xi., 1858, Pl. xvii., fig. 90; *Id.,* Kobelt, Conch. Cab., iii., 1893, p. 131, Pl. xix., figs. 5-8; *Id.,* Hervier, Journ. de Conch. xlvii., 1899, p. 356; *Id.,* Shirley, Proc. Roy. Soc. Q'sland, xxiii., 1911, p. 101.

Columbella plicaria Montrouzier, Journ. de Conch., x., 1862, p. 234, Pl. ix., fig. 3; *Id.,* Brazier, Journ. of Conch. ii., 1879, p. 188; *Id.,* Pace, Journ. de Conch, l., 1902, p. 419; *Id.,* Smith, Fauna Maldive Lacc. Arch. ii., 1906, p. 608.

As *C. plicaria*, Brazier recorded from Fitzroy Island, a species not previously noted as Australian. Smith and Pace state that *C. plicaria* is merely a variety of *jaspidea*. I now suggest that the latter is a synonym of the long-lost *C. acleonta* Duclos. If von Martens was correct in referring the related *C. marquesa* Gaskain to *Daphnella*,* then the present species will probably accompany it. I have collected *C. acleonta* on Murray and Palm Islands, and have seen it from Bungaree Norah, N.S.Wales.

PYRENE PUNCTATA Bruguière.

Buccinum punctatum Bruguière, Ency. Méth. Vers, i., 1789, p. 281, Pl. 374, figs. 4, a, b.

Voluta discors Gmelin, Syst. Nat. xiii., 1791, p. 3455, for Martini iv., Pl. 150, fig. 1405.

Pyrene rhombiferum Bolten, Mus. Bolt., 1798, p. 134, for Martini, ii., Pl. 44, fig. 465.

Columbella semipunctata Lamarck, Anim. s. vert. vii., 1822, p. 294; *Id.*, Brazier, Journ. of Conch., ii., 1879, p. 188.

Columbella discors Kobelt, Conch. Cab. iii., 1897, p. 18, Pl. ii., figs. 17, 18; *Id.*, Dautzenberg, Journ. de Conch. lviii., 1910, p. 27.

Pyrene discors Shirley, Proc. Roy. Soc. Q'sland, xxiii., 1911, p. 101.

Under the name of *Columbella semipunctata*, this was first reported as Australian by Brazier, who found it on Fitzroy Island. Shirley reported it from Bowen. I have found it on Mornington Island, Gulf of Carpentaria, and have seen it from Port Essington, Northern Territory. Following the suggestion of Deshayes, museums and monographs have generally but erroneously preferred the name of Gmelin to that of Bruguière. This species is the type of the genus *Pyrene*, which can be maintained apart from *Columbella*. The latter has, for its type, the common West Indian *C. mercatoria* Linné, which Dr. Shirley pretends to occur at Bowen, Queensland.

---

* Von Martens, Fauna Mauritius, 1880, p.228.

Pyrene vittata Reeve.

Columbella vittata Reeve, Conch. Icon., xi., 1859, Pl. xxx., fig. 192.

C. vincta Tate, Trans. Roy. Soc. S.A., xvii., 1893, p. 190, Pl. i., fig. 11; *Id.,* Pritchard & Gatliff, Proc. Roy. Soc. Vict. xi., 1899, p. 202; *Id.,* May, Proc. Roy. Soc. Tasm., 1902, (1903), p. 109; *Id.,* Verco, Trans. Roy. Soc. S.A., xxxiv., 1910, p. 133.

In the British Museum there is one *C. vittata,* perhaps type, but not so marked, labelled, "Isle of Luzon, Philippines, stones low water, H.C." Again, there are three shells, not types, labelled "vittata Reeve, Oyster Cove, V.D.L., Joseph Milligan, Esq." The Philippine habitat is repeated but not confirmed by Hidalgo. Milligan's specimens are certainly *C. vincta* of Tate. A series of *C. roblini* Tenison-Woods from Kelso, Tasmania, presented by J. H. Ponsonby, seem similar.

Pritchard and Gatliff have placed *C. vincta* as a synonym of *C. nubeculata* Reeve, but the type of *nubeculata,* in the British Museum, has a prominent tubercle at one-third the length of the aperture, is less than half the length, and altogether unlike *vincta.* Probably *C. nubeculata* is not an Australian species. Their error has misled Dr. Verco also.

With *C. vincta,* May has identified *C. irrorata* Reeve. But the type of that, in the British Museum, is equally distinct, being twice the length of *C. vincta,* and very sharply pointed.

Pyrene pulla Gaskoin.

Columbella pulla Gaskoin, Proc. Zool. Soc., 1851 (1852), p. 6; *Id.,* Reeve, Conch. Icon. xi., 1858, Pl. xix., fig. 106; *Id.,* Angas, Proc. Zool. Soc., 1867, p. 195.

In the British Museum are five "pulla Gask., Australia, Strange, M.C." This species is about half an inch long, rather elongate-conical, purplish-brown with a buff snout, the latter delicately and obliquely grooved. Another set of fifteen labelled "pulla Gask. (?), Oyster Cove, V.D. Ld., Joseph Milligan, Esq.," are *P. tenebrica,* by comparison with the type of that species. The latter differs by being smaller, two-thirds the length of *pulla*; it has not the pale snout of *pulla*, but has faint longitudinal stripes. This species has not, I think, been recorded for Tasmania.

But *C. pulla* is nothing like *Columbella nux* Reeve, with which Tryon, Pritchard and Gatliff, have associated it. I saw the type of *C. nux*, which may be described as a worn and monochrome specimen of *C. infumata* Crosse. On the other hand, *C. badia* Ten.-Woods seems to be a variety of *C. pulla*, as it was considered by those authors.

ÆSOPUS AUSTRALIS Angas.

Truncaria australis Angas, Proc. Zool. Soc., 1877, p. 172, Pl. xxvi., fig. 5.

According to the arrangement adopted in the British Museum, *Truncaria australis* Angas, is transferred to the genus *Æsopus*. In this change it is accompanied by *Columbella plurisulcata* Reeve. What appears to be a large form of *Æ. australis*, from Singapore, has been sent to me by Mr. H. B. Preston. Dr. Dall has indicated that the genus *Truncaria* should be restricted to the type-species, *T. filosa* Ad. & Reeve,* and another described by himself.

ÆSOPUS CUMINGI Reeve.

Columbella cumingi Reeve, Conch. Icon. xi., 1859, Pl. xxv., fig. 156; *Id.*, von Martens, Fauna Mauritius, 1880, p. 248, Pl. xx., fig. 11.

Specimens from Caloundra, Queensland, were compared with the types of Reeve's species from the Philippine Islands. The Australian shells are half the length of the types. In the Philippine specimens, the filleted bands of brown and orange are more distinct than in the Australian examples. The sculpture and other details correspond, and the two are, I think, specifically identical. As a local race, the Caloundra form may be distinguished as var. *queenslandica*, var.n.

ZAFRA A. Adams.

Zafra A. Adams, Ann. Nat. Hist., (3), iv., 1860, p. 331. Type *Z. mitriformis*, Smith, Proc. Zool. Soc., 1879, p. 209. Not *Zafra* H. Adams, Proc. Zool., 1872, p. 14.

---

* Dall, Bull. Mus. Comp. Zool., xliii., 1908, p.304.

This genus has been neglected and misunderstood. Here H. Adams referred a new species, *Zafra pupoidea,* thereby misleading Nevill, Fischer, and Tryon to transfer *Zafra* to the Pleurotomidæ, with *Z. pupoidea* for type. But H. Adams emphasised his own error by noting that *Seminella* of Pease [type, *Columbella garretti,* Tryon] was equivalent to *Zafra.* Another name for "the minute ribbed Columbellidæ occurring in the Indo-Pacific region" is *Citharopsis* Pease, type *Columbella lachryma* Reeve. (*Mitra lachryma* Reeve, 1845 = *Columbella pamila* Chenu, 1848.)

It was suggested to me, by Mr. Tom Iredale, that *Zafra* could be suitably employed for certain Australian shells. Accordingly I propose to transfer to it the following species:—

Columbella abyssicola Brazier, 1877.
Mangilia atkinsoni Ten.-Woods, 1876.
Pyrene beachportensis Verco, 1910.
Columbella darwini Angas, 1877.
Columbella digglesi Brazier, 1874.
Pyrene dolicha Verco, 1910.
Pyrene fenestrata Verco, 1910.
Columbella franklinensis Gatliff & Gabriel, 1910.
Columbella fulgida Reeve, 1859.
Col. gowlandi Brazier, 1874.
Pyrene jaffaensis Verco, 1910.
Col. legrandi T.-Woods, 1876.
Pyrene lurida Hedley, 1907.
Col. melvilli Hedley, 1899.
Col. peasei Mart. & Langk., 1871.
Col. regulus Souverbie, 1863.
Col. renwoensis Gat.&Gab., 1910.
Col. russelli Brazier, 1874.
Col. smithi Angas, 1877.
Col. troglodytes Souverbie, 1866.

Zafra fulgida Reeve.

Columbella fulgida Reeve, Conch. Icon. xi., 1859, Pl. xxviii., fig. 178.

C. interrupta Angas, Proc. Zool. Soc., 1865, p.56, Pl. ii., fig.9-10.

Pyrene angasi Verco, Trans. Roy. Soc. S.A., xxxiv., 1910, p.137.

In the British Museum, I found four, labelled, "type, fulgida Reeve, Conch. Ic. xi., sp. 178, Port Lincoln;" also thirteen "Columbella minuta Gaskoin, = C. fulgida Reeve, C.I. sp. 179, Adelaide, Australia." Both tablets certainly represent a species universally known in Australia, as *Columbella angasi* Brazier. The localities of the types of *fulgida* and *interrupta* (= *angasi*) are but a few miles apart. Gaskoin never published *C. minuta.*

Reeve's figure of *C. fulgida* is so poor that, without the aid of the actual type, I did not recognise it. No intimation is given that the figure of *C. fulgida* is enlarged, but on the same plate, and also without notice of enlargement, are *rorida* Reeve, *lunata* Say, and *diminuta* Adams, each in nature about 5 mm. long, and magnified three or four diameters. This agrees with the presumption that *C. fulgida* is also enlarged four diameters. The drawing of *C. fulgida* is too slender, and the number of whorls are incorrectly indicated. But the same errors are repeated in the case of *rorida* immediately above *C. fulgida.*

RETIZAFRA, subgen.nov.

For some small "Columbella" which do not quite conform to *Zafra,* I suggest a division *Retizafra.*

In size and form they correspond, but differ by clathrate sculpture. Also the *Retizafra* usually inhabit deeper water. Type, *Pyrene gemmulifera* Hedley, 1907. Other members are *Pyrene calva* Verco, 1910; *Pyrene intricata* Hedley, 1912; *Columbella plexa* Hedley, 1902; and the Lifuan *Columbella brevissima* Hervier, 1899.

MUREX SEROTINUS A. Adams.

(Plate xix., figs. 78, 79.)

Murex serotinus A. Adams, Proc. Zool. Soc., 1851,(1853), p.268; *Id.,* Angas, Proc. Zool. Soc., 1865, p. 154; *Id.,* Sowerby, Thes. Conch., iv., 1879, Murex index, p. 54; *Id.,* Tryon, Man. Conch., ii., 1880, p. 135; *Id.,* Verco, Trans. Roy. Soc. S.A., xix., 1895, p. 96.

Under the name of *Murex serotinus* A. Ad., three species are exhibited in the British Museum. The first (my fig. 78), a lot of four, is marked type "Murex serotinus, A. Ad., P.Z.S.,1851, p. 268, Hab. (?), M.C." The second (my fig. 79), is marked "(?) serotinus A. Ad., Aldinga. From the Colln. of H. Adams."

As Dr. Verco remarked, "No other collectors have taken it in Australia," the inference being that the species is exotic. It would, therefore, be a convenient riddance to accept Sowerby's reference of *serotinus* to the Mediterranean *Muricopsis blainvillei* Payraudeau, though the British Museum specimens of that protean species do not exactly correspond.

MUREX ACANTHOPTERUS Lamarck.

Murex acanthopterus Lamarck, Anim. s. vert., vii., 1822, p. 165; Encyl. Méth., Pl. 417, fig. 2.

Murex saibaiensis Melvill & Standen, Journ. Linn. Soc., Zool. xxvii., 1899, p. 161. Pl. x., fig. 1.

In the British Museum is one specimen marked as the type of *M. saibaiensis*, from Torres Straits, which corresponds to others labelled *M. acanthopterus*. And in the Geneva Museum, I found Lamarck's type of *M. acanthopterus* still preserved. Comparing the shell of Lamarck with the illustration of Melvill and Standen, I found that the shell from Torres Straits was half the length of Lamarck's type, but otherwise identical. By Lamarck's name, the species was previously reported from Torres Strait by the Challenger Expedition. The name should be ascribed to Lamarck, not, as is sometimes done, to Schroeter.

TROPHON PETTERDI Crosse.

Trophon petterdi Crosse, Journ. de Conch., xviii., 1870, p. 303; xix., 1871, p. 324, Pl. 12, fig. 2; *Id.*, Pritchard & Gatliff, Proc. Roy. Soc. Vict., x., 1898, p. 256; *Id.*, Sykes, Proc. Malac. Soc., iv., 1900, p. 39.

Murex pettardi Sowerby, Thes. Conch., iv., 1879, p. 48, Pl. 403, fig. 255.

Under the genus Murex, I found, in the British Museum, two shells labelled "Pettardi Brazier, Tasmania. From the Colln. of H. Adams, acquired 78 1/28." Mr. E. A. Smith agreed that this was the original of Sowerby's figure. This, as Pritchard and Gatliff have already noted, should be included in the synonymy of Crosse's species. *M. cristatus* Brocchi has been unfortunately associated with *T. petterdi* by Mr. Sykes.

CRASPEDOTRITON SPECIOSUS Angas.

Murex scalarinus A. Adams, Proc. Zool. Soc., 1863, p. 508; Not *Murex scalarinus* Bivona, Gen. e sp. Moll., 1832, p. 27, Pl. iii., fig. 11.

Triton speciosus Angas, Proc. Zool. Soc., 1871, p. 13, Pl.i., fig.7; *Id.*, Kesteven, These Proceedings, xxvi., 1902, p. 713, Pl. xxvi., figs. 10, 11, and xxvii., 1902, p. 479, fig. 3.

Trophon eburnea Petterd, Journ. of Conch.,iv., 1884, p.142; *Id.*, Pritchard & Gatliff, Proc. Roy. Soc. Vict., x., 1898, p. 258; *Id.*, Tate & May, These Proceedings, xxvi., p. 357, text-fig. 1.

In the British Museum are exhibited a series of three, marked "types, scalarinus A. Adams, P.Z.S., 1863, p.508, = Triton(Cumia) speciosa Angas, P.Z.S., 1871, p. 13, Pl. i., f. 7. Port Jackson." Beside these, another series of three, the types of *speciosa*, are marked "= scalarinus A. Adams."

It was characteristic that A. Adams should fail to observe that the *Triton speciosus* of his literary partner Angas, was his own *Murex scalarinus*. Having left his species, in the wrong genus, unfigured, unlocalised, known and knowable only to those who saw the type, Arthur Adams fortunately crowned his work by the adoption of a preoccupied name. Hence we are relieved from the necessity of following the British Museum procedure, and abolishing the well-worn name of *speciosus*.

Under the genus *Craspedotriton* Dall, the British Museum includes this species in association with *convolutus* Brod., and *scalariformis* Brod. While agreeing with the reference to *Craspedotriton*, I would suggest that the information on the apex, radula, and operculum of *speciosus*, supplied by Kesteven, supports a transference of Dall's genus from the neighbourhood of Triton to that of Trophon. Petterd's *T. eburnea* represents a comparatively smooth southern form of *C. speciosus*.

Craspedotriton fimbriatus Lamarck.

Murex fimbriatus Lamarck, Anim. s. vert., vii., 1822, p. 176; *Id.*, Deshayes, op. cit. (2), ix., 1843, p. 599. Reeve, Conch. Icon., iii., 1846, Ricinula, sp. 28.

Murex planiliratus Reeve, Conch. Icon., iii., 1845, Pl. 31, fig.149; *Id.*, Hedley, These Proceedings, xxvi., 1902, p. 700.

Deshayes has commented on the loss of the identity of this species, which, after a disappearance of ninety years, it is my good fortune to restore to its proper position. Conchological science is indebted to the administration of the Geneva Museum for the admirable care with which the Lamarckian collection is preserved. The types of *M. fimbriatus* consist of two specimens, one perfect, the other incomplete. Contrasting, in the Geneva Museum, the former with Reeve's plate, I found it to correspond exactly.

In the British Museum, I saw three, perhaps types, but not so marked, labelled "planiliratus Reeve, Swan R., M.C." In London, I also saw one, marked type "Murex polypleura Brazier, Port Lincoln, S. Australia. Pres. J. Brazier, 95/3/7." Again, one as type of Brazier's pink variety. I have already noted the identity of *polypleurus* and *planiliratus*.

Craspedotriton pholidotus Watson.

Murex pholidotus Watson, Journ. Linn. Soc. Zool., xvi., 1883, p. 62; Chall. Zool., xv., 1886, p. 158, Pl. x., fig. 3.

(?) *Fusus cereus* Smith, Zool. Coll. Alert, 1884, p. 46, Pl. v., fig. D.

It is now suggested that *Murex pholidotus* Watson, may also be added to *Craspedotriton*. Perhaps *Fusus cereus* Smith, is identical with that Challenger species. The material in the British Museum under these names is not sufficient to reach a satisfactory conclusion. Perhaps *Murex brazieri* Angas, should also be inserted in this genus.

Trophon recurvus Philippi.

Fusus recurvus Phil., Abbild. Beschr., ii., 1846, p. 119, Fusus, Pl. iii., fig. 6.

Trophon paivæ Crosse, Journ. de Conch., xii., 1864, p. 278, Pl. xi., fig. 7; *Id.,* Tryon, Man. Conch., ii., 1880, p. 155.

By Tryon, *T. paivæ* Crosse was united to *T. hanleyi* Angas, a decision which has misled Australian collectors. In the British Museum are six specimens marked type "Trophon paivæ Crosse, York's Peninsula, South Australia. Pres. G. F. Angas, 70/10/26." There are also five shells marked type, and labelled "Fusus hanleyi Angas, P.Z.S., 1867, p. 110, Pl. xiii., fig. 1. Pres. G. F. Angas, 70/10/26." Not only are these two clearly distinct, but *T. paivæ* so closely agrees with other specimens determined as *T. recurvus* Koch, that I consider that the name given by Crosse should be regarded as a synonym of *T. recurvus*. Probably when Prof. Hutton* wrote that *Trophon paivæ* belonged to his new genus *Kalydon*, he intended to refer to *T. hanleyi*.

KALYDON VINOSUS Lamarck.

Buccinum vinosum Lamarck, Anim. s. vert. vii., 1822, p. 275.

Ricinula adelaidensis (var.) Crosse & Fischer, Journ. de Conch. xiii., 1865, p. 50, Pl. ii., fig. 1.

Purpura littorinoides Ten.-Woods, Proc. Roy. Soc. Tasmania, 1875, p. 135.

No writer subsequent to Lamarck has identified this Australian species. In the Geneva Museum are three specimens, apparently cotypes of *Buccinum vinosum*. A note beneath the tablet, perhaps by Kiener or Chenu, remarks that these specimens do not conform to Lamarck's phrase, "labro intus striato."

By the kind help of Mr. W. L. May I sent a series of Tasmanian *R. adelaidensis*, exhibiting range of variation, to Geneva. From these my correspondent picked out a form representing *P. littorinoides* Ten.-Woods with the assurance that this perfectly corresponded to the Lamarckian types of *B. vinosum*. Other varieties of this species are represented by *Ricinula adelaidensis* Crosse & Fischer, *Cominella albolirata* T.-Woods and *Purpura propinqua* T.-Woods. Examples of the latter, which I gathered at Huskisson, Jervis Bay, mark the eastern limit of the species.

RAPA INCURVA Dunker.

Bulbus incurvus Dunker, Zeit. f. malak., 1852, p. 126; *Id.*, Novit. Conch, 1858, p. 17, Pl. v., fig. 34; *Id.*, Crosse, Journ. de Conch. xxxii., 1884, p. 12.

In the British Museum are two shells from "Raines islet, N.E.C. Australia, J. B. Jukes," and two "N. Australia, Mrs. Ince," in the labels of which "rapa" has been struck out, and "incurva Dkr."

* Hutton, Trans. N.Z. Inst., xvi., 1884, p.220.

substituted. Crosse has hinted that *incurva* may be but a variety of *R. rapa.* At any rate, typical *Rapa rapa* Linné (compared by Hanley to Kiener, Pyrula, Pl. xiv., fig. 2) also occurs in Queensland.

Rapana nodosa A. Adams.

(Plate xix., fig. 80.)

Rapana nodosa A. Adams, Proc. Zool. Soc., 1853 (1854), p. 98; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 192.

Latiaxis nodosa Gray, Ann. Mag. Nat. Hist. (3), xx., 1867, p. 78; Id., Brazier, Journ. of Conch., vi., 1889, p. 67; *Id.*, Sowerby, Thes. Conch., v., 1882, p. 4, Pl. 424, fig. 17; *Id.*, Pritchard & Gatliff, Proc. Roy. Soc. Vict., x., 1898, p. 262.

In the British Museum are two shells, which Mr. E. A. Smith identified as types of *R. nodosa.* These are said to be from the Philippines, and mounted with them is a larger (22 x 14 mm.) specimen from Port Jackson. Personally, I think that the Philippine locality is erroneous, and that all three are Sydney shells. Sowerby's figure in the Thesaurus is so unlike, that it might have been derived from another species. One of the original Cumingian pair, 20 mm. long by 11·5 mm. broad, is here figured.

On a single, immature, encrusted, and distorted shell, Pritchard and Gatliff based *Coralliophila wilsoni*,* from Port Phillip. This they afterwards united to *C. rubrococcinea* Melvill & Standen, from the Persian Gulf. The material I have examined is insufficient for a final conclusion, but I am disposed to consider that *C. wilsoni* will prove identical with *R. nodosa,* but distinct from *C. rubrococcinea.*

Coralliophila elaborata H. & A. Adams.

(Plate xix., fig. 81.)

Coralliophila elaborata H. & A. Adams, Proc. Zool. Soc., 1863, p. 433; *Id.*, Verco, Trans. Roy. Soc. S.A., xxxii., 1908, p. 344.

In the British Museum are three, probably types, but not so marked, labelled, "elaborata H. & A. Adams, Sandwich Is." From

---

*Pritchard & Gatliff, Proc. Roy. Soc. Vict., x., 1898, p.140, Pl. xx., figs.8, 9; and xxiv., 1911, p.193.

one of these, an inch broad, an inch and a half long, my figure is derived. Mr. J. C. Gabriel is responsible for including this as an Australian species. My figure does not well agree with the shell to which he referred.

Cassidula decussata H. & A. Adams.

(Plate xix., figs. 82, 83.)

Cassidula decussata H.& A. Adams, Proc. Zool. Soc.,1854(1855), p. 32.

This Australian species has not been previously figured. The present drawing is of one in a lot of three, in the British Museum, marked types. It is in length 12 mm., in breadth, 7 mm., and labelled "Cassidula decussata H. & A. Ad., P.Z.S., 1854, p. 32, Hab., Moreton Bay, M.C."

Cassidula sowerbyana Pfeiffer* has been confused both with *C. decussata* and *C. doliolum.* But, on assembling these notes, I find that I failed to observe their differential characters.

Cassidula doliolum Petit.

(Plate xix., fig. 84.)

Auricula doliolum Petit, Proc. Zool. Soc., 1842, p. 201.

Cassidula doliolum Pfeiffer, Cat. Auricul. in Brit. Mus., 1857, p. 83.

In the British Museum are three, perhaps types, but not so marked, labelled, "doliolum Petit, M.C." These are 9 mm. long, and 6 mm. broad. One of them is here represented.

An unnamed form of the same species is only marked "Australia." It is larger, viz., 13 mm. long, and 7 mm. broad, and has the colouring of *C. zonata,* from which a mucronate apex and four alternately larger and smaller denticles within the outer lip, distinguish it.

Leuconopsis pellucidus Cooper.

(Plate xix., fig. 85.)

Auricula pellucida Daniel Cooper, Microscopic Journ. i., Jan. 1841, p. 16; *Id.*, Pfeiffer, Cat. Auric. Brit. Mus., 1857, p. 109; *Id.*.

---

* Tapparone-Canefri, Ann. Mus. Genoa, xix., 1883, p.227, text-fig; and von Martens, Weber's Zool. Ergebnisse, iv., 1897, p.147, Pl. viii., fig.3.

H. & A. Adams, Proc. Zool. Soc., 1854 (1855), p. 11; *Id.*, Pfeiffer, Mon. Auric., p. 58; *Id.*, Gatliff, Victorian Naturalist, xxii., 1905, p. 16.

In the British Museum are four specimens mounted on a glass slide, presented by D. Cooper and evidently types. These were said to have been picked out of "sand from Van Diemen's Land." One of them is here figured.

Tenison-Woods, Tate, May, and Gatliff have assumed that *A. pellucida* is a synonym of *Marinula patula.* But the species proves to be a *Leuconopsis,* smaller than *L. inermis* Hedley. After comparison in the British Museum with all the other members of the genus except *L. victoriæ* Gatliff, which is absent from that collection, I found *L. pellucidus* distinct.

Probably this is the species catalogued by Tate and May as *"Ophicardelus minor"* from the Tamar Heads.

Ophicardelus sulcatus H. & A. Adams.

(Plate xix., fig. 86.)

Ophicardelus sulcatus H. & A. Adams, Proc. Zool. Soc., 1854 (1855), p. 34; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 231.

In the British Museum are five shells, which Mr. E. A. Smith considered to be types, marked, "Laim. sulcata H. & A. Ad., P.Z.S., 1854, New Zealand, M.C." This species, in some respects, is like *O. ornatus,* but it has a shorter spire, furrowed with spiral grooves, five on the last whorl and three on the penultimate. The shell is 14 mm. long, and 8 mm. broad.

Ophicardelus quoyi H. & A. Adams.

(Plate xix., fig. 87.)

Ophicardelus quoyi H. & A. Adams, Proc. Zool. Soc.,1854 (1855), p. 34; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 231.

Melampus quoyi Pfeiffer, Cat. Auricul. Brit. Mus., 1857, p. 37.

There are, in the British Museum, nine shells of this species, which Mr. E. A. Smith regarded as types, labelled Moreton Bay. These are 13 mm. long, and 7 mm. broad. One of them is here figured. I think that the species extends to New Zealand.

OPHICARDELUS STUTCHBURYI Pfeiffer.

(Plate xix., fig. 88.)

Melampus stutchburyi Pfeiffer, Proc. Zool. Soc., 1856 (1857), p. 393; *Id.*, Gassies, Faun. Conchyl. Nouv. Caled., 1871, p. 105; *Id.*, Brazier, These Proceedings, ii., 1878, p. 134.

This species is represented in the British Museum by a set of six, marked types, and labelled "Melampus stutchburyi Pfr., P.Z.S., 1856, p. 393. Mr. Stutchbury, M.C."

Gassies erroneously united this with the Tasmanian *O. ornatus*, but it is far closer to *O. sulcatus.*

These type-shells are 17 mm. long, and 9 mm. broad. In colour, they vary from brown with a narrow white line on the shoulder, to white with three revolving brown lines.

OPHICARDELUS ORNATUS Férussac.

Auricula ornata Férussac, Tab. Syst. 1821, p.103, fide Potiez & Michaud.

Auricula ovata Gray, Spicil. Zool., i., 1828, p.5, Pl.6, f.21; not *Auricula ovata* Lamarck, 1806.

Auricula australis Quoy & Gaim., Zool. Astrolabe, ii., 1832, p.169, Pl. xiii., figs.34-38; Crosse, Journ. de Conch., xlii., 1894, p.320.

Auricula bidens Potiez and Michaud, Gal. de Douai, i., 1838, p.201, Pl. xx., f.9-10.

Melampus tetricus Morelet, Journ. de Conch., xii.,1864, p. 290.

Ophicardelus irregularis Mousson, and *O. minor* Mousson, Journ. de Conch., xvii., 1869, pp.64, 65, Pl. v., figs.2, 3.

In the British Museum are three, marked type, labelled "*Mel. tetricus*, Morelet, Nlle. Galles du Sud. J.d.C., 1864, p.290." This unfigured species proves to be a squat variety of *O. ornatus.*

Judging from specimens from the type-locality, and from the figures and descriptions, I consider that *O. irregularis* and *O. minor* are abnormal or deformed specimens of *O. ornatus.*

Seeing that Quoy & Gaimard obtained their types of *O. australis* near Hobart and in Western Port, it is improbable that Crosse was correct in recording that from New Caledonia.

Leucotina pura A. Adams.

Monoptygma pura A. Adams, Thes. Conch., ii., 1854, p.820, Pl. 172, fig.23.

Leucotina esther Angas, Proc. Zool. Soc., 1867, p.116, Pl. xiii., fig.31.

In the British Museum, is a single shell, marked type, and labelled "pura A.Ad., Thes. ii., p.820, pl.172, fig.23." This is said to be from New Zealand, and is specifically identical with two marked type, and labelled "Leucotina esther Angas, Port Jackson, Pres. G. F. Angas, 70/10/26."

In general appearance this is like one in the British Museum, marked type of *Monoptygma concinna*, from Moreton Bay. In comparison with that, *L. esther* is shorter, broader, and has finer sculpture.

Leucotina amœna A. Adams.

Monoptygma amœna A. Adams, Proc. Zool. Soc. 1851 (1853), p.223; *Id.*, Thes. Conch., ii., 1854, p.818, Pl.172, fig.21.

Myonia amœna Cooke, Ann. Mag. N. H.(5), xvi., 1885, p.41.

Pyramidella amœna Dall & Bartsch, Proc. U. S. Nat. Mus., xxx., 1906, p.330, Pl. xix., fig.1.

Angas has recorded* *Myonia concinna* from Port Jackson. He presented to the British Museum the shell he thus named, which is now corrected to "Monopt. amoena A.Ad., var." A specimen of this species, which I obtained in Port Jackson, approaches nearer to Adams' Philippine type of *amœna* than the shell of Angas does.

Although the record by Angas of *L. concinna* from this State is thus shown to be incorrect, that species really inhabits our coast. Forbes had previously noted† "Monotigma" casta from Port Jackson, 6 fth. Mr. E. A. Smith‡ explains that in this genus, *casta* of Adams is anticipated by an earlier *casta* of Hinds, transferred from *Daphnella* to *Leucotina*. Therefore the synonymous *L. concinna* comes into service.

---

* Angas, Proc. Zool. Soc., 1867, p.225.

† Forbes, Voy. Rattlesnake, ii., 1852, p.365.

‡ Smith, Ann. Natal Mus., ii., 1910, p.183.

Perhaps the record by Angas* of *M. speciosa* A. Adams, from the Lane Cove, is another error for *amœna*.

RINGICULA DENTICULATA Gould.

Ringicula denticulata Gould, Proc. Bost. Soc. Nat. Hist., vii., 1860, p.325.

Ringicula caron Angas (not Hinds), Proc. Zool. Soc., 1871, p.98.

The original of Gould's description was obtained in Port Jackson by Dr. W. Stimpson, and is still preserved in the National Museum at Washington. In the British Museum are four exactly similar specimens, probably cotypes, labelled "R. denticulata, Otia, p.121, Port Jackson, M.C."

Angas has recorded *Ringicula caron* Hinds, as dredged by Brazier in 10 fathoms off Goat Island, Sydney Harbour. There is in the British Museum one, perhaps type, but not so marked, labelled "R. caron Hinds, P.Z.S., 1844, p 97, Str. of Malacca. M.C." This is smaller than *denticulata*, with widely spaced, engraved spirals, and sharply pointed spire. Angas presented, to the British Museum, the shell he had identified as *R. caron* Hinds. By comparison of the authentic material described above, this is certainly not *R. caron*, but is certainly *R. denticulata*. The record of Angas is, therefore, to be erased.

RINGICULA DOLIARIS Gould.

Ringicula doliaris Gould, Proc. Bost. Soc. Nat. Hist., vii., 1860, p.324; *Id.*, Watson, Chall. Rep. Zool., xv., 1886, p.634, Pl. xlvii., fig.8.

Ringicula arctata Angas (not Gould), Proc. Zool. Soc., 1871, p.98.

In the British Museum there are four, probably cotypes, of *R. doliaris* Gould. These are light and thin, like my *R. semisculpta*, but have spirals above as well as below, and a tooth on the body-whorl. Angas catalogued *R. arctata* Gould, as taken by Brazier off Goat Island, Sydney Harbour. The Sydney specimen, which Angas presented to the British Museum as *R. arctata*, does not

* Angas, Proc. Zool. Soc., 1871, p.98.

agree with typical specimens of that species from Hong Kong. I consider that it is an example of *R. doliaris* with an unusually thickened lip. So *R. arctata* Gould, can be eliminated from the fauna of this State.

Retusa apicina Gould.

Tornatina apicina Gould, Proc. Bost. Soc. Nat. Hist., vii., 1859, p.139.

T. brenchleyi Angas, Proc. Zool. Soc., 1877, p.40, Pl.5, f.20.

Utriculus avenarius Watson, Journ. Linn. Soc. Zool., xvii., 1883, p.328; *Id.*, Chall. Rep. Zool., xv., 1886, p.658, Pl.49, f.5.

T. fusiformis Angas, not Adams, Proc. Zool. Soc., 1878, p.869.

In the British Museum are two specimens of *T. brenchleyi* Angas, from 10 faths., Sydney, presented by J. Brenchley, in 1873. Though not so marked, these are obviously the types of Angas. They seem to me to be identical with the types, four specimens, of *T. avenarius* Watson, collected by the Challenger Expedition, in 10 faths., Sydney. With these agrees a photograph of *T. apicina* Gould, from the same habitat, kindly taken for me from the type in the National Museum, Washington, by Dr. Paul Bartsch.

From the China Sea are six shells marked, in the British Museum, as the types of *Tornatina fusiformis* A. Adams. These have an upright, projecting, heterostrophe apex, and arcuate longitudinal riblets. I think that Angas was mistaken in identifying this with an Australian shell. Cook* considered that *T. fusiformis* was *T. olivæformis* Issel.

Retusa decussata A. Adams.

Bulla (Cylichna) decussata A. Adams, Thes. Conch., ii., 1850, p.594, Pl.125, f.147; *Id.*, Brazier, These Proceedings, ii., 1877, p.80.

Retusa impasta Hedley, These Proceedings, xxxiv., 1909, p.463, Pl. xliv., f.101.

In the British Museum, I noticed five, marked "types C. decussata A. Adams, Thes., &c., China Seas. M.C." These appeared to me like *R. impasta*, so that, after my return to Sydney,

* Cook, Ann. Mag. Nat. Hist., xviii., 1886, p.129.

I sent examples of the latter to London for comparison. Mr. G. C. Robson replies: "The sculpture of Adams' species is more strongly marked than that of yours, but whatever differences there are, I do not hold them to be sufficient to separate the species upon." Under these circumstances, I withdraw the name I proposed.

EXPLANATION OF PLATES XVI.-XIX.

Plate xvi.

Figs. 1,2,3.—*Nucula consobrina* Ad. & Angas, from the type.

Figs. 4,5,6.—*Nucula simplex* A. Adams, from the type.

Figs. 7,8,9.—*Nucula cumingii* Hinds, from the type of *Nucula loringi* Ad. & Angas.

Fig. 10.—*Myrtæa venusta* Philippi, from the type of *Lucina strangei* A. Adams.

Figs 11,12,13,14,15.—*Joannisiella moretonensis* Deshayes, from the type of *Cyrenella moretonensis*.

Figs. 16,17,18,19.—*Solecardia strangei* Deshayes, from the type of *Scintilla strangei*.

Figs. 20,21,22.—*Cardium dionæum* Sowerby, from the type of *Cardium productum* Deshayes.

Figs. 23,24.—*Dosinia tenella* Römer, from the type.

Figs. 25,26.—*Venerupis planicosta* Deshayes, from the type.

Figs. 27,28.—*Venerupis subdecussata* Deshayes, from the British Museum example.

Plate xvii.

Figs. 29,30,31,32,33.—*Semele ada* Adams & Angas, from the type.

Figs. 34,35,36,37.—*Semele exarata* Adams & Reeve, from a British Museum example.

Figs. 38,39.—*Donax striatellus* Deshayes, from the British Museum example.

Figs. 40,41,42,43,44.—*Cryptomya elliptica* A. Adams, from the type of *Sphænia elliptica*.

Fig. 45.—*Clanculus jucundus* Gould, from the British Museum example.

Fig. 46.—*Clanculus conspersus* A. Adams, from a British Museum example.

Fig. 47.—*Calliostoma punctulosus* A. Adams, from a British Museum example.

Fig. 48.—*Cantharidus cingulatus* A. Adams, from the type of *Leiopyrga cingulata*.

Fig. 49.—*Cantharidus pallidulus* A. Adams, from the type.

Fig. 50.—*Leptothyra crassilirata* Preston, from the type.

Fig. 51.—*Littoridina gunnii* Frauenfeld, from a specimen of *Hydrobia gunnii* in the British Museum.

Fig.52.—*Littoridina diemensis* Frauenfeld, from a specimen of *Amnicola diemense* in the British Museum.

Fig.53.—*Iravadia clathrata* A. Adams, from a specimen of *Pyrgula clathrata* in the British Museum.

Plate xviii.

Fig.54.—*Diala suturalis* A. Adams, from a specimen of *Monoptygma suturalis* in the British Museum.

Fig.55.—*Diala picta* A. Adams, from a specimen in the British Museum.

Fig.56.—*Diala varia* A. Adams, from a specimen in the British Museum.

Fig 57.—*Diala pulchra* A. Adams, from the type of *Alaba pulchra.*

Fig.58.—*Diala lauta* A. Adams, from the type.

Fig.59.—*Diala monile* A. Adams, from the type of *Alaba monile.*

Fig.60.—*Diala pagodula* A. Adams, from the type of *Alaba pagodula.*

Fig.61.—*Diala imbricata* A. Adams, from the type of *Alaba imbricata.*

Fig.62.—*Alaba vibex* A. Adams, from the type.

Fig.63.—*Plesiotrochus unicinctus* A. Adams, from the type of *Ziziphinus unicinctus.*

Fig.64.—*Cæcum bimarginatum* Carpenter, from the Australian specimen.

Figs.65-66.—*Cæcum bimarginatum* Carpenter, from the Singapore specimen.

Fig.67.—*Cæcum subquadratum* Carpenter, from the type.

Figs.68-69.—*Cæcum regulare* Carpenter, from the Singapore specimen.

Fig.70.—*C.*(?) *regulare* from the Australian specimen.

Fig.71.—*Bivona constrictor* Mörch, from the type.

Plate xix.

Fig.72.—*Stephopoma tricuspe* Mörch, from the type.

Figs.73,74.—Opercula of same.

Fig.75.—*Mangelia mitralis* Adams & Angas, from the type of *Bela mitralis.*

Fig.76.—*Mangelia australis* Adams & Angas, from the type of *Bela australis.*

Fig.77.—*Drillia æmula* Angas, from the type.

Fig.78.—*Murex serotinus* A. Adams, from the type.

Fig.79.—British Museum shell marked "(?) serotinus A. Ad., Aldinga."

Fig.80.—*Rapana nodosa* A. Adams, from the type of *Rapana nodosa.*

Fig.81.—*Coralliophila elaborata* H. & A. Adams, from the type.

Figs.82,83.—*Cassidula decussata* H. & A. Adams, and enlarged sculpture, from one of the types.

Fig.84.—*Cassidula doliolum* Petit, from one of the types.

Fig.85.—*Leuconopsis pellucidus* Cooper, from the type of *Auricula pellucida.*

Fig.86.—*Ophicardelus sulcatus* H. & A. Adams, from the type.

Fig.87.—*Ophicardelus quoyi* H. & A. Adams, from the type.

Fig.88.—*Ophicardelus stutchburyi* Pfeiffer, from a specimen in the British Museum.

REVISION OF THE AMYCTERIDES.

Part ii. *Talaurinus* (continued).

By Eustace W. Ferguson, M.B., Ch.M.

(Continued from Vol. xxxvii., p.135.)

Talaurinus typicus Macl., *loc. cit.*, p.230.

♂. Size moderate, elongate-ovate. Black, subnitid, almost without clothing.

Head with forehead concave. Rostrum moderately long, as wide as head at apex; external ridges long, convergent towards base, continued along forehead; internal ridges long, prominent, somewhat oblique; sublateral sulci long, narrow, extending into concavity of forehead; median area linear, depressed. Scrobes extending almost to eye, subdivided by a vertical ridge near posterior end. Eyes subrotundate. Prothorax(4·5 × 5 mm.) evenly rounded on sides, apical margin lightly sinuate, lobes not prominent; granules for the most part small, somewhat irregular, discrete; sides granulate. Elytra(12 × 7 mm.) elongate, sides gently rounded, apex moderately produced, base lightly emarginate, humeri with a rather prominent granule; disc with six rows of tubercles, small, granuliform at base, becoming larger and coarser more posteriorly; sutural row small, close together, larger at base; second with six large prominent tubercles; third with from ten to thirteen tubercles, smaller on declivity; fourth with four large ones; fifth with eleven, the posterior ones rather smaller, sixth with seven; seventh interstice lateral, with seven smaller granules, sides otherwise rugosely granulate. Metasternum feebly concave; intermediate segments long, fifth segment with feeble impression at apex, bordered by two projections 1 mm. apart, situated on posterior edge. Femora without spines beneath, tarsi long. *Dimensions* : ♂.19 × 7 mm.

Hab.—New South Wales; Argyle (type in Macleay Museum), Goulburn, Lockyersleigh.

The female is larger, more robust, and the elytral tubercles are rather smaller and more numerous, especially on the third interstice. The number on this interstice is subject to variation in both sexes, in the type ♂ there are ten on the left and thirteen on the right.

Macleay regarded this species as the typical example of *Talaurinus,* as exemplified in the structure of head and rostrum. In the event of the genus being subdivided, the name *Talaurinus* will belong to the group of which *T. typicus* is the type.

TALAURINUS ALTERNANS Macl., *loc. cit.*, p.231.

♀. Size moderate, elliptical-ovate, convex. Black, granules subnitid; sparsely clothed with muddy-grey scales; setæ small, black.

Head convex, forehead concave between the ends of the external rostral ridges, these latter long, slightly convergent, running almost to vertex; internal rostral ridges long, well defined, convergent, median area narrow. Scrobes open behind, partition obsolete. Prothorax (4 × 5 mm.) evenly rounded on sides, apex with a feeble postorbital sinuosity; finely granulate, granules round, discrete, somewhat irregular in size; sides with smaller obsolete granules. Elytra (12 × 7 mm.) moderately produced at apex and feebly mucronate, base emarginate, humeral angles marked but not produced; disc with six rows of granules; sutural minute, in single series larger at base; second with six or seven larger, more elongate ones (and on one side with a few smaller ones on declivity); third with much smaller granules, in double series near base, but in single on declivity; fourth with five or six longer ones; fifth and sixth each with a single series of smaller ones (seventeen and ten); sides seriate-granulate. Fifth ventral segment with a round depression at apex, the edges feebly raised on either side. *Dimensions*: ♀.18 × 7 mm.

Hab.—New South Wales: Clyde River (Macleay Museum type).

Closely related to *T. typicus,* this species may be recognised by its finer and more regular sculpture, and by the third row of granules being in double series in basal half.

Two females, from Mittagong, differ in their larger size (21 × 8 mm.), and in having the granules on the second and fourth interstices more rounded and not so elongated; they probably represent a variety. A male in Mr. A. M. Lea's collection probably belongs to this species; it has, however, the granules of the third row in single series.

TALAURINUS LONGIPES, n.sp.

These Proceedings, 1912, Pl. iii., fig.4.

♂. Elliptical-elongate, size moderately large. Black, granules subnitid; practically without clothing.

Head obsoletely and sparsely punctate, external rostral ridges continued back towards vertex, forehead shallowly concave, with a feeble median carina. Rostrum moderately long, excavate; internal ridges long, prominent, little convergent; lateral sulci and median area forming three longitudinal sulci. Scrobes continued up and back in front of eye, division obsolete, represented by a slight downward projection from the external ridge. Eye depressed, subrotundate. Prothorax (4·5 × 5·5 mm.) evenly rounded on sides, apical margin with a feeble postocular sinuosity, collar-impression faint, disc with small hemispherical granules, somewhat irregular in size, moderately closely set, but not contiguous; sides granulate. Elytra (13 × 8 mm.) in shape as in *T. typicus*, shoulders noduliform, prominent; disc striate-punctate, interstices tuberculate, sutural with fine granules; second with four large, somewhat flattened, oval tubercles; fourth with two similar ones, in both cases the tubercles spaced out and differently placed on either side; third interstice finely granulate in single series, the granules somewhat depressed, tending to become transversely confluent with the intrastrial ridges; fifth with humeral and two small granules at shoulders, otherwise with granules similar to third, but less distinct; sixth with a row of seven or eight stronger, rounded tubercles more closely placed. Sides striate-punctate, interstices obsoletely granulate. Fifth ventral segment with the impression covering more than the middle third of segment, the edges ending posteriorly in small tubercles, somewhat convergent. Legs long and thin, femora transversely scarred ventrally; tibiæ long, thin, the anterior and middle almost straight; posterior feebly curved, the concavity posterior; tarsi lineariform. *Dimensions* : ♂. 20 × 8 mm.

Hab.—New South Wales: Coonabarabran (T. G. Sloane, and Macleay Museum).

Close to *T. typicus,* but with the scrobes not divided, different elytral sculpture, especially of the third interstice, and longer and thinner legs.

Talaurinus miliaris, n.sp.

These Proceedings, 1912, Pl. iii., figs.1-2.

♂. Size moderately large, elongate, convex. Black, opaque; clothed with a few muddy scales in depressions; setæ minute, light coloured.

Head continued on to rostrum without interruption, forehead feebly convex between the ends of the rostral ridges. Rostrum moderate, thick, strongly excavate in front; external ridges convergent basally, continued up on to forehead; internal long, convergent; lateral basal sulci long and deep, median area depressed, a deep pit between the ends of the internal ridges. Scrobes subdivided, posterior portion open, extending almost to eye. Eyes rather large, subovate. Prothorax (4·5 × 5·5 mm.) rounded on sides, apex truncate above, ocular lobes moderately well defined; disc without impressions, moderately finely granulate, granules somewhat irregular in size and distribution, finer in centre, and not contiguous; sides practically without granules. Elytra (13 × 7 mm.) gently rounded at sides, apex obtuse, feebly mucronate; base truncate, humeral angles not marked. Disc granulate in six series, sutural row finely, almost obsoletely, at base more coarsely granulate, the granules at base flattened and in double series; second interstice with a single row of seven to nine larger, but still small, granules distantly placed and absent on declivity; third with a row of about 50 finer granules in double series on disc, but in single on declivity; fourth with about five granules equal in size to those of second row, and situated far apart; fifth with a double row of minute granules only distinct near humeral angles, elsewhere more irregular and confused; sixth row of about sixteen small granules in single series. Between interstices no definite striæ recognisable, but small intermediate rows of granules, forming with the interstitial granules short, low, transverse rugæ. Metasternum flattened; intermediate abdominal segments long, feebly impressed at sides; fifth segment large, with a shallow mesial impression, and a short, rather deep, transverse one at extreme apex, overhung by two small tubercles.

♀. Much more obese, the elytra more rounded, with the apex more produced, the elytral granules more numerous (about double) on the second and fourth interstices, finer and more irregular on the third and fifth, where they tend to be in triple series. Beneath, rather strongly convex; fifth segment with a deep narrow mesial fossa at apex. *Dimensions*: ♂.21 × 7 mm.; ♀.22 × 9 mm.; prothorax, 5 × 6 mm.; elytra, 14·5 × 9 mm.

Hab.—New South Wales: Mittagong (Dr. C. D. Clark, per H. J. Carter).

Differs from *T. alternans* in the extreme fineness of the elytral granules, which are much smaller than in any other member of the *T. typicus*-group. The female has the granules even more numerous than in the male, and on the third interstice in triple series.

TALAURINUS MITCHELLI Macl., *loc. cit.*, p.234.

♀. Size moderate, elongate-ovate. Black, opaque, granules nitid; densely clothed with yellowish-grey scales, granules not so clothed, beneath each segment maculate in centre.

Head continued on into rostrum, forehead feebly concave. Rostrum with the external ridges rather strongly convergent, continued on to vertex; internal ridges long, oblique, median area depressed. Scrobes incompletely divided, open posteriorly. Prothorax (4·5 × 5·5 mm) rounded on sides, apical sinuosity slight, disc irregularly granulate, granules varying in size and distribution; sides granulate. Elytra (12 × 8 mm) ovate, apex moderately produced, feebly mucronate, base lightly emarginate, humeral angles marked by a nodule; interstices with prominent granules, sutural with a row of minute granules; second with five or six large prominent tubercles; third with about ten smaller ones, fourth with four larger; fifth and sixth with about nine smaller ones each, those in the sixth being rather the larger; sides granulate. Fifth ventral segment with a small depression at apex. *Dimensions* : ♀.19 × 8 mm.

Hab.—"Victoria River, Mitchell's Expedition." Type in Macleay Museum.

This species may be recognised by the rounded prominent tubercles on the elytra, larger than in *T. typicus;* from this latter species, the presence of clothing will distinguish it; also the granules on the third interstice are more spaced out, and the external rostral ridges are more convergent. On the prothorax, the granules are somewhat peculiarly arranged; along the anterior margin and at the sides, they are small, and irregularly placed; in the centre, there is a group of small granules, with a row of five larger ones on either side, then a bare space containing two large granules.

Two specimens from Moorilla, (near Young, N.S.W.) differ in being more elongate, and in having the prothorax more finely and evenly granulate; the elytral granules, though somewhat smaller, are prominent, and the clothing dense. They probably represent a variety, or possibly a distinct species.

Talaurinus acutipennis, n.sp.

These Proceedings, 1912, Pl. iii., fig.7.

♂. Elongate-elliptical, subdepressed. Black, subnitid; practically without clothing; setæ minute, scattered, black; legs with long black setæ.

Head convex, scarcely punctulate, forehead somewhat concave. Rostrum about twice the length of head, and rather narrower, deeply excavate, the external ridges long, prominent, slightly convergent, and extending on to forehead; internal long and convergent, but not meeting; median area depressed, sulciform; lateral basal sulci long and deep. Scrobes deep, open behind, with a short prolongation upwards in front of eye. Eyes small, round. Prothorax(4 × 4·5 mm.) rounded on sides, widest across middle, apex with a slight postorbital sinuosity, no definite lobes present; granules moderately large, rounded, contiguous, each with a minute setigerous puncture; sides obsoletely granulate. Elytra(11 × 6 mm.) ovate, apex produced, sharply and strongly mucronate, base lightly emarginate, humeral angles marked but not produced. Disc irregularly foveo-striate, foveæ large, somewhat open, tending to become confluent laterally, the intervening ridges raised; interstices nodulose, hardly granulate, tending to become confluent laterally, the intervening ridges raised; interstices nodulose, hardly granulate, tending to become interrupted opposite the foveæ; sutural depressed, only indicated by a ridge of small granules, and a short ridge at base; second with four or five well-defined nodules, third with nine or ten, fourth with four, hardly recognisable from cross reticulations; fifth with ten more definite ones, sixth with about seven; the whole sculpture confused. Sides striate-foveate. Beneath, concave over metasternum and first and second ventral segments, convex over other segments; fifth segment shallowly excavate. *Dimensions*: ♂.18 × 6 mm.

Hab.—Victoria: Mt. Macedon (H. J. Carter).

Close to *T. typicus* in general appearance, but the elytral sculpture much more confused. The derm is definitely striate-foveate, the foveæ bounded antero-posteriorly by definite ridges, which, on the interstices, form the nodules or granules, the foveæ communicating laterally across the interstices; the strong apical mucronation is also characteristic.

TALAURINUS FOVEO-GRANULATUS, n.sp.

These Proceedings, Pl. iii., fig.6.

♂. Moderately large, elongate-elliptical. Black, subnitid; with a few scales in depressions; beneath, each segment with a yellowish macula in centre; setæ black, small, few and little evident.

Head convex, forehead feebly concave, the external rostral ridges continued back along head, lævigate, with a few scattered setæ. Rostrum excavate, external ridges slightly convergent basally; internal long, prominent, convergent; median area and sublateral sulci long, deeply depressed. Scrobes without division, but with a prolongation above eye. Eyes subovate. Prothorax(5 × 5·5 mm.) strongly rounded and dilatate on sides, base slightly narrower than apex, apical margin rounded above, with a feeble postocular sinuosity; collar-impression faintly marked, a feeble transverse impression present in front of base; closely set with small rounded granules, each with a small setigerous puncture. Elytra (12 × 7 mm.) widest behind middle, thence gradually narrowed to before apex; apex moderately produced, rounded, feebly mucronate; base gently arcuate, humeral angles prominent laterally, tuberculiform; disc with small foveæ in striæ, about ten in each to declivity, thence smaller and more punctiform, ridges between foveæ well defined though irregular towards base, becoming obsolete and absent on declivity; interstices with separate granules, sutural costiform at base; second with seven small rounded granules to declivity, thence raised but with the granules barely traceable to apex; third subcostate in basal half, thence with granules distinct but closer than on second; fourth not raised, with five or six more isolated granules; fifth and sixth with more continuous granules, but not costiform; sides foveo-striate, interstices hardly granulate. Apical ventral segment with a shallow depression in middle, intermediate segments flattened in centre. Femora without ridges beneath. *Dimensions*: ♂.18 × 7 mm.

Hab.—West Australia (Macleay Museum type).

In its elytral structure, this species approaches to *T. acutipennis*, but, in general build and appearance, it resembles some of the members of the section *Costati*, the shape of the prothorax and elytra being similar to that of *T. lævicollis*. I have seen only a single specimen, but it is so distinct, that I have had no hesitation in describing it.

TALAURINUS ALTERNATUS Macl., *loc. cit.*, p.240.

♀. Elongate-elliptical, size large. Black, opaque; sparsely clothed with greyish scales; setæ small, black.

Head convex, forehead feebly concave. Rostrum excavate, external ridges glabrous, long, convergent, continued on to forehead; internal long, prominent, strongly convergent; lateral basal sulci long, deep; median area depressed throughout.

Scrobes open behind, posterior portion not divided off. Eyes small, subrotundate. Prothorax (5 × 6 mm.) rounded on sides, postorbital sinuosity feeble; disc closely and finely granulate, granules not contiguous; sides granulate. Elytra (15 × 8·5 mm.) with apex moderately produced, mucronate, base feebly arcuate, humeral angles marked by nodules, but not projecting; disc striate, striæ with shallow transverse punctures, interstices as a whole not raised, sutural with a row of very fine obsolete granules thickened at base, second with six larger (but still small) granules distantly spaced; third raised and costate, becoming granulate on declivity; fourth with four larger granules; fifth and sixth each with a single row of small contiguous granules, on the sixth almost subcostate. Fifth ventral segment with a rectangular impression at extreme apex, subtended by a small nodule anteriorly. *Dimensions*: ♀.23 × 8·5 mm.

Hab.—"New Holland" (type in Macleay Museum).—New South Wales: Mittagong (Australian Museum).

Differs from all other species of the *T. typicus*-group, with the exception of the following species, in having the third interstice costate, thus combining the costate and granulate types of the elytral sculpture. From *T. rugicollis*, the prothoracic granulation, as well as the different elytral sculpture, will distinguish it.

TALAURINUS RUGICOLLIS Macl., *loc. cit.*, p.241.

♀. Elongate-ovate, size large. Black, opaque, granules subnitid; sparsely clothed with muddy scales.

Head continuous with rostrum, forehead flattened between the ends of the external rostral ridges. Rostrum deeply triangularly excavate, external ridges convergent basally and extending to vertex, less convergent on head; internal long, convergent; median area triangularly depressed. Scrobes double, posterior portion extending in front of eye. Eyes subrotundate. Prothorax (4·5 × 5·5 mm.) widest in front of middle, apical sinuosity very feeble; disc rugosely granulate, granules irregular, confluent; sides more evenly granulate. Elytra (14 × 8 mm.) ovate, apex moderately produced, base lightly emarginate, humeral angles noduliform; disc with obsolete rows of depressions, sutural interstice subcostate at base and on declivity, elsewhere represented by a row of setæ; second not raised, but with two, large, rounded granules on left, and four on right side; third prominent, costiform, granulate on declivity; fourth with two large granules; fifth with granules obsolete, except for humeral nodule; sixth with nine somewhat obsolete granules; sides with transverse rugæ more prominent. Fifth ventral segment with a shallow depression at apex. *Dimensions* : ♀.22 × 8 mm.

Hab.—New South Wales : Singleton (Macleay Museum type).

A very distinct species, in its semicostate elytra allied to *T. alternatus.*

TALAURINUS CATENULATUS Macl., *loc. cit.*, p.234

♀. *T amycteroides* Macl., *loc. cit.*, p.235.

♂. Elongate-elliptical, size large. Black, opaque, granules subnitid, rather densely clothed with greyish scales; head and rostrum bivittate.

Head continued on into rostrum. External rostral ridges continued almost to vertex; internal long, little prominent; median area narrow, slightly depressed, continued up forehead as a feeble carina; lateral basal sulci narrow, shallow. Scrobes single, with a prolongation upwards in front of eye. Prothorax(4·5 × 5·5mm.) subquadrate, truncate in front, with hardly any indication of lobes; granules moderately large, irregularly distributed, leaving three bare spaces; sides granulate. Elytra (13·5 × 8 mm.) moderately ovate, not greatly ampliate; humeral angle with a small nodule; disc puncto-striate, rugulose between punctures; interstices granulate, first at base only costate; second with four or five, large, elongate granules; third with eight large, elongate and two smaller ones on declivity; fourth without granules, fifth with twelve stouter, less elongate, and closer together; sixth with eight smaller ones not reaching base; sides striate-punctate, interstices irregularly granulate. Metasternum feebly concave; fifth ventral segment with a feeble impression, the lateral edges raised posteriorly. *Dimensions* : ♂.22 × 8 mm.

♀. *T. amycteroides* Macl., type (Australian Museum). Larger, of a more ovate obese form than male; elytra with tubercles on interstices elongate, flattened, second with five, third with ten, fourth with none, fifth with ten, sixth with seven, seventh with about ten, almost completely on side, the tubercles very little prominent, sides with interstices similar. *Dimensions*: ♀. $23 \cdot 5 \times 9$; prothorax, 5×6; elytra, 16×9 mm.

Hab. - Queensland. Types in Australian Museum.

I have placed this species in the *typicus*-group, but it does not seem greatly at home there; the internal rostral ridges almost obsolete would indicate an approach to the *bucephalus*-group; probably it will be necessary later to propose an intermediate group to receive this species, *T. tumulosus* and possibly *T. sobrinus*.

TALAURINUS CAVICEPS Macl.

Macleay, *ibid.*, 1866, p.320; *T. victor* Pascoe, Journ. Linn. Soc. xii., 1873, p.10.

Size large, ovate, robust, convex. Black, granules nitid, covered with ferruginous scales except on granules, ventral segments feebly maculate.

Head large, convex, external ridges continued on up head as two prominent carinæ, a median carina also present. Rostrum short but longer than head, deeply excavate; external ridges prominent, subparallel; internal ridges short, distinct, but much less prominent, convergent; median area narrow, depressed, lateral basal sulci deep, meeting behind internal ridges and extending into concavity of forehead. Scrobes open posteriorly, with a feeble posterior prolongation in front of eye. Eyes subrotundate. Prothorax($5 \cdot 5 \times 7$ mm.), dilatate, subangulate, apex rounded above, ocular lobes feeble; disc with feeble impressions near and in front of lateral angles, granules round, discrete, distantly placed, larger on disc but more thickly grouped at lateral angles, the centre and lateral depressions almost without granules; sides with smaller granules. Elytra (16×10 mm.) elongate-ovate, strongly convex, gently declivous posteriorly, apex sharply mucronate, base emarginate, humeral angles tuberculiform, tubercles projecting laterally. Disc granulate in six rows, sutural with about twenty small granules evenly placed, becoming progressively smaller posteriorly; second with eight larger, more flattened granules on disc, and three smaller ones on declivity; third with twelve slightly smaller, the basal flattened, the others more rounded; fourth with three flat granules, fifth with nine, sixth with twelve more rounded ones; all interstices with granules more or less flattened on disc, rounded more posteriorly and progressively smaller on declivity, rows of small distantly placed granules in between larger ones. Beneath, intermediate segments large, fifth without impressions, all the segments strongly convex. *Dimensions*: ♀.24 × 10 mm.

Hab.—South Australia: Port Lincoln.

The specimen described above is one of two females in the Macleay Museum; as Macleay did not mark his types, it is hard to say if these are such. The Australian Museum specimens agree with the above description.

I have compared cotypes of *T. victor* Pasc., with the Macleay Museum specimens, but can find no difference.

T. SEMISPINOSUS-GROUP.

T. semispinosus Bohem., Schönnh., Gen. Curc. vii.,(1), p.59.

T. pastillarius Bohem., *loc. cit.*, p.60.

T. (Sclerorinus) echinops Pasc., Journ. Linn. Soc., xii., 1873, p.10.

T. simulator Pasc., *loc. cit.*, p.13.

T. funereus Pasc., *loc. cit.*, p.11.

T. pustulatus Pasc., *loc. cit.*, p.11.

A very considerable amount of confusion exists regarding the species of this group, at any rate in Australian collections. Until quite recently, none of Pascoe's species were recognised among Australian entomologists, the descriptions being practically worthless. In almost all collections, the species would be found under two names—*T. Roei* Bohem., for large specimens, and *T. semispinosus* Bohem., for smaller ones. *T. pastillarius* was unknown. As shown in the first portion of this paper, *T. Roei* is a totally different species, most probably related to *T. tessellatus* Pasc.

Some little time ago, the British Museum authorities sent, for examination, to Mr. A. M. Lea, specimens compared with Pascoe's types. I have had an opportunity of examining these, and of making notes on them. Among them were authentically named specimens of *T. echinops*, *T. pustulatus*, and *T. funereus*.

A number of specimens of *T. echinops* were sent, one labelled "*S. echinops*, compared with type"; another bore a label *T. simulator*, an identification almost certainly wrong. Later, I sent several species to the British Museum for comparison, a task which Mr. K. G. Blair kindly undertook, and his notes on three specimens (labelled 3, 4, 5) of *T. pustulatus*, I will quote in full.

"No.3. Tubercles not so numerous as in *T. simulator*, and bluntly conical towards base of elytra, instead of rounded; in *T. simulator* they are also more polished, and there is an additional row between third and fourth rows in No.3, consisting of few tubercles and disappearing on hinder half of elytra. Your specimen agrees with our series of *T pustulatus*, though, in the type, the large tubercles are much less developed than normally. *T. simulator* has fewer and larger granules on thorax than *T. echinops* (agreeing in this respect with your No.3), and the pustules on elytra, especially on hinder half, are larger and more prominent." *T. echinops* = *T. semispinosus* Bohem.,(Lea det.).

"Nos.4 and 5. Both *T. pustulatus*, the latter approaching type in character of pustules though smaller."

In Mr. A. M. Lea's collection, there is a specimen labelled by G. J. Arrow, "*Talaurinus semispinosus* Bohem.,(= *T. echinops* Pasc.). The specimen sent to you labelled (by Pascoe) *T. simulator* Pasc., seems rather different from the actual type of *T. simulator*, which is unique."

From the above notes it is evident that the synonymy, *T. echinops* = *T. simulator*, recorded in the list of synonyms in the first part of this paper, is incorrect. At the same time, it would be rash to definitely sink *T. echinops* under *T. semispinosus* until the type of the latter can be examined, though I believe that this synonymy is probably correct. In most collections, *T. pustulatus* is regarded as *T. semispinosus* Bohem.

T. pastillarius Bohem., probably belongs to this group; I have had *T. tuberculatus* Macl., sent under that name. A specimen sent from the British Museum to Mr. Lea is labelled, in Mr. Arrow's writing—" *Talaurinus pastillarius* Boh., see Pascoe (probably wrong)." The specimen is a female of *T. tuberculatus* Macl.

TALAURINUS PUSTULATUS Pasc., *loc. cit.*, p.11.

Size moderate. Black, opaque, the granules subnitid; sparsely clothed with greyish scales; setæ minute, black.

Head convex, forehead strongly concave, sparingly setigero-punctate. Rostrum excavate, external ridges slightly convergent, continued on to head, internal ridges obsolete, lateral sulci oblique, foveiform, median area smooth, not raised, a punctiform depression in middle at base. Eyes subrotundate. Prothorax (4·5 × 5·5 mm.) with apex feebly rounded above, and moderately deep postocular sinuosity; granules depressed, somewhat obsolete, fewer in middle, tending to become confluent transversely; sides obsoletely granulate. Elytra (11 × 7 mm.) not produced at apex, base arcuate, with thickened border, humeral angles noduliform; disc with small irregular depressions not definitely seriate, but with intermediate granules, interstices granulate or tuberculate, sutural with a few depressed granules at base, second with four, third with seven, fourth without any, fifth with six, sixth with five; tubercles anteriorly depressed, granuliform, posteriorly conical. Fifth ventral segment with a transverse apical sulcus containing two small tubercles. *Dimensions*: ♀.15 × 7 mm.

The above description was drawn up from a specimen (♀) marked "compared with type," and agrees with Pascoe's description except in regard to the tubercles of the outer row. The comparative size of the elytral tubercles appears to vary considerably; examination of a fairly large series, including four other specimens which have been compared with the type, shows that hardly two specimens agree in all details.

TALAURINUS FUNEREUS Pasc., *loc. cit.*, p.11.

♂. Elongate, subparallel. Black, with brownish scales, prothorax feebly bivittate, elytra feebly maculate with white, ventral segments with a few yellowish scales in centre.

Head convex, forehead concave, rather densely clothed with blackish scales intermingled with black decumbent setæ. Rostrum excavate, external ridges feebly convergent, rugosely punctured, internal obsolete; median area triangular, impunctate; lateral sulci deep, running into frontal concavity. Scrobes open posteriorly. Eyes subrotundate. Prothorax(4·5 × 6 mm.) rotundate, postorbital sinuosity rather deep, disc closely covered with small rounded granules. Elytra(12 × 7 mm.) elongate, subparallel, base gently arcuate, humeral angles, moderately produced and marked by a small granule; disc striate-punctate; interstices granulate, sutural with a few at base, second with five or six, third with ten to twelve, the last five conical, fourth with four small ones in basal half, fifth with eight small ones not extending beyond middle, sixth with about ten more conical ones. Beneath, rather densely setigero-punctate; fifth ventral segment with a feeble transverse impression at apex. Legs setigerous, anterior femora with a ridge below in outer half. *Dimensions*: ♂.17 × 7 mm.

Hab.—West Australia: Swan River.

Belongs to the same group as *T. simulator* and *T. pustulatus*, but with the prothoracic granulation closer and finer, and the elytral tubercles more acute than in any other species.

TALAURINUS BUCEPHALUS Olivier.

Olivier, Ent., v., 83, p. 399, t. 25, f. 355; Masters' Catalogue, No.4687; *T. Camdenensis* Macl., *loc. cit.*, p. 226; *T. murrumbidgensis* Macl., *l.c.*, p. 227; *T. rudis* Macl., *l.c.*, p. 227; *T. rugosus* Macl., *l.c.*, p.229; *T. salebrosus* Macl., *l.c.*, p.229; (?)*A. granosus* Guér., Voy. Coquille, ii.(2), 1830, p.120; (??)*A. Westwoodi* Bohem., Schönh., Gen. Curc. vii.,(1), 1843, p.63.

♂. Small, elongate-ovate, convex. Black, granules subnitid, sparsely clothed in cavities.

Head convex, separated from rostrum by a constriction. Rostrum short, thick, excavate, external ridges subparallel, internal little prominent, moderately long, convergent, lateral basal sulci deep, median area deeply sunken anteriorly. Scrobes simple, open posteriorly. Prothorax(4 × 4·5 mm.) evenly rounded on sides, apex with a well-defined postorbital sinuosity, median lobe small, ocular lobes rather strongly produced; disc evenly and closely covered with small, round setigerous granules; sides obsoletely granulate. Elytra (10 × 6 mm.) evenly widened to behind middle, thence somewhat abruptly rounded to apex, which is rather strongly flanged; base widely and deeply arcuate, humeral angles prominent, tuberculiform. Disc irregularly and somewhat rugosely puncto-striate; interstices granulate or tuberculate, sutural with a single row of fine granules, larger and becoming costiform at base, second with five to six small oblong granules more conical posteriorly and not continued to base; third with five basal granules confluent, prominent, and costiform, and seven more conical tubercles, the whole extending from base to apex; fourth with three small granules situated anteriorly to middle; fifth with humeral tubercle and nine smaller ones, the posterior conical; sixth with six small obtuse granules; sides with granules obsolete. Intermediate ventral segments rather short; fifth rather deeply excavate, with a well defined boat-shaped fossa near apex, extending anteriorly, and with a tubercle at the end of each lateral horn, and another on the inner side, the two inner tubercles connected by a U-shaped edge. Anterior femora ridged beneath. *Dimensions*: ♂. 15 × 6 mm.

♀. Very similar in appearance to the male, but rather more produced posteriorly; fifth ventral segment not excavate, but with a short obtuse carina in centre, its anterior end surrounded by a horseshoe-shaped depression or sulcus.

The above description of the male is drawn from a specimen sent for examination by the Brussels Museum authorities, and apparently the specimen Boisduval had so named, perhaps from comparison with the type.

The species is a very variable one in regard to size, and the number and position of the elytral tubercles. In some specimens the granules at the base of the third interstice are conjoined, in others they are more or less distinct. Lea has given the synonymy of Macleay's species, and, from personal examination of the types, I can find no valid reason for maintaining them as good species. Macleay seems to have relied on differences in the number of the tubercles, in the fourth interstice being granulate (or tuberculate) or not, and on the mucronation of the elytra. The mucronation is extremely variable, some specimens having very distinct, sharp, divergent projections at the apex, others having no sign of these; further, these are not sexual, and there are intermediate degrees. The identity of Macleay's species with *T. bucephalus* is clear on comparison with Olivier's illustration; also the British Museum specimens are all so named. The species considered by Macleay as *T. Westwoodi* Bohem., is also synonymous. *T. rudis* might be regarded, possibly, as a variety, owing to its having the granules or tubercles on the second and third interstices conjoined more or less, and the interstices thus subcostiform.

Specimens were sent to Paris for comparison with the type, and also with *Amycterus granosus* Guér. In reply, M. P. Lesne kindly writes: "Nous n'avons pas le type; mais l'espèce envoyée par vous, figuré dans nôtre collection sous le nom de *bucephalus* Ol." In regard to *A. granosus* Guér., he says: "Nous n'avons pas le type." The description, however, agrees closely, and I believe that *A. granosus* Guér., must also rank among the synonyms of *T. bucephalus* Oliv.

Talaurinus subvittatus, n.sp.

These Proceedings, 1912, Pl. iii., fig.9.

Black; ♂ abraded, ♀ variegated with white scales; head with median (bifurcate on rostrum) and supraorbital vittæ, prothorax trivittate on disc and with white on sides, elytra maculate, the macules forming irregular vittæ; beneath, each segment with a small patch in centre.

♂. Elongate-ovate. Head convex, forehead feebly flattened, continued on to rostrum much in the same direction. Rostrum short, widely and moderately deeply excavate, external ridges separated from head by a feeble impression; internal long, obsolete; median area feebly depressed, with a small fovea at base; lateral sulci rather deep, foveiform. Scrobes closed posteriorly by a slight ridge, with a narrow sulcus behind, extending up and in front of eye. Eyes subovate, rather deeply set. Prothorax

(4 × 5 mm.) not greatly widened, but obtusely subangulate on sides, postorbital sinuosity moderately well developed, lobes feeble; an irregular, feeble collar-impression present; median line not impressed, but without granules; with small hemispherical granules, not contiguous and slightly irregular in size; sides granulate. Elytra (11 × 7 mm.) subovate, apex moderately abruptly rounded, base arcuate; humeral angles tuberculiform, projecting laterally; sculpture rough and confused, with small rounded granules hardly in striæ, interstices not raised but with rather strong nitid tubercles, sutural with three or four small granules at base, second with three distant tubercles in middle, and three more conical on declivity, extending to apex; third with five smaller rounded ones extending from base to middle, and two more posteriorly; fourth with two near middle, fifth with three spaced out ones near shoulder, and four or five more conical and more closely placed posteriorly; sixth with four conical distantly placed tubercles, seventh with six smaller ones; sides transversely rugose, not granulate. Beneath, with a few scattered setæ; intermediates long, fifth rather deeply subquadrately excavate, edges ending abruptly in tuberculiform projections, middle of segment thickly clothed with black, hirsute, setæ. Apical tergite rugosely punctured at apex. Legs rather long and slender; anterior femora with a prominent ridge beneath in outer half.

♀. More robustly ovate, with elytral tubercles rather larger, and about six in all on third interstice, larger and more conical; beneath, convex; fifth with a feeble impression at extreme apex. *Dimensions*: ♂.17 × 7; ♀.18 × 8 mm.

Hab.—North Queensland (received from F. P. Dodd, per T. G. Sloane, collected in the Atherton District).

Mr. Dodd has forwarded one male and four females belonging to this species; the females show a good deal of variation both in size, and in the number and position of the elytral tubercles.

It appears to be most closely allied to the common New South Wales species, *T. bucephalus*; but the clothing and the sculpture of the anal excavation of the male prohibit my regarding it as a variety. One of the females before me measures 21 × 9 mm.

TALAURINUS SOBRINUS, n.sp.

These Proceedings, 1912, Pl. iii., fig.13.

♂. Moderately large, elongate. Black, moderately densely clothed with muddy-grey scales; granules not clothed; setæ black. Rostrum short, much as in *T. subvittatus*, the internal ridges little prominent, median area depressed, strongly in front, feebly foveate at base; lateral sulci strongly foveiform. Scrobes extending almost to eye, with a groove running from the postero-inferior angle into orbit. Eyes ovate. Head feebly depressed in front, with a faint mesial line, hardly carinate, with scattered decumbent setæ. Prothorax (4 × 5 mm.) subangulate on sides, with a deep, transverse, subapical constriction; disc granulate in four groups, median line without granules, and lateral lineæ with fewer granules, the granules small, rounded, setigerous. Elytra (11 × 7 mm.) gradually widened to behind middle, apex widely rounded, base slightly emarginate, humeral angles marked by a small granule; disc with small, irregular, punctiform depressions, hardly traceable in striæ, often intercommunicating, and attended by small setigerous granules; with rows of small, somewhat elongate tubercles; second interstice with four, widely separate, on disc, and three on declivity; third with eight, rather closer, and not present on declivity; fourth and sixth without tubercles, but with a row of fine setigerous granules similar to the intra-strial ones; fifth with twelve tubercles, becoming slightly conical posteriorly; seventh with about ten, moderately close together, and not conical; size of tubercles smaller than in *T. subvittatus*. Sides puncto-striate, interstices rugose, somewhat obsoletely granulate. Beneath, uniformly and moderately closely clothed with black setæ, intermediates large; fifth with a shallow central impression, with a median vitta of strong hirsute setæ, and a small hirsute tubercle on either side. Anterior femora without a ridge beneath.

♀. Similar but more ovate, and with the tubercles rather stronger; beneath, convex, without impressions. *Dimensions*: ♂.17 × 7; ♀.17·5 × 7·5 mm.

Hab.—Queensland (Macleay Museum-type), Cardwell (Queensland Museum).

In the structure of the anal excavation, closely allied to *T. subvittatus*, but with the granules or tubercles much smaller, and without the ridge on the undersurface of the anterior femora.

TALAURINUS SCABROSUS Macl., *loc. cit.*, p.235.

♂. Large, elongate-ovate. Black, rather densely clothed with muddy-grey scales, granules subnitid; setæ minute, black.

Head convex, ends of external rostral ridges continued back along forehead. Rostrum moderately long, broad, excavate; external ridges slightly confluent, junction with head marked by a slight constriction; internal ridges obsolete, and median area depressed. Scrobes deep, open posteriorly. Eyes subovate. Prothorax (5·5 × 6·5 mm.) widest in front of middle, obtusely subangulate, apex rounded above, ocular lobes well defined, collar-constriction present; granules moderately large, discrete, rounded, widely dispersed, leaving the centre and longitudinal areas near sides free; granules obsolete on sides, except below lateral angle. Elytra (14·5 × 9 mm.) ovate, apex strongly rounded, mucronate, base subtruncate, humeral angle with a single tubercle; disc with depressions obscured by clothing, interstices tuberculate, tubercles unevenly distributed, more strongly developed and conical posteriorly, sutural with a row of fine granules; second with six to eight and a few small ones on declivity; third with seven to nine, fourth with two or three, fifth with eight or nine, sixth with six or seven, the last all conical tubercles; sides with rounded subdepressed granules. Below, each segment with a yellow macule in centre; intermediate segments long; fifth with the anterior portion depressed in centre, posterior portion strongly excavate in middle, the division between the two portions marked with a tubercle at either side. Anterior femora with a double ridge in outer half. *Dimensions* : ♂.22·5 × 9 mm.

Hab.—Queensland (Mitchell's Expedition).

Perhaps a strongly tuberculate variety of *T. verrucosus*, but with rather dense clothing between the tubercles. I am ignorant of its exact habitat, the types, two males, in the Australian Museum, being without exact locality-labels.

TALAURINUS TUBERCULATUS Macl., *loc. cit.*, p.233.

Elongate-ovate, strongly tuberculate. Black, with white and ochraceous scales; head with a white line bifurcate on rostrum; prothorax trivittate; elytra with white along suture, maculate near sides, and a white band along margin of sides.

Head convex, forehead concave between rostral ridges. Rostrum rather longer and narrower than head, deeply excavate, external ridges subparallel, continued on to forehead; internal ridges obsolete, median area depressed, lateral basal sulci represented by small foveiform depressions at base. Scrobes open posteriorly. Prothorax (5 x 6 mm.) rounded on sides, almost subangulate, ocular lobes rather prominent, a transverse collar-impression present behind apex; granules rounded, somewhat irregular in size, but rather large, and not contiguous Elytra (12 x 7 mm.) with apex strongly rounded, not mucronate, base lightly arcuate; humeral angles strongly tuberculate; disc not definitely striate, but with the interstices strongly tuberculate, and smaller granules interspersed; sutural with a row of small granules, larger at base; second with two to four tubercles in middle; third with seven to eight tubercles, larger and more acute posteriorly; fourth with two near middle; fifth with a humeral tubercle, and five more separate ones; sixth with six conical tubercles; sides granulate. Intermediate ventral segments long; fifth with a broad, shallow excavation, deeper laterally, and bordered by a ridge, becoming more prominent and ending posteriorly in a raised point, a transverse narrow sulcus present along apical margin. Apical tergite also shallowly excavate. Anterior femora with a median ridge on undersurface.

♀. Similar to the male, but the apex of elytra with two subparallel mucrones near suture. *Dimensions*: ♂.18 x 7; ♀.18 x 7 mm.

Hab.—Victoria. Type in Macleay Museum.

The type appears to be abraded or discoloured, and the description of the clothing given above is from a specimen in my own collection. The species appears to be common in Victoria, and I have had specimens referred to me as from the south of

West Australia. It may be recognised by its strongly tuberculate, almost bristling, appearance, combined with its somewhat narrow, deeply excavate rostrum, and the deep anal excavation.

It is possible, though hardly probable, that *T. pastillarius* is this species. Specimens were sent from the British Museum under this name, but I do not think it wise to sink Macleay's name, until the type can be examined.

TALAURINUS IRRORATUS, n.sp.

These Proceedings, 1912, Pl. iii., fig.3.

♂. General facies that of *T. verrucosus*; size large. Black, moderately densely clothed with greyish scales, head trivittate, median vitta bifurcate on rostrum, prothorax trivittate on disc, elytra maculate; beneath, each segment feebly maculate in middle and at sides with yellow; setæ black.

Head convex, setigero-punctate, forehead shallowly concave. Rostrum moderately long, deeply excavate; external ridges convergent basally, internal obsolete, median area narrow, lævigate, not raised, base bifoveate. Scrobes open posteriorly. Eyes subovate. Prothorax (5 × 6 mm.) obtusely subangulate on sides, apex rounded above, with a well marked postocular sinuosity; disc without collar-impression; granulate, granules small, hemispherical, setigerous, not present along vittæ; sides granulate. Elytra (13 × 7·5 mm) elongate, little rounded ; apex moderately strongly rounded, mucronate; base arcuate, humeral angles tuberculiform. Disc puncto-striate, punctures hardly traceable on account of the tubercles; interstices tuberculate, tubercles small, rounded basally, becoming more acutely conical towards apex; sutural with a single row of granules, second with nine or ten, third with fifteen to seventeen, rather smaller; fourth with six, more spaced out and not present on declivity; fifth with twelve to fourteen, sixth with eleven to twelve, forming lateral border. Sides granulate. Intermediate ventral segments long ; fifth deeply excavate, anterior half with a shallow impression occupying the middle two-fourths of segment, and with a small tubercle on either side, posterior portion occupied by a deep, transversely oval fossa in middle, and more shallowly excavate at sides. Anterior femora with a double ridge on ventral aspect. *Dimensions* : ♂. 21 × 7·5 mm.

Hab.—New South Wales. Type in Australian Museum.

Closely allied to *T. verrucosus*, and with a similar excavation of the apical segment of abdomen, but with the elytral granules or tubercles much smaller and more regular. The type is without locality-label, but probably comes from New South Wales.

A male in the Macleay Museum appears to be a small specimen of this species; it is smaller (18·5 × 7 mm.), and practically destitute of scales, but has the granules and anal excavation identical. The locality is Hunter River, N.S.W.

Talaurinus incanescens Macl.

Macleay, *loc. cit*, p.244; *T. encaustus* Pasc., *loc. cit.*, p.14.

♂.(Specimen in Australian Museum). Elongate, subparallel. Black, rather densely clothed with brownish scales, prothorax trivittate with white, elytra maculate on disc, with white along sides; beneath, with a few whitish scales in middle, and at sides of ventral segments.

Head convex, forehead convex. Rostrum moderately excavate; external ridges short, subparallel; internal prominent, convergent; lateral sulci long, deep; median area depressed, linear. Head and ridges rather densely setigero-punctate. Scrobes closed behind. Prothorax (4·5 mm.) rather strongly dilated on sides, apical and median lobes moderately developed, collar-constriction and median line marked; set with small, rounded granules, absent over median and lateral vittæ; sides granulate. Elytra (9·5 × 6·5 mm.) subparallel, apex strongly rounded, flanged, base subtruncate, humeri tuberculate; puncto-striate on disc, the lines somewhat irregular, each puncture subtended by a small granule; interstices tuberculate, second with six, third with nine, fourth with none or one, fifth with eight, sixth with none, seventh and lateral interstices granulate. Beneath, flat; intermediate ventral segments moderately long; fifth with a shallow, triangular excavation clothed with dense black hair.

♀.(Type in Macleay Collection). More ovate than male; head, rostrum, and prothorax (4 x 5 mm.) similar. Elytra (8 x 6 mm.) shorter, more ovate; base truncate; with somewhat irregular rows of punctures, each subtended by a small granule; second interstice with three or four tubercles, third with eight, basally rounded, conical towards apex, extending on to declivity; fourth with two near middle; fifth with eight, regular, less acute than in the male, not reaching to apex. Sides with interstices feebly granulate. Beneath, convex, intermediates long; with whitish scales, forming a feeble macule on each segment, and dispersed over the apical one; fifth segment without impressions. *Dimensions* : ♂.14·5 x 6·5; ♀.13 x 6 mm.

Hab.—West Australia: King George's Sound.

TALAURINUS INCANESCENS Macl., var. MURICATUS Macl.

Macleay, *ibid.*, 1866, p.321; *T. Macleayi* Pasc., *loc. cit.*, p.14.

♂. In general shape and appearance as in typical specimens, elytra with white clothing more pronounced. Head, rostrum, and prothorax (4 x 5 mm.) as in *T. incanescens.* Elytra (8·5 x 6 mm.) with the striæ more regular, the granules accompanying punctures not recognisable as such; interstices tuberculate, second generally with two, sometimes without, tubercles; third and fifth strongly tuberculate throughout, fourth without tubercles. Otherwise as in typical specimens. *Dimensions* : ♂.14 x 6 mm.

Hab.—West Australia.

Close to *T. incanescens*, of which I regard it only as a variety. The chief distinction seems to lie in the strial punctures and the accompanying granules.

Of this species and the variety, I have had under examination the following: (1) type of *T. incanescens* Macl.,♀; (2) cotypes of *T. encaustus* Pasc.; (3) type of *T. muricatus* Macl.; (4) cotypes of *T. Macleayi* Pasc.; (5) other specimens in the Australian Museum, Lea's and my own collections. *T. incanescens* and *T. encaustus* appear to have been founded on female specimens; *T. muricatus* and *T. Macleayi* on males. I formerly regarded the differences observable in the elytral striæ as sexual, and grouped these four as one; recently, however, more critical examination of a male of

T. incanescens in the Australian Museum, and comparison with the type of *T. muricatus*, have led me to regard the latter as at least worthy of varietal rank.

TALAURINUS RUGIFER Boisduval.

Boisd., Voy. de l'Astrolabe, ii., p.378; Macl., *l.c.*, p.236; *T. excavatus* Bohem., *l.c.*, p.54; Macl., *l.c.*, p.236.

♂. Elongate-elliptical, convex, robust. Black, in cavities sparingly squamose; setæ small, black.

Head large, convex, forehead concave. Rostrum deeply excavate; external ridges prominent, convergent slightly and continued on to forehead; internal ridges almost obsolete, represented by two elevations in the depth of the excavation. Scrobes open behind, continued almost to eye; eyes large, ovate. Antennæ moderately long, club hardly pedunculate. Prothorax(7 × 8mm.) strongly rounded on sides, apical sinuosity feeble; disc feebly depressed, granules minute, rather closely set; sides granulate. Elytra (16·5 × 9 mm.) elongate, subparallel; base strongly arcuate, apex rounded, humeral angles with a small nodule; disc with three double rows of moderately large, rounded, foveiform punctures, the intrastrial partitions not raised; interstices prominent, costiform, sutural slightly raised on declivity and near base, second very prominent, straight; third humeral; fourth lateral, well defined, and ending on sides of declivity; costæ with minute, obsolete, setigerous granules; sides with rather larger punctures, the interstices more granular. Beneath, with a brownish vitta; intermediate segments long; fifth not excavate. Anterior femora with a median tooth beneath, also rather closely granulate.

♀. Differs from male in its more ovate shape; in the elytra more produced and strongly mucronate; and in the absence of the femoral tooth. *Dimensions*: ♂.25 × 9; ♀.25 × 9 mm.

Hab. New South Wales: Sydney.

In ascribing the names *T. rugifer* and *T. excavatus* to the present species, I am following Macleay's identification; in the Macleay Collection, the male stands under *T. rugifer*, and the female under *T. excavatus*. I believe these names to be correct; of *excavatus*, Bohemann says: "apice . . . . . emarginata, nonprocul a sutura acumine valido"; and again: "supra convexa, transversim rugosa, bifariam rude sed minus profunde striato-punctata, interstitiis alternis elevatis, costatis, obsolete seriatim granulatis . . . ."; in regard to *T. rugifer*, the description might apply to this or the following form; in some ways, the description might even apply to *T. scabricollis* mihi (= *T. scaber* Macl.), but I do not know the male of that species, or whether it possesses the femoral spine distinctly mentioned by Boisduval.

TALAURINUS SIMILLIMUS Macleay.

Macleay, *l.c.*, p.237; Lea, Trans. Roy. Soc. S. Aust., p 111.

♂. Elongate, subparallel. Black, with sparse brown clothing in depressions; median vitta moderately dense, greyish-yellow; setæ minute, black.

Head convex, forehead concave, rather closely setigero-punctate, and with scattered yellow clothing. Rostrum deeply excavate, external ridges parallel, running back into head; internal very small, almost obsolete; median area depressed. Scrobes open behind. Eyes ovate Club moderately elongate. Prothorax (6 × 7 mm.) not depressed, collar-constriction feeble, set closely with very small, even, noncontiguous granules; sides granulate. Elytra (14 × 8 mm.) elongate, apex moderately produced, rounded; base subtruncate, humeri noduliform; with three double rows of small foveæ, the ridges between moderately raised, adjacent foveæ often communicating, interstices costiform, the sutural raised on declivity, less prominent elsewhere, the lateral interstices showing a tendency to resolve into component granules; sides with deep, subquadrate foveæ, interstices obsoletely granulate. Fifth segment without impressions. Anterior femora with a small spine situated near middle. *Dimensions*: ♂.21 × 8 mm.

Hab.—New South Wales: Merimbula Type in Macleay Museum.

Close to the preceding, of which, perhaps, it ought to be regarded only as a "form." It appears to differ chiefly in the character of the elytral foveæ, these being larger and more foveiform than in *T. rugifer*, the interstices also show no trace of that fine granulation visible in *T. rugifer*. It is certainly not a synonym of *T. foveatus*, as stated by Lea.

TALAURINUS FOVEATUS Macl., *loc. cit.*, p.237.

♀. Elongate-ovate, large. Black, sparingly cinereo-squamose in cavities, setæ black.

Head convex, forehead feebly concave at base of rostrum. Rostrum short, thick, deeply excavate; external ridges prominent, parallel, not continued along forehead; internal ridges low, well defined, convergent and contiguous basally. Scrobes open posteriorly, almost reaching eye. Eye large, ovate. Prothorax (5·5 x 6·5 mm.) rounded but not dilate on sides, with a feeble, apical, postocular sinuosity; disc convex, without impressions, granules small, rounded (not minute as in *T. rugifer*); sides granulate. Elytra (15 x 9 mm.) elongate-ovate, base subtruncate, humeral angle with a small nodule; disc with three double rows of foveæ, foveæ deep, irregular in shape, often confluent in the lateral row, never in the median, separated by irregular but well defined partitions; interstices prominent, costiform, somewhat wavy in outline; sutural slightly raised posteriorly and thickened at base; second and third (humeral) most prominent; fourth prominent, subgranulate; sides rugose, irregularly foveo-striate, interstices obsoletely granulate. Beneath, with a feeble yellow vitta; intermediate segments long, fifth not excavate. *Dimensions* : ♀.23 x 9 mm.

Hab.—" N.E. Coast." Type in Macleay Museum; Sydney.

A male, which appears to belong to the above species, from Sydney, is in my collection; it differs in the usual way in the genus, and also it lacks the median tooth on the anterior femora.

T. FOVEATUS, var. MONTANUS, n.var.

These Proceedings, 1912, Pl. iii., fig.17.

♂. Larger, relatively more elongate. Head and rostrum as in type; prothorax (6·5 x 7 mm.) more elongate; elytra (16 x 9 mm.) with somewhat different foveæ, having more tendency to become confluent laterally, the sides definitely and regularly foveate; beneath, with a median vitta of black hair. *Dimensions* : ♂.25 x 9; ♀.26 x 10 mm.

Hab.—New South Wales : Blue Mountains, Mt. Irvine.

In some respects, this variety approaches *T. lacunosus*, particularly in the regular foveation of the sides.

TALAURINUS LACUNOSUS Macl., *loc. cit.*, p.240.

♂. Size moderately large, elongate, not greatly widened posteriorly. Black, in cavities with yellowish-grey squames; setæ black.

Head strongly convex, forehead feebly flattened at base of rostrum, densely clothed and more sparsely setigero-punctate. Rostrum deeply excavate; external ridges prominent, slightly divergent; internal short but prominent at base, median area depressed, lateral sulci deep, triangular. Scrobes open and dilated posteriorly. Eyes ovate. Prothorax (5 × 6 mm.) strongly rounded on sides, apical sinuosity feeble; disc closely set with small, discrete, rounded granules. Elytra (14 × 7 mm.) elongate, apex strongly rounded, not mucronate, base subtruncate, humeri with small out-turned nodules, disc with three double rows of foveæ, foveæ deep, each confluent with one alongside in the same row, partitions between pairs of foveæ prominent, somewhat irregular, but complete; interstices prominent, costate, somewhat wavy in outline, and sparingly setigero-punctate; sides with regular rows of large foveæ. Beneath, with a brown median vitta; intermediate segments long, fifth feebly impressed. Anterior femora without a ventral tooth. *Dimensions*: ♂. 21 × 7 mm.

Hab.—New South Wales: Manning River (type in Macleay Museum; Port Macquarie (G. Masters).

A strongly foveate species, close to *T. foveatus*, but with large, more open foveæ; and with a more regular foveation on the sides of the elytra.

TALAURINUS SCABRICOLLIS, n.sp.

T. scaber Macl., (*nom. præocc.*), *l.c.*, p.240.

♀. Large, robust, elongate-ovate, strongly convex. Black, granules subnitid; depressions with muddy scales; setæ sparse, black.

Head convex, forehead feebly concave at base of rostrum, rather densely setigero-punctate. Rostrum short, deeply excavate; external ridges prominent, slightly divergent posteriorly; internal short but prominent, convergent; median area depressed, lateral sulci long, uniting with basal sulcus. Scrobes widely open posteriorly. Eyes ovate. Prothorax (5·5 x 6·5 mm) widest in front of middle, base truncate, apex with open postocular sinuosity, ocular lobes not prominent; disc rugosely granulate, granules irregular, confluent, tending to be arranged radially from area in centre, which is free from granules; towards and on sides the granules more distinct. Elytra (16 x 10 mm.) ovate, base almost truncate, shoulders thickened, noduliform; apex moderately produced, rather strongly mucronate, apical flange prominent; disc with three double rows of foveæ on each elytron, foveæ deep but irregular and confluent, the partitions prominent but incomplete, and seldom extending from interstice to interstice; interstices costiform, somewhat crenulate, first only costate at base, elsewhere represented by contiguous granules, second and third costate fourth split into granules by foveæ; sides rugosely granulate. Beneath, each segment with a feeble macule in centre; intermediates long, fifth large, with a feeble depression at apex. *Dimensions* : ♀.23 x 10 mm.

Hab.— Queensland(?). Type in Macleay Museum.

The name *T. scaber* being preoccupied by *T. scaber* Boisd., (= *T. aberrans* Macl.), a new name is required for the present species. The locality, Swan River, given by Macleay, I believe to be quite wrong; there is a specimen in the Australian Museum labelled "Victoria R., Mitchell's Expedition"; and the species probably comes from South Queensland or Northern New South Wales. The prothoracic sculpture should prevent this species from being confused with its immediate congeners. There is just a possibility that it may turn out to be *T. rugifer* Boisd.; unfortunately I do not know the male, and cannot tell if the anterior femora are armed or not.

TALAURINUS FOSSULATUS, n.sp.

These Proceedings, 1912, Pl. iii., fig 17.

♂. Large, elongate-ovate. Black, subnitid, esquamose, a few greyish scales on under side of prothorax, median vitta black; setæ minute, black.

Head convex, feebly impressed in front, rather strongly setigerous. Rostrum strongly excavate, external ridges somewhat divergent in basal half; internal short, prominent, arising from external ridges in middle, and strongly convergent; lateral sulci triangular, foveiform, meeting behind internal ridges median area strongly depressed. Scrobes somewhat open behind. Eyes ovate. Prothorax (5 x 6 mm.) not greatly dilated on the sides, apex with postocular sinuosity feeble, and feeble ocular lobes; disc with median line and collar-impression faintly marked; granules small, irregular, depressed, of abraded appearance, particularly near the centre, where the granules show a tendency to coalesce. Elytra (13·5 x 7·5 mm.) subparallel, little dilated on sides, apex widely rounded, base gently arcuate; humeral angles dentiform, projecting laterally; disc with three rows of large open foveæ, separated by well defined though irregularly disposed ridges, the foveæ becoming divided posteriorly and laterally by low and incomplete partitions; interstices prominent, costiform, crenulated in outline, sutural not so raised; sides with single rows of large foveæ, the interstices not raised. Intermediate segments long, flattened; fifth feebly depressed under cover of median vitta. Legs simple, femora not dentate *Dimensions*: ♂. 21 x 7·5 mm.

Hab.—Queensland: Warra Type in Australian Museum.

Perhaps closest to *T. scabricollis* in the partial confluence of the prothoracic tubercles, but not very unlike in general appearance. From *T. foveatus* and *T. lacunosus*, the difference in prothoracic sculpture should distinguish it.

TALAURINUS NIVEO-VITTATUS, n.sp.

These Proceedings, 1912, Pl. iii., fig. 14.

♂. Elongate-ovate, convex, robust. Black, densely clothed with white, forming longitudinal vittæ, head trivittate, median vitta bifurcate on rostrum; prothorax trivittate, each elytron with three, broad, dense vittæ; sides with white scales along striæ; beneath, with a median vitta of dark brown or black hair; setæ small, sparse.

Head convex, separately so from rostrum, with scattered setæ. Rostrum short, as wide at apex as head, deeply excavate, external ridges subparallel, slightly out-turned at base; internal ridges well defined but not prominent, separated throughout by a median sulcus; lateral sulci wide but shallow. Eyes large, ovate. Scrobes deep, open posteriorly towards eyes. Prothorax (6 × 6 mm.) elongate, somewhat feebly rounded on sides, base truncate, apex feebly sinuate behind eyes, but without definite lobes; disc convex, with three, deep, longitudinal furrows, between these not definitely granulate, but irregularly rugose; sides coarsely granulate, not reaching to coxæ. Elytra (15 × 8 mm.) gently rounded, apex rather abruptly rounded, feebly mucronate; base feebly arcuate, humeral angles slightly thickened but not prominent; each elytron with three broad striæ on disc, each with a double row of foveæ, the ridges between running up on to costæ; interstices costate, somewhat wavy in outline, all equally prominent; sides with three rows of deep foveæ. Undersurface flat, intermediate segments long, fifth with a shallow mesial impression. Legs simple, femora not dentate.

♀. Like ♂, but more ovate and robust; prothorax (7 × 8 mm.) and elytra (19 × 11 mm.) as in ♂, save that the elytra are more rounded on sides; beneath, feebly convex, median vitta much sparser, fifth segment with a short transverse impression at apex. *Dimensions*: ♂.23 × 8 mm.; ♀.27 × 11 mm.

Hab.—South Queensland (T. G. Sloane), Mt. Tambourine, Upper Logan (Queensland Museum; R. Illidge, R. J. Tillyard, A. M. Lea).

A very distinct species, readily distinguished, except from *T. Carteri* and *T. crenulatus*, by the broad longitudinal white vittæ. From *T. Carteri*, it differs in the smaller elytral foveæ; from *T. crenulatus*, *inter alia multa*, the great difference in size will prevent any confusion.

The female described is probably abnormally large; others I have seen are but little larger than the male.

Talaurinus Carteri, n.sp.

These Proceedings, 1912, Pl. iii., fig. 15.

♂. Large, oblongate. Black, elevations subnitid; densely clothed with greyish scales in depressions, forming longitudinal vittæ on prothorax and elytra; below, with median vitta of black.

Head large, convex, densely clothed. Rostrum moderately long, excavate, especially deep at apex; external ridges slightly sinuate, and out-turned at base; internal moderately prominent, convergent, sulci rather deep, confluent across base. Scrobes open behind. Prothorax (6 x 7 mm.) widest in front of middle, postocular sinuosity feeble; with three longitudinal impressions or spaces free from granules; the latter arranged in four groups on disc, irregular in size, and often confluent, but less so than in *T. niveo-vittatus*, a large confluent mass situated across apex of median line; sides granulate but not to coxæ. Elytra (15 x 9 mm.) little widened, apex strongly rounded, humeral angles thickened; each elytron with three longitudinal striæ, densely clothed and constituted of confluent foveæ in double series; interstices strongly raised, costiform, strongly undulate in outline, wlth lateral spurs running into striæ, often continuous across in the more lateral striæ; interstices showing a tendency to become split into nodules laterally and on declivity. Sides rugosely and irregularly nodulose. Fifth ventral segment rather deeply impressed at apex, the impression clothed with black hair. Lgs simple, anterior femora without tooth beneath. *Dimensions*: ♂.23 x 9 mm.

Hab.—New South Wales; Inverell.

I am indebted to Mr. H.J. Carter for the opportunity of describing this species. It is closely allied to *T. niveo-vittatus*, but differs in both its prothoracic and elytral sculpture, besides being a broader, more robust species. The foveæ on the elytra are rather larger than in *T. niveo-vittatus*, and more definitely foveæ, not merely punctiform depressions along the sides of the striæ.

TALAURINUS IMPRESSICOLLIS Macl., *loc. cit.*, p.239.

T. hiscipennis Macl., *ibid.*, 1866, p. 321.

♂. Elongate, subparallel. Block, opaque; in depressions with muddy-grey clothing.

Head convex, forehead feebly concave, not sharply marked off from rostrum, densely clothed. Rostrum deeply excavate throughout, external ridges parallel; internal short, strongly convergent, subdepressed. Scrobes open posteriorly, not subdivided. Eyes large, ovate. Prothorax (6 x 6·5 mm.) strongly rounded on sides, apex with postocular sinuosity rather strongly marked; disc depressed along median line, and with collar-constriction; finely, almost minutely, granulate, the granules rounded, contiguous; sides granulate to coxæ. Elytra (14 x 8 mm.) gently widened to behind middle, apex moderately produced, rounded, base feebly arcuate; each elytron with three, broad, double striæ on disc, each shallowly and closely cross-reticulate, with an indication of an intermediate interstice in centre; interstices four in number, all (including sutural) prominent, costiform, and extending from base almost to apex; sides obsoletely strio-reticulate, interstices subcostate. Beneath, with a median vitta of dark brown hair; fifth with a shallow depression at apex. Anterior femora with a sharp spine near base.

♀. More widely ovate in shape; prothorax (5·5 x 6 5 mm.) larger, not so dilatate; elytra (14·5 x 8·5 mm.) more strongly rounded, apex more produced, strongly mucronate and dehiscent, structure on sides more obsolete; beneath, feebly convex, with a feebler, more yellowish vitta; fifth segment with a longitudinal depression at apex; femora not spined. *Dimensions*: ♂. 21 x 8; ♀. 22·5 x 8·5 mm.

Hab.—Victoria. Types, *T. impressicollis* in Macleay Museum; *T. hiscipennis* in Australian Museum.

Though I have never seen specimens taken *in cop.*, there is no doubt that Macleay described the two sexes separately, *T. impressicollis* being the male, and *T. hiscipennis* the female.

The species seems to combine characters belonging to the first two groups of the section *Costati*, the rostrum being similar to that of *T. rugifer*, while the elytral sculpture is not deeply foveate, but is like the sculpture in *T. Kirbyi*.

TALAURINUS LÆVICOLLIS Pascoe, *loc. cit.*, p.17, t.2, f.8.

Black, nitid, practically without clothing, save for a yellow macule on each ventral segment.

Head depressed in front; rostrum excavate, external ridges slightly convergent, continued on to head; internal long, convergent; median area depressed throughout. Scrobes with a feeble extension backwards and upwards. Eyes subrotundate. Prothorax (4 × 5 mm.) rounded, disc convex, with a sinuous impression across in front of base, and a feebler one behind apex, absolutely lævigate, with minute scattered punctures. Elytra (11 × 6·5 mm.) ovate, apex moderately produced, mucronate; humeral angles with a prominent out-turned nodule; foveate in double series in two central striæ, in single in lateral stria; foveæ large, open, communicating irregularly, and separated by plications often incomplete; as a rule, foveæ situated side by side are not separated off; second interstice most prominent, costiform, and strongly undulating in outline; sides with smaller and more regular foveæ. Beneath, fifth segment not excavate, but with a feeble oblong impression at apex. Femora not spined.

♀. Similar, but rather more ovate, and convex beneath. *Dimensions*: ♂.17 × 6·5; ♀.19 × 8 mm.

Hab.—Victoria.

Readily distinguished by its lævigate prothorax; its relationship to the second group of the Section is indicated by the structure of the rostrum and third elytral stria.

Talaurinus costipennis, n.sp.

These Proceedings, 1912, Pl. ii., fig. 15.

♀. Size small, elongate-ovate. Black, opaque; depressions with a few dingy scales; setæ small, black.

Head convex, forehead very gently concave between ends of rostral ridges. Rostrum short, deeply excavate; external ridges rather strongly convergent, extending on to forehead, profile of head and rostrum straight; internal ridges long, extending from near apex, strongly convergent; median area narrow, depressed; lateral sulci long, deep. Scrobes with a feeble prolongation in front of eye. Eyes subrotundate. Prothorax (3·5 × 4·5 mm.) rather strongly rounded, orbicular, apex truncate, with very feeble postocular sinuosity; disc closely and evenly set with fine, somewhat depressed, granules; sides similarly granulate. Elytra (10 × 6·5 mm.) ovate, apex moderately produced, and conjointly mucronate; base subtruncate; humeral angles not produced but marked by a slight prominence; disc with double rows of regular, small, transverse punctures, interstices between single rows not prominent, between double rows interstices prominent, costate, nitid, with small decumbent setæ; *i.e.*, sutural interstice, second and third (humeral) raised the striæ between in double series, lateral interstice less prominent, with a tendency to granulation, striæ between humeral and lateral interstices in single series. Sides puncto-striate in single series; interstices feebly raised, setigerous. Under surface convex. *Dimensions* : 15 × 6·5 mm.

Hab.—Victoria.

In general appearance like a small specimen of *T. impressicollis*, but with the lateral striæ in single and not in double series. The male, of which there is a specimen in the National Museum, Melbourne, from Mooroolbark, differs in its less ovate shape, and in having a feeble depression on the apical ventral segment.

TALAURINUS CRENULATUS, n.sp.

♂. Small, elongate. Black, elevated parts subnitid; densely clothed elsewhere with white, especially condensed along each side of elytra; below each segment with dense yellowish scales, leaving lower border free; a thin median vitta of dark brown hair present; head bivittate.

Head convex, densely clothed, except along median line, sparingly setigero-punctate. Rostrum not quite in same plane as head, excavate; external ridges somewhat closer than normal, convergent; internal well defined but not prominent, median area strongly depressed, sulciform; sides ampliate. Scrobes widely open behind. Eyes rotundate. Prothorax (3·5 × 4 mm.) subquadrate, sides not greatly widened in middle, anterior margin truncate above, postocular sinuosity feeble; disc rugosely granulate, granules irregular, confluent, arranged in groups on either side of median line, which is strongly impressed, and at each side; sides without granules. Elytra (9 × 5·5 mm.) gently widened on sides, apex moderately produced, base arcuate, humeral angles prominent but not produced; each elytron with three double rows of punctures; the latter open, foveiform, confluent, without intervening ridges; interstices costiform, extremely undulate in outline, especially on third and fourth interstices, the intervening stria being narrower, and the interstices noduliform; sutural interstice only slightly prominent at base, second most prominent and straight at base. Sides puncto-striate, interstices not raised. Beneath, almost flat, intermediates long, fifth practically without impressions. Penis acutely pointed. Femora simple. *Dimensions*: ♂.14 × 5·5 mm.

Hab.—New South Wales: Tenterfield. A single male received from Mr. H. J. Carter.

In this and the two following species, the structure of the rostrum is like that in Group iv.; and it is possible that these three species should be referred to that group, as there appear to be intermediate forms at present undescribed. The clothing of the present species will readily distinguish it from the other two.

Talaurinus foveipennis, n.sp.

These Proceedings, 1912, Pl. ii., fig.11.

♂. Size moderate, form elongate-ovate. Black, subnitid, clothing practically absent, setæ black.

Head feebly convex in front, median line smooth, with obscure scales on either side of middle, and sparingly setigerous. Rostrum short, deeply excavate; external ridges convergent to base; internal short, rather more prominent at base than external; median area widely and deeply depressed in front, becoming sulciform behind; lateral basal sulci small, but marked. Scrobes open behind, second fossa not very definitely separate. Eyes small, deeply set in orbit, a narrow line extending from orbit to undersurface of neck. Prothorax (4·5 × 5·5 mm.) with evenly rounded sides, apex subtruncate above, with moderately marked ocular lobes; disc with somewhat ill-defined collar-impression, and broad, smooth, little impressed, median line; granules moderately large, depressed, with a tendency to become confluent, set in two rows on either side of middle, and grouped at each side, where the granules are more separate and rounded. Sides not granulate except above. Elytra (12 × 7·5 mm.) elongate-ovate, base deeply arcuate-emarginate; humeral angles strongly produced, tuberculiform; seriate-foveate in double series, foveæ moderately large, distinct; interfoveal ridges and intermediate interstices, second, fourth and sixth, evident as part of a reticulum separating the foveæ, but not greatly raised, and non-granulate; interstices third, fifth and seventh raised, costiform, undulate in outline, with a tendency to become nodulose and obsoletely granulate. Sides more regularly foveate, interstices not raised, lævigate. Beneath, flat, rather closely clothed with small black setæ. Apical segment very feebly impressed in middle, but showing faint indications of a deeper semicircular fossa and arrangement as in *T. humeralis*. *Dimensions*: ♂ 18 × 7·5 mm.

Hab.—Queensland (George Masters). Type in Macleay Museum.

Closest perhaps to *T. crenulatus*, but larger, without white clothing, with smaller, less open foveæ, and more strongly advanced shoulders. From *T. mythitoides*, the elytral sculpture and less confluent prothoracic granules will separate it.

The humeral angles are as strongly produced as in *T. humeralis* and allies.

Talaurinus mythitoides, n.sp.

These Proceedings, 1912, Pl. iii., fig.8.

♂. Elongate, elliptical-ovate, size moderate. Black, elevations subnitid, feebly clothed with greyish in depressions; beneath, with median vitta of yellow, and a patch on the side of each segment; setæ few, scattered, black.

Head feebly convex in front, with a smooth, subcarinate, median line, and more feebly subcarinate above eyes. Rostrum deeply excavate, external ridges convergent basally, not continued up forehead; internal definite, but less prominent; median area deeply depressed in front, sulciform behind. Scrobes open behind, secondary fossa not divided from scrobe. Eyes rotundate, deeply set in orbit. Prothorax (3·5 × 4·5 mm.) obtusely subangulate on sides, apex truncate above, ocular lobes feeble; median line impressed, wider in centre, bounded on either side by a continuous ridge, wider and nodulose in middle, a second large nodule near each side, between these other elevations more or less confluent, and leaving irregular spaces. Sides not granulate. Elytra (10 × 6·5 mm.) evenly widened, base arcuate, humeral angles noduliform, not greatly advanced; disc seriate-foveate, foveæ definite and in double series in inner striæ, becoming less definite laterally, interstices nodulose, second not traceable; third with a series of large, transverse, smooth nodules confluent on either side with ridges between the foveæ; fourth, fifth, and sixth with smaller, separate nodules, showing a tendency to coalesce laterally, but separated above and below; the whole sculpture confused, and differing on each elytron; sides more regularly striate, interstices smooth, not elevated. Beneath, without impressions. Legs simple. *Dimensions*: ♂.16 × 6·5 mm.

I am a little dubious about the sex of the type, as I have not ventured to relax the specimen, and there are no ventral impressions to guide.

Another specimen differs rather considerably in the elytral sculpture, having the second interstice more costiform and less nodulose, and the lateral interstices both more continuous and more connected laterally It probably is a different species, but until a large number of specimens can be examined to determine the range of variation, I do not think it wise to make a new species on every form. The specimen described is from Mr. G. Masters' Collection in the Macleay Museum, and was taken at Coonabarabran.

TALAURINUS ANGUSTATUS Macl., *loc. cit.*, p.241.

♂. Narrow, elongate, subcylindrical. Black, practically without clothing save for a few greyish scales in foveæ; setæ few, small, and black.

Head convex, obsoletely rugosely setigero-granulate, with an obsoletely impressed median groove. Rostrum short, little excavate; external ridges slightly divergent posteriorly; internal much broader, somewhat flattened, subparallel; lateral sulci long, deep at base, elsewhere shallow; median area feebly depressed, deepened behind apical emargination and in median basal notch. Scrobes strongly curved downwards towards eye. Eyes set low down, ovate. Prothorax (5 × 5 mm.) widest behind apex; median and ocular lobes, for the genus, strongly dveloped; closely set with coarsely, somewhat depressed granules, with a small setigerous puncture in centre of each; median area moderately free from granules; sides granulate. Elytra (10 × 5·5 mm.) elongate, little widened, strongly convex from side to side, base feebly arcuate, humeral angles marked but not pronouncedly produced; with three rows of double foveæ, the foveæ large, adjacent ones confluent to form larger open foveæ, separated above and below by well defined divisions, irregular in outline; interstices costiform, undulate in outline; sides foveo-reticulate, foveæ in single rows, separated by divisions equally prominent with interstices. Intermediate segments long; fifth with a rather deep quadrangular impression, the segment coarsely punctured. Femora without ridges beneath.

♀. Larger, more elliptical in outline, elytral sculpture showing a tendency to become granulated, most marked on sides where the foveo-reticulate structure is lost; fifth ventral segment obsoletely rugose, without impressions. *Dimensions*: ♂. 15 × 5·5; ♀. 18 × 6·5 mm.

Hab.—West Australia: King George's Sound. Specimens described from the Macleay Museum.

An isolated species, which might perhaps be regarded as distinct generically. Pascoe, under *T. capito*, notes — "*T. angustatus*, Macleay, jun., has a similarly marked rostrum." In *T. capito,* however, the rostrum is widely dilated beyond the external ridges; this is not at all the case in *T. angustatus,* in which the width across the external ridges is almost equal to the width of the rostrum. The eyes are ovate, and placed rather low down, so that, if the external ridges were continued back, they would pass considerably above the eye.

TALAURINUS CAPITO Pascoe, *loc. cit.*, p.17, t.2, f.7.

(?)♀. Elongate, subparallel. Black, practically without clothing. Head very large and broad (across eyes 4 mm.), continued on into rostrum without interruption; forehead strigose behind internal rostral ridges, elsewhere sparingly setigero-punctate. Rostrum very short and wide, not excavate, width across external ridges narrower than head (2 mm.), ridges subparallel; internal prominent, flattened, extending on to forehead farther than external; median area reduced to a narrow impressed line between internal ridges; sides widely dilated (4·5 mm. across apex of rostrum). Scrobes deep, short, with a broad extension sloping backwards to eye, and grooved along lower border; secondary lateral fossa shallow, strigose. Eyes small, round. Prothorax (4·5 × 5·5 mm.) broader across apex than base, apical margin without sinuosity or lobes, disc evenly and closely granulate, also on sides, granules somewhat depressed. Elytra (11·5 × 7 mm.) elongate-ovate, apex moderately strongly rounded, base truncate, humeral angles marked by a small nodule; disc with rows of small shallow foveæ; interstices not raised, granulate in double and single series, the granules flattened, not prominent, intrastrial granules present betwen the foveæ; sides foveo-striate, interstices similarly granulate. Beneath, setigero-punctate. *Dimensions*: 18·5 × 7 mm.

Hab.—West Australia: Champion Bay.

Another isolated species, whose exact position is extremely doubtful. It may be recognised by the extraordinarily large head and rostrum, and by its regular elytral sculpture, consisting of flattened granules. I have had, under observation, a specimen referred by the British Museum authorities.

TALAURINUS PRYPNOIDES, n.sp.

These Proceedings, 1912, Pl. ii., fig. 9.

♂. Small, narrow, elongate-ovate. Densely clothed all over with brown scales, prothorax with a lighter vitta near each side, and a median vitta feebly indicated at base; anterior and middle femora with rings of greyish scales near apex; setæ black.

Head little convex above, continued into rostrum in the same plane, somewhat rugose at base of rostrum, densely clothed and with scattered setæ. Rostrum short, little excavate, width across external ridges practically equal to width of rostrum; internal ridges long, little convergent; median area depressed, sulciform; lateral sulci moderately deep, narrow. Scrobes somewhat open, extending almost to eye. Eye rather long, ovate. Antennæ long, scape rather strongly incrassate. Prothorax (2·5 × 3 mm.) little widened on side, greatest width in front of middle, apex truncate above, practically without sinuosity; median line faintly impressed at base, irregularly impressed along lateral vittæ; granules setigerous, little elevated, obscured by clothing. Elytra (6·5 × 4 mm.) gradually widened to behind middle, thence narrowed to apex, which is rather strongly produced; base feebly arcuate, almost subtruncate; humeral angles noduliform, but not prominent; disc with small, regular foveæ in rows, foveæ separated by spaces of equal width, and arranged alternately in contiguous rows; interstices hardly traceable as such, but the third and fifth slightly more evident, not granulate but with numerous small setæ; sides foveostriate, interstices feebly granulate. Beneath, flat, with a few scales at sides, sparingly setigerous; intermediates long, fifth segment with a feeble longitudinal impression.

♀. Of somewhat larger, more ovate form; rostrum with internal ridges apparently shorter and more prominent; prothorax (2·75 × 3·5 mm.) widest in front of middle, relatively wider than in ♂; elytra (7·5 × 5 mm.) more ovate, base strongly arcuate, basal angles produced forwards; beneath, convex, with a feeble impression at apex. *Dimensions* : ♂.10 × 4; ♀.12 × 5 mm.

Hab.—South Australia. Type in Macleay Museum.

In general appearance, rather resembling *T. cavirostris* Lea, but with very different rostral sculpture. The species will not fit into any of Macleay's Sections, though he would probably have placed it among the *Foveati*. Above, the rostrum rather resembles that of *T. angustatus*, but the eyes are very differently set, and the scrobes are not curved.

TALAURINUS RAYNERI Macleay, *loc. cit.*, p.221.

♀. Large, robust, ovate. Black, densely clothed with yellowish scales, prothorax trivittate, elytra feebly maculate, and with the marginal vitta, white. Setæ long, bright yellow.

Head convex, rather closely setigero-punctate, separated from rostrum by a transverse sulcus. Rostrum little excavate, internal ridges broad, flattened; lateral sulci feeble, median area narrow, deeply sulciform. Scrobes deep, prolonged downwards. Eyes subovate. Prothorax (6 x 7 mm.) evenly rounded on sides, apical sinuosity feeble; disc convex, densely covered with fine, flattened granules, each bearing a long seta. Elytra (15 x 9 mm.) evenly rounded, apex not greatly produced nor mucronate, base subtruncate, humeral angles rounded; disc with longitudinal striæ feebly rugulate, not definitely punctate, each with single row of setæ down middle; interstices not much raised, with double or triple rows of fine, somewhat obsolete granules, bearing long decumbent setæ; seventh marginal. Beneath, convex, fifth segment with a punctiform depression at apex. Legs moderate in length. *Dimensions*: ♀.22 x 9 mm.

Hab.—(?)"West Coast of Australia." Type in Macleay Museum.

Evidently closely allied to *T. ambiguus* Macleay, and, like that species, rather doubtfully referred by Macleay to *Talaurinus*. Unfortunately I have never seen a male, but have no doubt that it will prove to be similar to *T. ambiguus*, which, whatever its position, certainly does not belong to *Psalidura*.

The locality given by Macleay, is, I believe, erroneous, and it is likely to prove to be a Queensland insect.

TALAURINUS AMBIGUUS Macleay, *loc. cit.*, p.225.

♂. Large, robust, convex. Black, densely clothed with brown scales variegated with lighter brown and white, setæ yellow. Head clothed with yellow setæ, trivittate with white, prothorax trivittate, elytra with white along inner side of each costa, also maculate more internally, sides albo-vittate; beneath, each segment with yellow hair, larger on each side of ventral excavation; posterior tibiæ with a brush of yellow hair along inner side.

Head strongly convex, densely setigero-punctate. Rostrum short, little excavate, save in front; external ridges not prominent, slightly convex in profile; internal thick, more prominent; lateral sulci shallow; median area linear, feebly depressed throughout. Scrobes deep, widely open posteriorly. Eyes subovate. Prothorax (6 x 7 mm.) rotundate, apical margin feebly sinuous above, with rather a strong postocular sinuosity; disc slightly depressed, and with a faint collar-impression; median line present; evenly and closely set with small, rounded, depressed granules, each bearing a long stout decumbent seta. Elytra (13 x 8·5 mm.) elongate-ovate, apex abruptly rounded, base subtruncate, humeral angles rounded. Disc with three broad striæ on each elytron, not foveate, but with a double row of obsolete cross-reticulations separated in middle by an obsolete intermediate interstice; interstices prominent, costate, each with a row of decumbent setæ along upper and inner aspect. Sides striate, each stria with a row of granules; interstices broad, setigero-granulate. Intermediates long; fifth segment large, with a deep median excavation, bounded on either side by a projection covered with long yellow hair; apical tergite likewise clothed. Legs short, tibiæ not longer than femora, thick; posterior tibiæ fringed on inner side. *Dimensions*: ♂.19 x 8·5 mm.

The above description is taken from a large unabraded male in my own collection.

Type, ♀.(Macleay Museum). Size smaller; setæ yellowish-red; clothing abraded, more feebly maculate and absent beneath; prothorax (5 x 6 mm.) with feebler impressions; elytra (12 x 8 mm.) with interstices more noticeably granulate and less costiform; seta smaller and situated nearer top of costa, intermediate interstices obsolete, striæ with cross-reticulations definitely granuliform. *Dimensions*: ♀.18 x 8 mm.

Hab.—Queensland: Darling Downs, Toowoomba

Notwithstanding the differences in size, I believe my specimens to be correctly identified, another male measuring 16 x 6 mm. I have left the species in *Talaurinus*, but the structure of the rostrum, prothorax, and legs would be quite sufficient to justify forming this and *T. Rayneri* into a new genus.

TALAURINUS AMBIGUUS var. DUBIUS Macleay, *loc. cit.*, p.226.

♀. Of the size and with the appearance of *T. ambiguus*. Black, practically without clothing; setæ light yellow.

Head and prothorax (5 x 6·5 mm.) as in typical specimens. Elytra (13 x 8 mm.) with intermediate interstices not obsolete, but interruptedly setigero-granulate in single series, fourth with only a few granules; interstices, one, three, five, and seven, prominent, subcostiform. Legs as in typical specimens. *Dimensions* : ♀.19 × 8 mm. Type in Macleay Museum.

Very close to *T. ambiguus*, of which I regard it as a variety, and not a constant one. Recently I have had, under examination, a series of specimens belonging to the Queensland Museum. On comparing the two types, *T. dubius* is almost without trace of clothing, and has distinct setigerous granules on the second, fourth, and sixth. *T. ambiguus* has dense clothing, a feeble row of setæ along the position of the second interstice, and none along fourth or sixth. These differences, I believe to be partly the effect of abrasion, and partly due to variation. In the Queensland Museum specimens, one can trace varying degrees of difference in both these details; one specimen before me, greatly abraded, has the second as prominent as the third and costiform, while the fourth is not even setigerous. Males corresponding to the type (♀) of *T. dubius* have the anal excavation as in corresponding males of *T. ambiguus*.

Hab.—Queensland : Gowrie, King's Creek.

Lataurinus, n.g.

Type, *Talaurinus rugiceps* Macleay.

Head large, broad; forehead flattened, continued on into rostrum in same direction, strongly setigero-granulate. Rostrum hardly excavate; internal ridges short, very prominent, obliquely set, subtended behind by a V-shaped groove separating rostrum from head; median area briefly carinate in centre. Scrobes wide, arcuate. Eyes ovate, set fairly low down. Prothorax evenly granulate. Elytra foveate.

The remarkable differences in the rostral structure and the granulate head, seem to entitle this species to, at least, subgeneric rank. It seems hardly possible to refer it, and one or two others here separated, to the same genus as *T. typicus*; but these aberrant forms differ so widely, *inter se*, as to make it impossible to refer them all to a common genus. The present genus seems closest to *Peritalaurinus*, but, *inter alia*, differs in the less convex, granulate head, and in the absence of the nodules at the base of the rostrum. From *Sclerorrhinella*, the strongly developed internal ridges, and differently set eyes, should be distinctive.

LATAURINUS RUGICEPS Macleay.

Talaurinus rugiceps Macl., *loc. cit.*, p.242.

♂. Large, elongate, subparallel. Black, subnitid, without clothing; setæ minute, black; undersurface and legs with longer, denser, black setæ.

Head broad, granules strong, somewhat rugose. Rostrum very short, rather broader than long; external ridges divergent posteriorly; internal strongly convergent, meeting; the rest as in the generic description. Prothorax (6 × 7 mm.) very broad, widest behind apex, thence narrowed towards base; apical margin with ocular and median lobes feebly but definitely marked; set with round, rather coarse granules, sides granulate. Elytra (12 × 7 mm.) not wider than prothorax, subparallel, base little arcuate, humeri subrectangular, not produced; disc with rows of small foveiform punctures, the inner two rows merged into one in anterior half, posteriorly separated by a row of granules, but communicating across, third and fourth, and fifth and sixth similarly communicating across interstices; interstices, first (basally), third and fifth prominent, subcostate, becoming granulate on declivity; second (where present), fourth, sixth, seventh and lateral interstices with rounded, closely set granules. Prosternum with a small projection on each side in front of coxæ. Beneath, densely setigero-punctate; intermediates long, fifth with a feeble ill-defined impression. Anterior femora not ridged.

♀. Like male, but broader, especially the elytra; humeral angles projecting laterally; beneath, convex, prosternal projections obsolete. *Dimensions*: ♂.21 × 7; ♀.14 × 8 mm.

Hab.—West Australia: King George's Sound. Specimens described, in the Macleay Museum, presumably the types.

Not close to any species known to me, on account of its curious rostrum. The antennæ are comparatively short, the scape hardly reaching the prothorax when lying back.

PERITALAURINUS, n.g.

Large. Head short, very broad, strongly convex. Rostrum separated from head by a transverse impression, short, wide, little excavate, not dilatate on sides beyond the external ridges; a bossy nodule present at base of external ridge, separated from rest of ridge by a constriction; median area raised; internal ridges noduliform. Scrobes strongly curved. Eyes ovate, compressed from behind forwards. Prothorax granulate. Elytra striate, interstices with flattened granules. The rest as in *Talaurinus*.

I have proposed this genus to receive the following species. It might be regarded as an aberrant form of *Talaurinus*, but its connection with the rest of the genus is so remote as to warrant its separation. The structure of the rostrum is most remarkable, particularly the projections at the base of the rostral ridges, these being on the rostrum, and not at the side of the head as in *Notonophes*. The compressed flattened appearance of the eyes is also characteristic.

PERITALAURINUS MACROCEPHALUS, n.sp.

These Proceedings, 1912, Pl. ii., fig.6.

♀. Large, robust, oblongate, convex, strongly declivous posteriorly. Black, subnitid; practically without scales, except on the appendages; setæ minute, black.

Head large, very short, and extremely convex, sparsely setigero-punctate, a few obsolete granules at base of rostrum. Rostrum short and thick, much wider than long, hardly excavate; apical marginal plate little emarginate, bordered behind by a deep transverse sulcus; external ridges divergent posteriorly, broad, rounded and convex in profile, dilated at base into a large nodule separated from the rest of ridge by a constriction; apical sulcus bordered posteriorly by a transverse ridge, continued back as a slightly elevated median carina; internal ridges situated at base, on either side of median area, large, noduliform, convergent. Scrobes deep, strongly curved. Eyes oblong-ovate, compressed. Mentum with a strong mesial tooth. Scape rather short but passing eye. Prothorax (7·5 × 9 mm.) rotundate, convex, sides rounded, apex very broad, with a feeble sinuosity on either side, without definite lobes; base broad, truncate; disc without impressions, closely and somewhat coarsely granulate. Sides granulate. Elytra(17 × 10 mm.) ovate, sides rounded, apex slightly produced, base almost truncate, humeral angles not produced; disc strongly convex and declivous posteriorly, longitudinally striate, striæ narrow, not foveate; interstices slightly raised, each composed of a row of low granules, closely placed in single series, granules equal in elevation, but on lateral interstices becoming transverse and in double series, the whole sculpture somewhat confused. Sides granulate in double series. Undersurface convex; first and second ventral segments transversely strigose, intermediates large, sparingly setigero-punctate; fifth not excavate, a feeble transverse impression present at apex. *Dimensions*: ♀, 26 × 10 mm.

Hab.—West Australia: York (C. French).

An aberrant and remarkable species, which it seems hardly possible to refer to *Talaurinus*. I have seen a male in a collection belonging to one of the European museums, and, except for being more parallel-sided, it did not differ much from the female. I have since seen a pair belonging to the South Australian Museum, which came from Blackburn's Collection.

OPHTHALAMYCTERUS, n.g.

Type, *T. laticeps* Macleay.

Head very broad, strongly granulate. Rostrum extremely short, no longer than head, little excavate; widely ampliate on sides, the width across external ridges less than width of rostrum. Scrobes short, posterior end definite, with a groove leading from inferior aspect towards eye. Eyes small, rounded, very prominent, situated distant to ends of scrobes. The rest as in *Talaurinus*.

I propose this new genus for a most curious species. In appearance, it seems a typical *Talaurinus*, but the structure of the head and rostrum, and particularly the curious form of the eyes, seem to warrant its separation from that genus. The eyes are small, but extraordinarily prominent, and present the appearance of the eyes in cases of exophthalmic goître.

OPHTHALAMYCTERUS LATICEPS Macl.

Talaurinus laticeps Macl., Trans. Ent. Soc. N. S. Wales, 1866, p.319.

♂. Black, without clothing; elongate, robust.

Head broad, 4·5 mm. wide across eyes; granules coarse, somewhat depressed, showing a tendency to radiate from centre of suture between head and rostrum. Rostrum very short and thick, apical concavity rather shallow; external ridges not raised, 2 mm. across, finely setigero-punctate; internal ridges short, most evident at base, where they are separated by a feeble groove; median area merging into internal ridges. Scrobes and eyes as in the genus. Prothorax (5 × 6 mm.) strongly transverse, practically without postocular sinuosity, with a moderately defined transverse impression behind apex; evenly set with rounded granules; sides granulate. Elytra (12 × 7 mm.) little wider than prothorax, strongly declivous, apex rounded, base feebly arcuate, humeral angles with small nodules; disc with ill-defined depressions accompanied by small granules; interstices tuberculate, sutural granulate, on the other interstices the tubercles becoming larger and more conical posteriorly, smaller and granuliform on declivity; sides with interstices regularly granulate. Beneath, fifth ventral segment with a shallow transverse depression.

♀. Elytra feebly maculate, not tuberculate, but interstices with numerous, small, flattened granules in single series, duplicated in places. *Dimensions* : ♂. 19 × 7 mm.

Hab.—West Australia : King George's Sound.

A species with a remarkable head and rostrum, not close to any other known to me. The great difference between the sexes, in regard to elytral granulation, suggests the possibility of their being two distinct species; but I have never seen a male with fine granulation, nor a female with tubercles. The table below gives a comparison of the elytral granules of four specimens (two of each sex).

Interstice.	Type ♂.	♂. Nat. Mus. Melbourne. L.	♂. Nat. Mus. Melbourne. R.	Type ♀.	♀. Nat. Mus. Melbourne.
2.	6	3	2	10	13
3.	11	11	9	20	numerous granules duplicated at base.
4.	...	.....	.....	5	6
5.	6	6	7	15	15
6.	5	5	5	10	12

Dicherotropis, n.g.

Type, *Talaurinus Dameli* Macl.

Allied to *Talaurinus*. Form narrow, subcylindrical in ♂, elongate-ovate in ♀. Head continuous with rostrum in the same plane above. Rostrum deeply excavate, external ridges separated from head by a distinct impression; basal end, as viewed from the side, bifurcate, the upper limb running towards forehead, the lower directed towards, but not reaching eye; median area deeply depressed, with a narrow impressed line at bottom; internal ridges absent. Eyes small, subrotundate. Prothorax subcylindrical. Elytra nodulose or foveate. The rest as in *Talaurinus*.

The bifurcation of the external ridges, together with their peculiar subcylindric form, appears to warrant the generic separation of the two species from *Talaurinus*. I have placed in this genus :—

Dicherotropis Dameli Macl.

Macleay, *loc. cit.*, p.242 : *T. cariosus* Pasc., *loc. cit.*, p.16; Lea, Trans. Roy. Soc. S. Aust., 1911, p.75.

Dicherotropis cavirostris Lea.

Lea, Mém. Soc. Ent. Belgique, xvii., p.83.

The two species, though evidently congeneric, show considerable difference in clothing and elytral sculpture. In *D. Dameli*, the clothing is practically absent, and both prothorax and elytra are strongly nodulose. In *D. cavirostris* Lea, the clothing is rather dense, while the elytral sculpture consists of small, punctiform foveæ, and is not nodulose.

As Mr. A. M. Lea has recently fully commented on both species, no further descriptions are necessary here.

Sclerorrhinella, n.g.

Type, *Amycterus Manglesi* Bohemann.

Allied to *Talaurinus* and *Sclerorrhinus*. Head convex, continued on into rostrum much in the same plane, set with small, rounded granules. Rostrum short, little excavate, a semilunar sulcus behind apical emargination; median area triangularly raised, lævigate, the angles of base produced to meet external ridges at apex of rostrum, the apex of triangle extending to base of rostrum; lateral sulci between median area and external ridges; internal ridges represented by a small nodule on each side in base of lateral sulci. Scrobes open posteriorly, but not reaching eye. Eyes subrotundate. Elytra tuberculate. The rest as in *Talaurinus.*

This genus will include *S. Manglesi* Bohem., *S. geniculata* Pasc., and *S. melanopsis* Pasc., referred, in Masters' Catalogue, to *Talaurinus*; and a new species, *S. granuliceps.*

Apart from its rostrum, the genus is in no way different from *Talaurinus*; in the raised median area, it approaches to *Sclerorrhinus*, but it is not carinate, as in that genus; while the presence of internal ridges denotes its affinity to *Talaurinus.* In its granulate head, *T. laticeps* is similar, but the rostrum is different. Unfortunately I have not been able to dissect out the male genitalia.

SCLERORRHINELLA MANGLESI Bohem.

Amycterus Manglesi Bohemann, Schonh., Gen. Curc., vii. (1), p.61; Macleay, Trans. Ent. Soc. N. S. Wales, i., 1865, p.244.

♂. Moderately large, ovate. Black, rather densely clothed with greyish; head with median vitta widely bifurcate on rostrum, and supraorbital vitta; prothorax trivittate, elytra maculate with grey and brown, suture grey, sides more densely clothed; median ventral vitta black.

Head and rostrum as in the genus; internal ridges represented by a stout, rounded granule in base of lateral sulcus on either side. Prothorax (4×5 mm.) moderately dilatate, apical lobes feeble, collar-constriction distinct; moderately closely set with small, rounded, feebly flattened granules, smaller along median and lateral vittæ; sides granulate. Elytra (11×7 mm.) rather strongly rounded, apex widely rounded, base feebly arcuate, humeral angles marked by a small nodule; disc somewhat transversely rugose, hardly foveate; with rows of tubercles, sutural with fine granules and a few larger ones at base, second with ten separate tubercles, the basal ones rounded, feebly depressed, the last four conical; third with smaller, more numerous, rounded tubercles, in double series in the middle, and about six small conical ones more posteriorly; fourth with five rounded ones in middle, and three conical ones at edge of declivity; fifth with a close row of twenty-five, the basal ones rounded, becoming larger to declivity, and then slightly smaller; sixth with fifteen small, but mostly conical; sides with less elevated, rounded granules. Beneath, subnitid, median vitta of dense hair extending from metasternum to fifth segment; apical segment with a moderately deep impression in apical half. Legs simple.

♀. More ovate, convex beneath, with silvery-grey, subsetose scales in middle, and at each side of segments. *Dimensions*: ♂, $17{\cdot}5 \times 7$; ♀, 17×8 mm.

Hab.—West Australia: King George's Sound.

A long described, and not uncommon West Australian insect; a comparison of my specimens with the original description, leaves no doubt, in my mind, of the correctness of the identification. The three species, known to me, of this genus, are all closely allied, and may conveniently be tabulated—

1.(6)Species densely clothed, clothing variegate.
2.(5)Elytral tubercles separate on second interstice.
3.(4)Elytral tubercles in double series in middle of third interstice............ *S. Manglesi* Bohem.
4.(3)Elytral tubercles in single series on third interstice.......................... *S. geniculata* Pasc.
5.(2)Elytral tubercles closely placed, and giving second interstice a serrate appearance... *S. granuliceps*, n.sp.
6.(1)Species esquamose, nitid. Size 6 lines... ....***S. melanopsis* Pasc.

Sclerorrhinella geniculata Pascoe.

Talaurinus geniculatus Pasc., *l.c.*, p.15.

♀. Ovate, obese. Black, densely clothed with ochraceous scales; prothorax trivittate; elytra maculate with white, brown,

* Known to me only from description.

and ochraceous; legs with whitish, setose scales, apices of femora black; setæ minute, black.

Head set with small, rounded granules, forehead feebly concave. Rostrum as in the genus, the external ridges rugosely punctured, internal ridges obsolete. Prothorax (4·5 × 5·5 mm.) rounded on sides, apical sinuosity feeble; disc convex, granules small, rounded and dispersed; sides granulate. Elytra (11 × 8 mm.) strongly ampliate posteriorly, apex abruptly rounded, strongly declivous; base arcuate, humeral angles prominent, noduliform; disc with six rows of granules becoming tuberculate posteriorly, sutural with only a few at base, second and third with about fourteen, the last five in each tuberculate; fourth with eight or nine, not present on declivity, fifth and sixth with about thirteen, the last six or seven conical. Beneath, convex, with a few scales on ventral segments. *Dimensions*: ♀, 16 × 8 mm.

Hab.—West Australia.

Seven specimens, sent out, for examination, from the British Museum, one (described above) marked as compared with type. Another specimen (♂) has the tubercles smaller; and, beneath, a median vitta with black hair, widening out into a shallow triangular impression at the apex of fifth ventral segment.

SCLERHORRHINELLA GRANULICEPS, n.sp.

These Proceedings, 1912, Pl. ii., fig.14.

♂. Elongate-elliptical. Black, rather densely clothed with dark brown scales, head feebly trivittate, median vitta bifurcate and more strongly marked on rostrum, prothorax and elytra broadly trivittate with white; median ventral vitta black; setæ small, black.

Head and rostrum as in the genus; granules on head small, rounded, somewhat depressed; external ridges convergent posteriorly, setigero-punctate; internal ridges small, obscured, graniform. Prothorax (4 × 5 mm.) strongly rounded on sides, postocular sinuosity feeble; closely and evenly set with small, rounded, setigerous granules, not contiguous; sides granulate. Elytra (10 × 6 mm.) elongate-ovate, apex strongly rounded, base arcuate, humeral angles noduliform; disc puncto-striate, punctures small, intervening ridges not granulate; interstices rather strongly raised, sutural with granules only, more evident at base; second closely set with about twenty-five granules, rounded, feebly flattened, basally becoming conical and tuberculiform posteriorly, and extending half-way down declivity; third with basal granules in double series to middle, thence as on second; fourth less prominent, with smaller, more distant, granules in single series to middle; fifth similar to third, but tubercles slightly smaller; sixth with a single row similar to fifth; sides with rounded, somewhat depressed granules. Below, with a narrow median vitta of black hair extending anteriorly to metasternum, posteriorly widened out on fifth segment, the latter with a shallow impression obscured by the vitta. Legs simple.

♀. Clothing lighter, with darker areas maculate with white, and without granules on fourth interstice; beneath, convex, without median vitta, subnitid, apical segment with a few white scales, transversely compressed above apex. *Dimensions*: ♂, 15·5 × 6; ♀, 17 × 6·5 mm.

Hab.—West Australia: Harvey Agricultural Area. Type in Australian Museum.

Closely allied to *S. Manglesi*, but with the elytral interstices more closely granulate or tuberculate, the tubercles being placed so close as to give the interstices a serrate appearance. I hardly think that this can be *S. melanopsis* Pasc.; as, of that species, the author states—"niger, nitidus, supra esquamosus . . . ", and gives the length as 6 lines. I have seen abraded specimens of both this species and *S. geniculata*, but none so small as 6 lines.

There is a species, in Mr. Lea's Collection, bearing a label in Arrow's handwriting, "Tal. Manglesi (of your collection) is T. melanopsis Pasc." The specimens are females of the species I regard as being almost certainly *S. Manglesi* Bohem. If this synonymy is correct, *T. melanopsis* must have been founded on a small abraded example.

The following description was inadvertently omitted from its proper place (p.347):—

TALAURINUS TUMULOSUS, n.sp.

These Proceedings, 1912, Pl. iii., fig.5.

♀. Size moderate, ovate. Black; with muddy-grey scales on elytral and prothoracic depressions, and along head and rostrum, forming two longitudinal stripes.

Head, as viewed from side, flat above, sloping on to rostrum without interruption; when viewed from in front, the external rostral ridges are seen to extend back to vertex, slightly converging; forehead concave between ridges, mesial line bare. Rostrum rather feebly excavate, external ridges prominent, median area triangular, elongate, the sides feebly raised to form the internal ridges, a small feeble fovea present at base, sublateral sulci long, shallow, continued on to forehead. Scrobes deep, rather short, with a shallow prolongation upwards and backwards in front of eye. Eyes small, round. Prothorax (3·5 x 5 mm.) transverse, apex feebly sinuate, no definite lobes present; disc irregularly rugose, a transverse impression in front of middle, in front of which are two small plicated elevations, and two larger ones behind, one on each side of middle line, a similar elevation at each side in the middle, posteriorly to these elevations a number of smaller granules are present; sides without granules. Elytra (11 x 7 mm.) evenly rounded, apex with a fine, rather long, mucro; base widely arcuate, humeri marked by a prominent granule. Disc with five rows of punctures, shallow, almost obsolete; interstices for the most part not prominent, but with large elongate nodules or tubercles, first with a single nodule at base, second with two larger ones in middle and two or three smaller conical ones on declivity, third with four large ones extending to base but not on declivity, the last one conical, fourth without tubercles, fifth with one or two near middle and two near humeral angle, the basal one large and prominent, sixth with five conical tubercles. Sides obsoletely granulate. Beneath, convex, intermediate segments long, fifth without impressions. *Dimensions*: ♀,17 x 7 mm.

Hab.—New South Wales: Inverell (J. Stephen, per H. J. Carter).

In the prothoracic sculpture, this species shows an approach to *T. catenulatus*, but the elytral sculpture is closer to that of *T. bucephalus*. As the external rostral ridges are continuous along head, I prefer to regard this species as belonging to the *typicus*-group, though the internal ridges are not prominent. Probably the discovery of a male would decide its true position; but the species is so distinct, that I have not hesitated to describe it on a single female.

ORDINARY MONTHLY MEETING.

July 30th, 1913.

Mr. W. S. Dun, President, in the Chair.

Mr. C. H. Burton Bradley, M.B., Ch.M., D.P.H., University of Sydney, was elected an Ordinary Member of the Society.

The President formally announced the decease of a Member, Mr. E. Betche, since the last Meeting. Mr. Betche joined the Society in 1887; for many years was Senior Botanical Assistant at the Sydney Botanic Gardens, and was an experienced and very capable taxonomic botanist.

Mr. Maiden bore testimony to Mr. Betche's worth, and said that, in spite of delicate health, his late colleague had accomplished much strenuous and valuable work.

Attention was called to communications from : (1) The Royal Society of South Australia, giving particulars of the Society's offer of monetary grants in aid of scientific research; and (2) Dr. A. R. Crook, Springfield, Ill., U.S.A., representing a committee appointed by the Illinois State Academy to consider the question of calendar-reform, submitting proposals for reforming the calendar, and inviting expressions of opinion thereon.

The Donations and Exchanges received since the previous Monthly Meeting (25th June, 1913), amounting to 18 Vols., 92 Parts or Nos., 22 Bulletins, 2 Reports, and 5 Pamphlets, received from 64 Societies, &c., were laid upon the table.

NOTES AND EXHIBITS

Dr. Kesteven asked to be allowed to rectify an omission in his paper "On a new Endoparasitic Copepod [*Ubius hilli*]" in Part 4 of the Society's Proceedings for 1912, recently issued. It should have been stated that the type-specimens had been presented to the Australian Museum.

Mr. A. R. McCulloch showed some drawings of fishes made upon specially prepared paper, the use of which reduced the time and labour otherwise necessary to produce similar results.

Mr. A. A. Hamilton showed specimens, from the National Herbarium, of *Mesembryanthemum edule* Linn., "Hottentot Figs," a South African plant which (so far as he knew) had not not been recorded for New South Wales. The plant is growing on Lady Robinson's Beach, associated with the indigenous *M. æquilaterale* Haw. It is easily distinguished from the latter by the larger leaves and fruits, and by having both yellow and purple flowers on the same plant. It is recorded from Victoria in Ewart's "Weeds, Poison-Plants, and Naturalized Aliens"(p.82).—Also a series of leaves taken from plants of *Senecio lautus* Forst., growing at Lady Robinson's Beach, showing variation from entire to pinnatisect, from ½ an inch to 6 inches long, and from under 1 line to nearly 1 inch broad. This particular form, of a widely distributed and variable species, seems to have selected the coastal sand-dunes as a habitat, no plants being seen more than a few hundred yards inland. It was noted that the leaves became more succulent as the plants approached the beach.

Mr. E. Cheel exhibited specimens of an interesting lichen, *Parmeliopsis semiviridis* (Nyl.) A. Zahlb., collected by Mr. D. G. Stead, at the junction of McKeown's Creek and Duckmaloi River. It was originally collected on rocks (Table Mt.) in Tasmania, by Robert Brown,(No.525b), and recorded by Crombie [Journ. Linn. Soc., Bot., xvii., 1880, 397] under the name *Chondropsis semiviridis* (F. Müll.), Nyl. See also Vict. Nat. iv., 95. Baron F. von Mueller afterwards collected specimens on the Murray River, and named them *Parmelia semiviridis*. This latter name is recorded by Nylander in his "Enumération générale des Lichens, et leur distribution géogr." *Parmelia hypoxantha* Müll.-Arg., Lich. Beitr., No.242 (1881); F.v.M., Fragm. xi. (Suppl.) 1883, p.116: Tepper, Proc. Roy. Soc. S. Austr., ix., also belong to the above species. The plants have the peculiar character of inrolling during dry weather, and unfolding in damp or rainy periods; and specimens from Belltrees, Scone, collected by Mr. H. L. White, in August, 1906, were exhibited at a meeting of this Society in 1909 [These Proceedings, 1909, 591]. In addition to the above, specimens have been received from Old Man Point, Canoblas (T. H. Johnstone; April, 1908). A variety of the species has been found and recorded from Spencer's Gulf, and Mount Eba (Giles, No.107); and Fraser's Range, S.A.(R. Helms, Nos.43, 73); and from Mueller River, Queensland (C. W. Birch), under the name *Parmelia semiviridis* var. *major* Müll.-Arg., (Lich. Beitr. No.579, and "Hedwigia," 1892, 193; see also Proc. Roy. Soc. Queensland, vi., 1889, 115; and Shirley's Lichen-Flora of Queensland, p.187, for the Queensland record). There is a specimen in the National Herbarium, from Biddenham Agathella, Queensland, collected by Miss H. Martin, which is only a slightly broader form, and clearly belongs to the variety. The specimens very closely resemble some forms of *Cladonia foliacea* Schaer., especially var. *convoluta* Wain.; and it is interesting to note that Nylander (*l.c.*) created a Section Cladonioides, of the genus Parmelia, for the inclusion of this very interesting species. It is quite possible that *Cladonia degenerans* f. *erratica* Lindsay, [Trans. Linn. Soc. London, xxv., 533, 1866] found at Woodburn, Saddle-Hill, New Zealand, may belong to this species, as it is said to become curled up into ball-like masses, which are detached in course of time from the ground, and which then roll freely before the wind on the downs about the seaward base of Saddle-Hill.—Mr. Cheel also contributed the following Note on Red Clover Rust: At the Agricultural Show held in Sydney, in 1909, I obtained a few seeds of the Perennial Red Clover, and sowed the seeds in my garden at Penshurst. The seeds germinated, grew into fine healthy plants, and flowered; and some of the seed was set, as several self-sown plants came up in the vicinity of the parent-plants. All the self-sown plants were allowed to grow, and they were healthy, showing no sign of disease. One of the self-sown plants was transplanted into some very poor virgin soil at Hill Top, in September, 1912, and in December of the same year I noticed that the plant was very badly "rusted" with *Uromyces trifolii*, specimens of which were exhibited at the Meeting of this Society in May, 1913. With a view of trying to infect plants of "White or Dutch Clover" (*T. repens*), I lifted the plant of "Perennial Red Clover" (*T. pratense-perenne*) which was in very poor condition, and every leaflet more or less "rusted." and put it into a flower-pot with some rich compost, and placed it in one of the hot-houses in the Botanic Gardens. The result was that the plant had now produced several apparently healthy shoots and leaflets, with no signs of "rust" on any part of the new growth.—On behalf of Dr. J. B. Cleland, the two following interesting species of *Phalloideæ* were shown : *Clathrus pusillus* Berk.,(Milson Island, Hawkesbury River; July, 1912) [for previous records, see These Proceedings, 1907, 839; and Cheel, in The Directors' Annual Report of the Botanic Gardens, Sydney, (1909) 1910, p.11]; and *Lysurus australiensis* Cke. & Mass., (Milson Island; July, 1912). In the National Herbarium, there is also a fine series of specimens from Campsie, collected by J. Nichol in April, 1912, with six and seven lobes instead of the usual five; and also specimens from Woolwich, collected by Mr. F. Smith, in June, 1908, with two of the lobes united at the apex: and from Botanic Gardens, Sydney (W. F. Blakely, and W. Challis).

Mr. H. J. Carter showed a representative series of specimens of the genus *Notonomus*, in illustration of Mr. Sloane's paper, distance preventing the exhibition of the author's collection.

Mr. North, with the sanction of the Curator of the Australian Museum, sent for exhibition, skins of an adult male and female Black-banded Fruit-Pigeon (*Leucotreron alligator* Collet). These specimens were collected respectively on 23rd and 24th June, 1912, at Owenpilly, East Alligator River, Northern Territory, by Professor W. Baldwin Spencer, of the University of Melbourne, and Director of the National Museum.

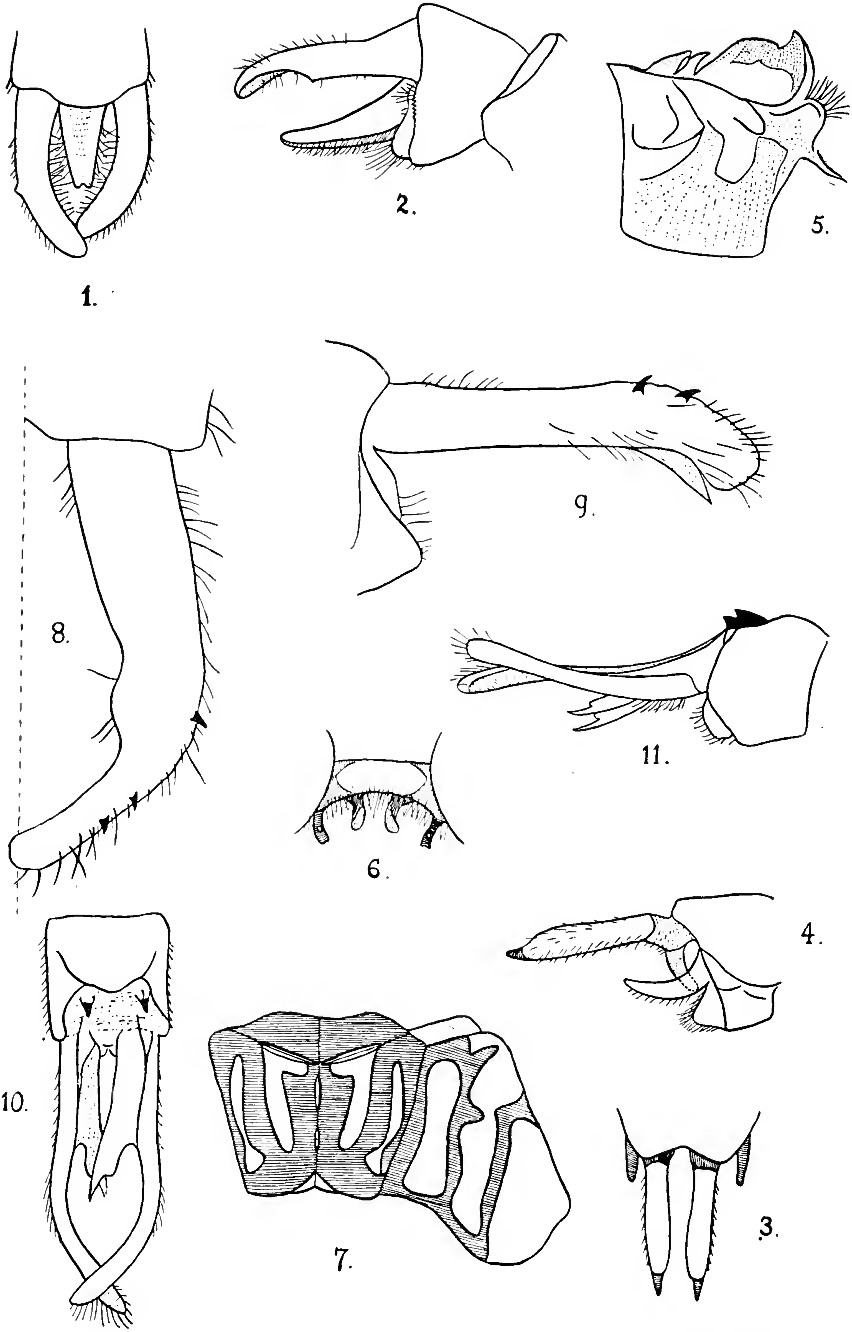
Mr. Fred Turner exhibited specimens of, and contributed notes on :—(1) *Andropogon ischæmum* Linn., from near Kempsey, N.S.W. This West Australian, European, and Asiatic grass appears to have established itself on the east coast, but there is no information to hand as to its value locally as stock-feed. In West Australia, pastoralists regard it as a valuable forage-grass. (2) *Isachne australis* R.Br. This species was collected on the Island of Singapore, and was brought by Mr. Neville for accurate determination. Although it is indigenous to Australia, Bentham(Flora Austr. vii., p.625) says it occurs "also in Tropical Asia from Ceylon and the Peninsula to the Malayan Archipelago and South China." *Isachne australis* is figured and described in Turner's "Australian Grasses"(Vol. i., p.31) (3) *Panicum plicatum* Lam., from near the Tweed Heads, N.S.W. This ornamental grass is indigenous to the Antilles, West Indies, but has long been growing in some Australian gardens. The specimens shown were evidently escapées from cultivation. There is a very beautifully variegated form of this species grown under the name of *P. plicatum* var. *niveo-vittatum*.

Mr. W. S. Dun exhibited, on behalf of the Department of Mines, a photograph of a slab of shale from the South Bulli Colliery, showing very clear Reptilian footprints. The shale forms the roof of the Upper or Bulli Seam. The footprints are practically identical with those described from the Upper Coal-Measures and Permian of the South of England, and Germany, as *Ichnium gampsodactylum*. The specimens were collected by Mr. A. E. O. Sellors, Superintendent of the mine. Many more are to be seen in the roof of the drive.

On behalf of Mrs. Masters, the Secretary asked the Society's acceptance of an enlarged photographic portrait, an excellent likeness, of the late Mr. George Masters, for many years Curator of the Macleay Museum, and an Original Member of the Society. The President gave expression to the pleasure which this addition to the Society's series of portraits of pioneers in science and old Members of the Society, afforded; and the Secretary was asked to convey to Mrs. Masters an appreciation of her kindness, and best thanks.

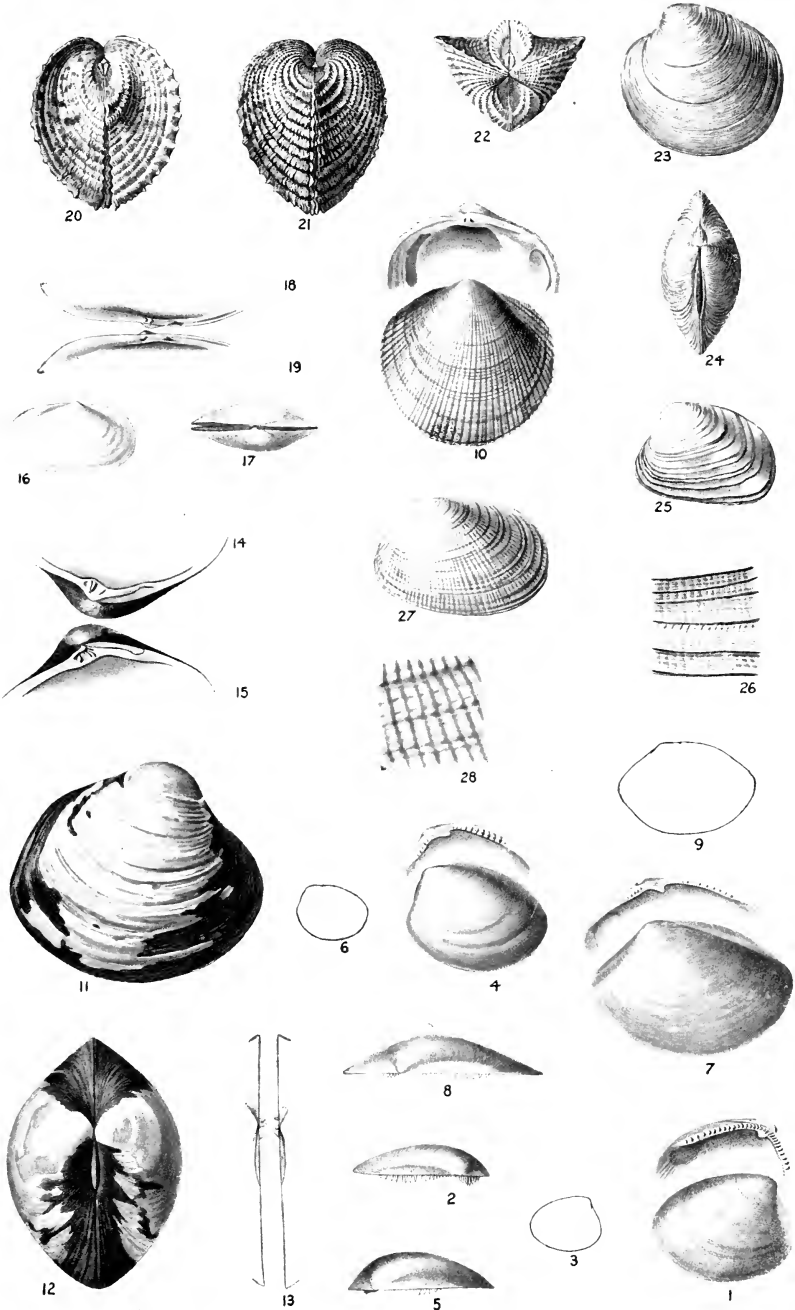
The discussion on "The Study of Zoogeographical Distribution by means of Specific Contours," introduced by Mr. Tillyard at the Meeting in May, was resumed. After Dr. E. W. Ferguson, and Messrs. Waterhouse, G. P. Darnell Smith, E. Mackinnon J. H. Maiden, Dr. Kesteven, and R. T. Baker had spoken, further discussion was adjourned to next Meeting.

[Printed off, 31st October, 1913.]



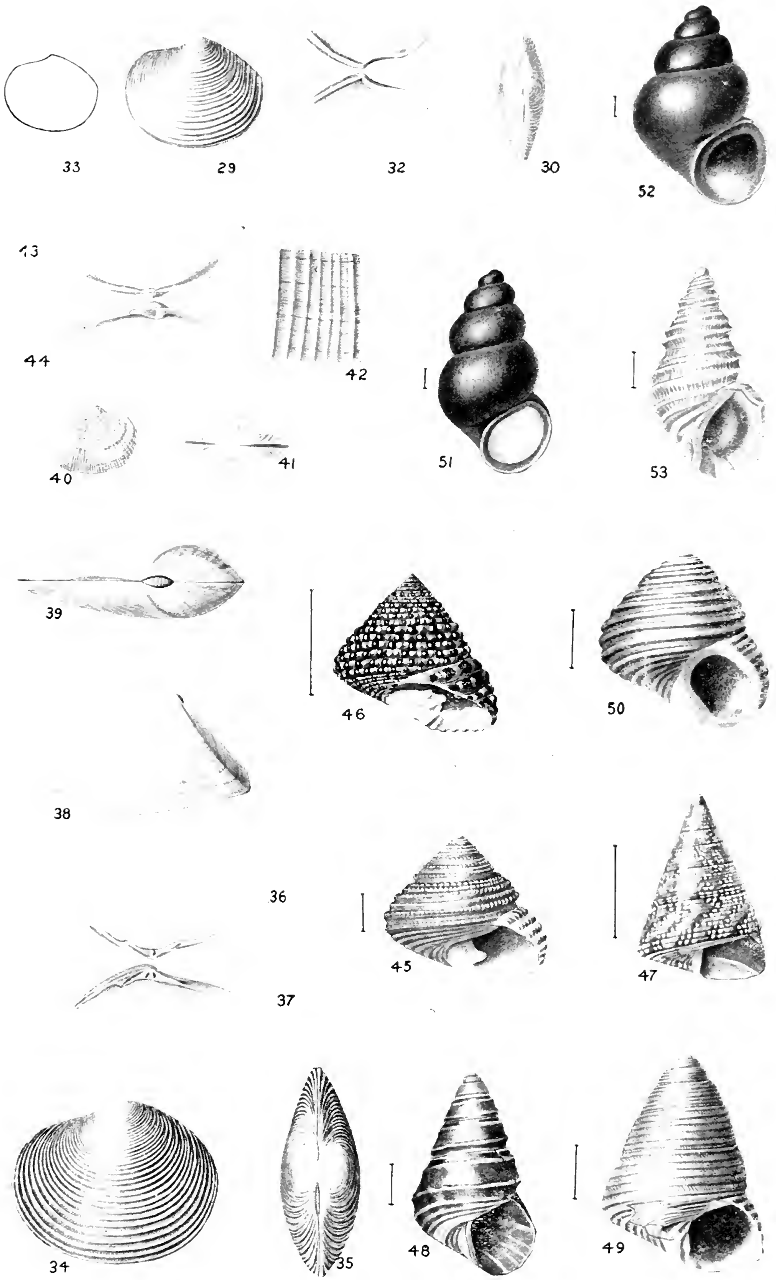
R. J. T. del.

New Forms of Australian *Odonata*.



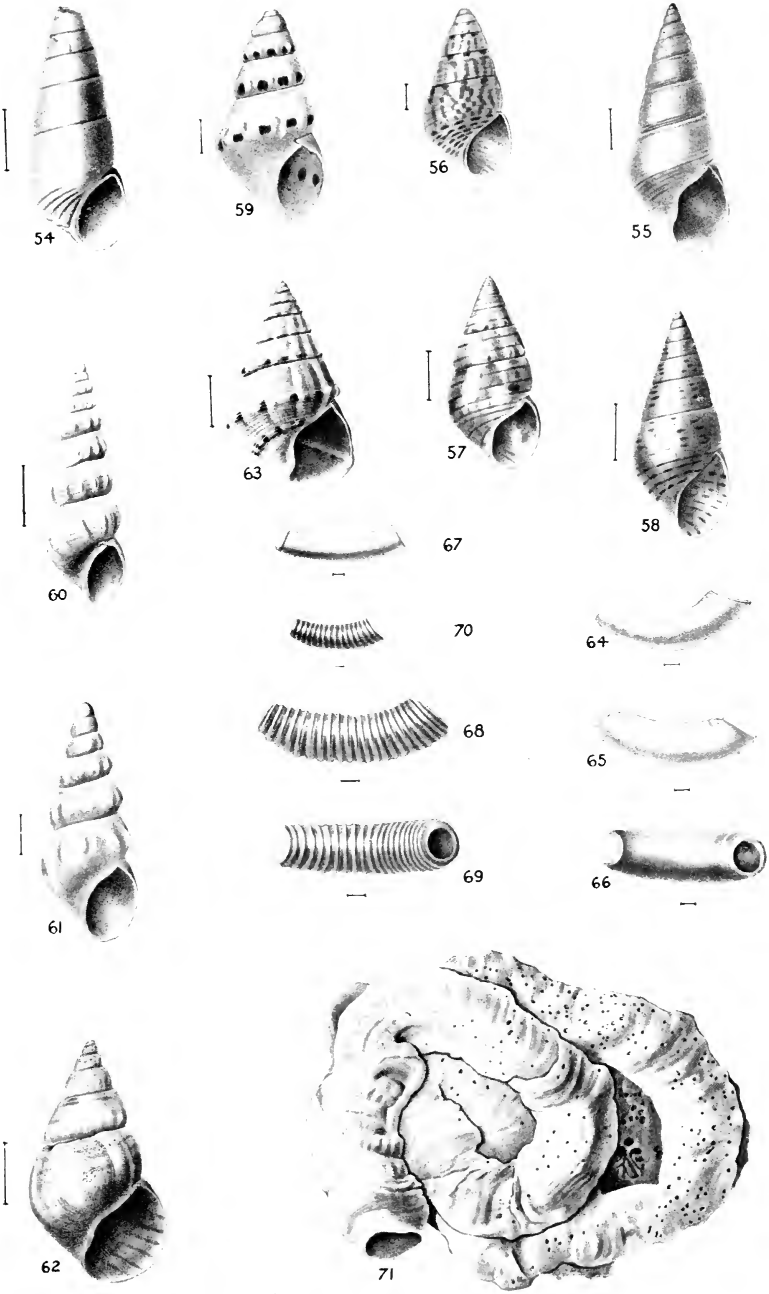
A.H. SEARLE, DEL.

Australian Mollusca.



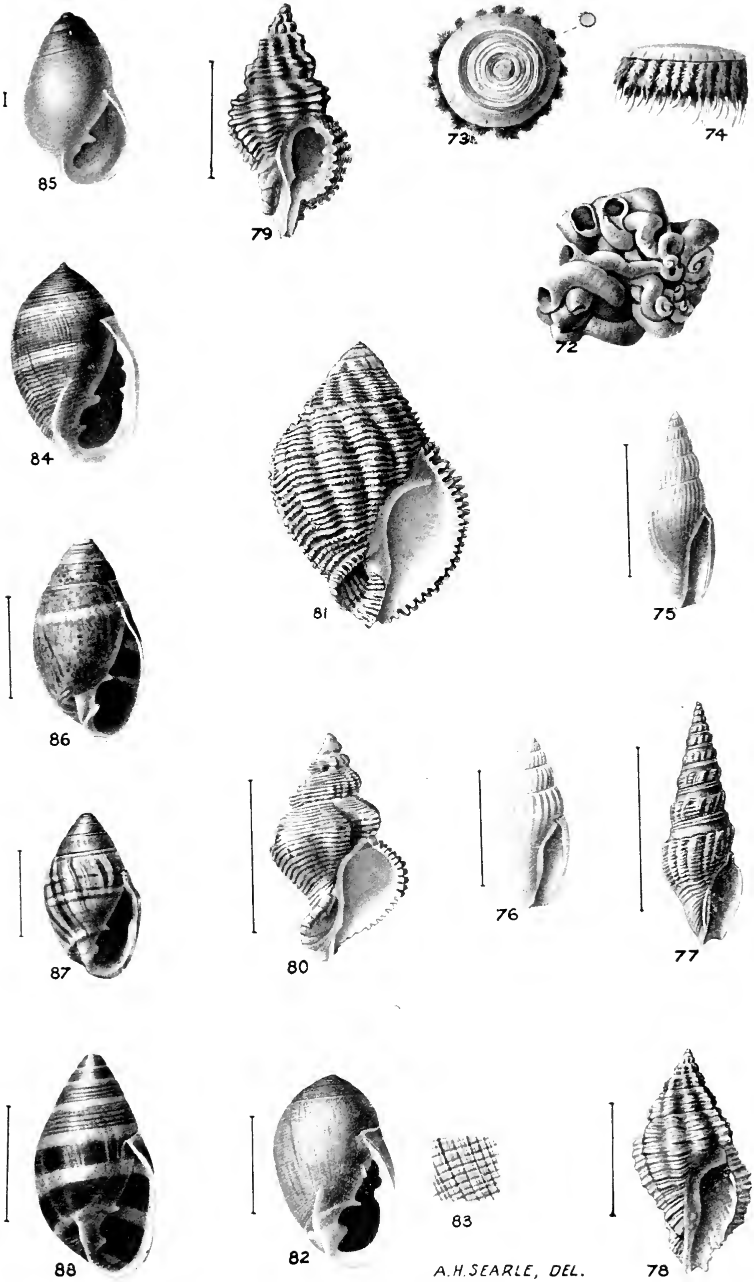
A.H.SEARLE, DEL.

Australian Mollusca.



A.H.SEARLE, DEL.

Australian Mollusca.



Australian Mollusca.

DESCRIPTIONS OF TWO NEW SPECIES OF *CICINDELA* FROM WESTERN AUSTRALIA.

By Thomas G. Sloane.

Cicindela browni, n.sp

♂. Elongate-oval Prothorax (including pronotum), mesosternum, lateral parts of metasternum, posterior coxæ, and abdomen beset with white hairs; a few white hairs near outer basal angle of cupreous area of elytra, and on sides of head beneath eyes; front with two white setules near margin of eye above insertion of antennæ; four basal joints of antennæ with white hair, upper side of basal joint densely clothed with white hair. Cupreous; elytra lacteous, with a cupreous discal area as in *C. sætigera* Horn. Labrum white, with four widely placed submarginal setæ; anterior margin arcuate, notched in middle, a small sharp tooth on each side of median notch just outside position of inner submarginal seta. Legs more elongate and slenderer than in *C. ypsilon* Dej.; three basal joints of anterior tarsi much less dilatate.

♀. Differs from male by larger size, elytra proportionately wider, labrum tridentate.

Length, 11·5-14; breadth, 4-5·2 mm.

Hab.—Western Australia: Lake Austin, near Cue (H. W. Brown).

I have dedicated this pretty species to Mr. H. W. Brown, an enthusiastic coleopterist, who found it on the margin of Lake Austin on 5th and 11th April. Mr. Brown notes that its flight is much slower than that of the coastal species. It is allied to *C. sætigera* (with which I have been unable to compare it), but differs by front and clypeus naked, except for the two or three white setules above the insertion of the antennæ; the pattern of the elytra is similar to that of *C. sætigera*, but the spatulate process, which extends backwards on each elytron from the basal cupreous area, is narrower anteriorly, and more inflated posteriorly; the elytra are singly rounded at apex, with a small spinule at suture in female, which is obsolete in male. From *C. ignicollis* Bates, it evidently differs by the pattern of the elytra, and by the want of a "dense patch of white laid hairs" on "forehead and base of labrum."

Cicindela lineifera, n sp.

♀. Elongate-oval. Glabrous, legs (including four anterior coxæ) beset with white hairs. Head, prothorax, and undersurface viridiæneous; abdomen with apical segment testaceous; labrum and base of mandibles lacteous, apex of mandibles and apical joint of maxillæ atro-viridescent; elytra lacteous, suture and two longitudinal stripes on each elytron æneous, the inner stripe uniting with the sutural stripe near scutellum, and with the outer stripe at apex.

Head 2·9 mm. across eyes, shagreened. Labrum bearing four widely placed submarginal setæ; anterior margin lightly arcuate, lightly emarginate in middle, a very small subdentate prominence on each side of median emargination. Prothorax transverse (1·75 × 2·5 mm.), roundly ampliate on sides at anterior third: pronotum roughly shagreened; apex arcuate; base lightly emarginate truncate; disc depressed, transversely impressed before and behind; posterior transverse impression limited on each side by the antebasal nodules; these nodules rounded externally, not raised or prominent, obliquely narrowed to base. Elytra oval (6·5 × 3·8 mm.); each elytron at apex separately, roundly produced beyond end of suture; a very short mucro at end of suture. Length, 11; breadth, 3·8 mm.

Hab.—Western Australia (found by Mr. DuBoulay, 100 miles north of Kalgoorlie). Type in National Museum, Melbourne.

This species belongs to the *C. tetragramma*-group, and is characterised by the rounded sides of the prothorax, which has the lateral basal nodules rounded externally and not prominent. It is closely allied to *C tetragramma* Chaud., which it resembles in the pattern of the elytra, but it differs from that species by colour (head, prothorax, and femora not cupreous); larger size; prothorax with sides roundly ampliate before middle, narrowed to base; lateral basal nodules far less developed. I am only able to compare the female of *C. lineifera* with the male of *C. tetragramma*. Comparing *C. lineifera* with Mr. Lea's figures of *C. albolineata* Macl., and *C. trivittata* Macl., (These Proceedings, 1896, Pl. xxx.) the pattern of the elytra is different; the prothorax is far more rounded on the sides, and has the lateral basal nodules much less developed.

REVISIONAL NOTES ON AUSTRALIAN CARABIDÆ.

Part. iv. The Genus *Notonomus.*

By Thomas G. Sloane.

In These Proceedings for 1902 (Vol. xxvii., Part 2), I published "A Revision of the Genus *Notonomus.*" At that time the number of species recognised in the genus was seventy-two, and, now, after making due allowances for species added since 1902, and alterations in nomenclature through some species being reduced to the rank of varieties, and others becoming synonyms, the full number will be seventy-four. To these, fifteen new species are added in the present paper, making eighty-nine in all; no doubt there are a considerable number of species still to be discovered.

The Table of species given by me in 1902 was constructed on artificial lines; in the present paper, I have tried to arrive at a better method of classification by the use of Species-groups. It is evident that the system of groups now adopted still leaves much to be desired, some species being attached to groups to which they have but doubtful affinities. This unsatisfactory result has been caused firstly, by my desire to make few groups; and, secondly, by the extremely intricate manner in which the characters, on which the groups are founded, are diffused generally throughout the genus, owing, no doubt, to their being derived from numerous ancient stems, probably along many lines of descent, so that the relationships of the present-day species present a bewildering labyrinth for the taxonomist to puzzle over. The following characters are useful in attempting to disentangle the relationships of the present-day species.

Sides of prothorax, sinuate or not before base; this is not a character of high taxonomic value, but in the *sphodroides*-group it has some importance.

Posterior marginal puncture of prothorax.—Whether the position of this setiferous pore is actually on the lateral border, or not, is a very important character. It does not vary in position to the extent of being on the border in the great natural *eques-* and *opacicollis*-groups; nor to the extent of being off the border in the *kingi-*, *lateralis-*, and *lesueuri*-groups. The *violaceus-* and *sphodroides*-groups, as here constituted, can only be differentiated in every case by this feature; and, though no doubt it cannot be affirmed that the difference in the position of this pore is of great importance between such species as *N. opulentus* and *N. besti*, still, this seems a case where, there being a difference, it must be used, on account of the great help it gives in arranging these species.

Striation of elytra.—A character of doubtful taxonomic value, though, outside the *chalybeus*-group, only *N. tenuistriatus* and *N. apicalis* have the disc faintly striate; in both these species, the eighth interstice, at least, becomes convex near apex, which it does not in the *chalybeus*-group. *N. sphodroides* is the only species, not belonging to the *chalybeus*-group, in which all the interstices, including the eighth, are depressed at apex.

Width of eighth interstice.—Though the relative width of the eighth and ninth interstices of the elytra does not vary in any species, it is not a feature of group-value.

Tenth interstice.—The presence of a tenth interstice on the sides of the elytra, near the apical sinuosity, is an ancient character; it seems to have originated outside the ninth interstice, and not to be derived from the ninth interstice. It is found also in other genera besides *Notonomus*. It varies greatly in length and development in *Notonomus*, and has probably progressed towards greater expansion in some species (e.g., *N. kingi*), while in others it has retrograded till it has become almost or quite obsolete (e.g., *N. muelleri* and *N. angustibasis*).

Basal border of elytra.—In my Table of 1902, too much importance was attached to whether the humeral angle of the elytra was dentate or not, for, although the form of the basal border at its point of junction with the lateral border hardly varies at all in any species (unless sometimes slightly in a variety), yet it is impossible to define two different forms of the border at the humeral angle, as I attempted to do in 1902; there is every degree of difference between the uninterrupted form of junction as in *N. rainbowi*, and the strongly dentate form as in *N. eques*.

Setiferous pores of elytral interstices.—I look upon it as an ancient character to have the third, fifth, and seventh interstices bearing setiferous pores. These occur in the genus *Ceratoferonia*, and, on the third and fifth interstices, in some of our species of *Trichosternus*; many Trigonomides of New Zealand have the seventh interstice punctate. The pluripunctate form of the third interstice is probably older than the bipunctate form. There is undoubtedly a tendency, throughout the genus *Notonomus*, for the number of setiferous pores on the third interstice to be reduced to two, but it cannot be said that the presence of only two punctures necessarily implies relationship between all bipunctate species; though, that there is some taxonomic importance attached to the presence of only two punctures, is impressed on the mind by the fact, that all the species of the *opacicollis*-group and the typical forms of the *kingi*-group are bipunctate; nevertheless, some other characters must be sought for before any near affinity can be recognised between species with the third interstice bipunctate. It may be suggested, as a theory, that the two setiferous pores of the third interstice, which are now the only ones found in so many species, must have been of more economic importance to the species of *Notonomus* than the other pores, such as are now found in *N. pluripunctatus* and many other species; and, therefore, have invariably persisted, while the other pores, being less important, have been lost, so that no species of *Notonomus* has the third interstice of the elytra with less than two punctures, and these similarly placed. Such an hypothesis will account for species, that are not nearly related, having the number of setiferous pores reduced to two, and will also enable it to be understood why a considerable taxonomic value may be attributed to this apparently trivial character in some groups of the genus.

Prosternum.—A complete border along the anterior margin of the prosternum is found only in *N. mediosulcatus*; sometimes this feature is fairly well developed in *N. macoyi*, but it is not constant in that species. Having attributed too much importance to this character in 1902, I was led to describe as a species, under the name of *N. howitti*, what was merely a specimen of *N. macoyi*. — *Intercoxal declivity*: though this is a very important character in *Notonomus*, the shape being constant in every species, it loses its value in the *eques*- and *kingi*-groups; and I can see that too high a value was given to the difference between the rounded and flat forms of the intercoxal declivity of the prosternum in my Table of species in 1902.

Tarsi.—The upper surface longitudinally striate occurs only in the *cupricolor*- and *eques*-groups; it is evidently a character of high taxonomic importance. The comparative length of the first joint of the posterior tarsi is a character of importance. The first joint of the four posterior tarsi is furnished, on the outer side, with a longitudinal costa. (This costa is feebly developed in the *chalybeus*-group, and is obsolete in the *mediosulcatus*-group). The external costa of the four posterior tarsi may be spinulose beneath, or not. These spinules may be called the *upper spinules of the outer side.** I look upon the presence of these upper spinules as an ancient character. When found on the hind tarsi, they are always present on the middle tarsi; in some species (e.g., *N. violaceus*) they are present, or not, on the hind tarsi, but, in such cases, are always found on the middle tarsi. These upper spinules are a great aid in helping to determine the affinities of many species.—*Onychium*: it is evidently the primitive form for the fifth joint of the tarsi to be setulose beneath; these setules (though usually absent in the species of *Notonomus*) have persisted in species not at all nearly related.

Setiferous pores of apex of abdomen.—Usually there are, in the male two, in the female four setiferous punctures at the apex of the abdomen; but throughout the *eques*-group, and in *N. parallelomorphus*, there are six in the female; the outer seta on each side is placed as is usual in the genus, the two inner ones near

* I have noticed in the genus *Eudromus*, from Madagascar, which is evidently an ancient form in the tribe Trigonotomini, that there are two, distinct, continuous rows of spinules on the outer side of the first joint of the hind tarsi. There is no costa, but the upper row of spinules is similarly placed to the upper spinules in *Notonomus*.

together. In the *opacicollis*-group, there are four setiferous pores in the female, but the two on each side are nearer together than usual (the outer one not so far out). The constancy of this apparently trifling character throughout the important *eques*- and *opacicollis*-groups, indicates considerable taxonomic importance for these setæ of the female.

Colour.—It may be assumed that black or brown is the primitive colour of the Carabidæ, as it is of the Cicindelidæ; but, although there are now many black species of *Notonomus*, it does not, on that account, seem necessary to suppose that colour had not begun to manifest itself in the division of the tribe Trigonotomini, from which *Notonomus* is derived, before the first Notonomus appeared. The evidence, as far as I can weigh it, suggests the belief, that the stem from which *Notonomus* is descended, probably had the upper surface at least partially virescent; and that some forms may have reverted to the primitive carabideous blackness, while others became more and more metallic. If this be so, colour will not be of much use in helping us to determine which of the present-day species most nearly represents the ancient type of the genus.

Groups.—The differences between the *cupricolor*-, *eques*-, *satrapus*-, *sphodroides*-, *opacicollis*-, *kingi*-, *lateralis*-, *mediosulcatus*- and *lesueuri*-groups are so decided, that all these groups must be taken to be of ancient origin; of these, the *cupricollis*-, *eques*-, *satrapus*-, *lateralis*-, and *lesueuri*-groups seem the oldest. The question occurs, are all the present-day forms descended from one type? To this question, I can give no answer, for I find it impossible even to guess at how much divergence from a central type into many groups, the relationships between which became more and more attenuated, may have occurred; nor, to what extent convergence from different points along these lines of divergence, and tending in various directions, may have taken place, and helped to jumble the species into the present agglomeration of forms, which now make up the genus *Notonomus*.

To sum up, I suppose that *Notonomus* is not a very primitive type of the tribe Trigonotomini, and that the following characters, none of which probably originated in the genus *Notonomus* (nor indeed does any single species of the present day show all of them) are ancient characters : head large, prothorax with posterior marginal puncture not on border ; elytra fully striate, third, fifth, and seventh interstices bearing setiferous pores, tenth interstice not greatly developed, basal border meeting lateral border at humeral angles without interruption; intercoxal declivity of prosternum rounded in middle; posterior femur considerably swollen on lower side behind apex of trochanter; tarsi with upper surface striolate, first joint of four posterior tarsi costate on outer side, the costa spinulose on lower side, onychium setulose beneath.

*89. *N. opacistriatus* Sl.—I now see that this species is not a true species of *Notonomus*, but requires a new genus for its reception; therefore, it is not included in *Notonomus* in this paper.

Species unknown to me.

23. *N. resplendens* Cast., is closely allied to the species I have named *N. metallicus*; but I have been unable to consider *N. metallicus* the same as *N. resplendens*, on account of its smaller size, and its want of a "beautiful red-gilt margin." I had formed a wrong idea of *N. resplendens* in 1902, and now see that it is not allied to *N. eques* Cast., as I had thought.

35. *N. striaticollis* Cast., seems allied to *N. polli* Sl., but it would be mere guess-work to think these the same; no doubt *N. striaticollis* could be identified, if specimens from the Clarence River were available for examination.

45. *N. depressipennis* Chaud., *vide* Sloane, These Proceedings, 1902, pp.305, 306.

60. *N. darlingi* Cast., I have not seen; it is, perhaps, more allied to *N australis* Cast., than to *N. nitidicollis* Chaud., the species with which Chaudoir compares it in his "Supplement."

75. *N. subiridescens* Chaud., seems allied to, but different from, *N. liragerus* Sl.

76. *N. ingratus* Chaud. All my attempts to identify this species have failed, nor do I think I have ever seen it; probably it is allied to *N. scotti* Sl.

*The numbers prefixed to the names of species throughout this paper, indicate the position in the genus, and correspond with those in the index at the end of the paper.

77. *N. semiplicatus* Cast.,(*Pœcilus id.*) should be allied to *N. apicalis* Sl., but it is vaguely described. It was impossible to consider *N. apicalis* the same as *N. semiplicatus*, seeing that the latter is said to have three punctures on the third interstice of the elytra, while the former has only two. Whether *N. semiplicatus* is sufficiently described for its identification to be possible, seems doubtful.

Table of Species-groups.

1.(30)Episterna of metasternum short.

2.(3)Point of prosternum setose between coxæ.............*cupricolor*-group.

3.(2)Point of prosternum glabrous.

4.(5)Tarsi with upper surface striolate. (Apex of abdomen in ♀ 6-setose) ....*eques*-group.

5.(4]Tarsi with upper surface not striolate. (Apex of abdomen in ♀ 4-setose; 6-setose only in *N. parallelomorphus*).

6.(7)Elytra deeply and fully striate, seventh interstice punctiferous. . ...*satrapus*-group.

7.(6)Elytra with seventh interstice not punctiferous. (Unipunctate in *N. tenuistriatus* and also in some specimens of *N. plutus*).

8.(17)Posterior marginal puncture of prothorax not on border.

9.(14)Intercoxal declivity of prosternum rounded in middle.

10.(11)First ventral segment not bordered on anterior margin behind metepimeron... ....*sphodroides*-group.

11.(10)First ventral segment bordered on anterior margin behind metepimeron.

12.(13)Prothorax rounded to base; elytra with humeral angles not dentate. ... .*excisipennis*-group.

13 (12)Prothorax sinuate posteriorly, basal angles rectangular; elytra with humeral angles dentate......... ....*angustibasis*-group.

14.(9)Intercoxal declivity of prosternum flat.

15.(16)Third interstice of elytra 4-punctate. . ...*atrodermis*-group.

16.(15)Third interstice of elytra 2-punctate... ....*opacicollis*-group.

17.(8)Posterior marginal puncture of prothorax on border at basal angle.

18.(29)Elytra strongly striate, interstices (including eighth) convex at apex.

19.(28)Elytra fully striate.

20.(21)Intercoxal declivity of prosternum always rounded; third interstice of elytra always bearing more than two setigerous pores... ... .*violaceus*-group.

21.(20)Intercoxal declivity of prosternum usually flat—if rounded, third interstice of elytra bipunctate.

22.(27)Posterior tarsi with first joint longer than two succeeding joints together.

23.(24)Apex of abdomen in ♀ 6-setose................ *parallelomorphus*-group.
24.(23)Apex of abdomen in ♀ 4-setose.
25.(26)Elytra with crenulate striæ, third interstice bearing more than two setiferous punctures.................................... *australis*-group.
26.(25)Elytra with simple striæ (only in *N. triplogenioides* crenulate), third interstice bipunctate (in *N. dyscoloides* often with three or four punctures)... *kingi*-group.
27.(22)Posterior tarsi short, first joint not longer than two succeeding joints together... *lateralis*-group.
28.(18)Elytra with striæ 1-4 deeply impressed, striæ 5-7 obsolete except at apex.. *mediosulcatus*-group.
29.(18)Elytra lightly striate, interstices flat and (including eighth) not convex at apex.. *chalybeus*-group.
30.(1)Episterna of metasternum elongate.............................. *lesueuri*-group.

The *cupricolor*-group.

Prothorax with basal angles rectangular; border widely reflexed posteriorly, and passing round angle and on to base as far as lateral basal impressions. Elytra with humeral angles rounded; interstices depressed, third 5-punctate, eighth narrower than ninth. Intercoxal declivity of prosternum wide, flat, sparsely setose. Tarsi with joints substriate on upper surface; first joint of four posterior tarsi strongly costate on external side, costa spinulose beneath; fifth joint glabrous beneath.

I have felt compelled to constitute a separate group for 1. *N. cupricolor* Sl., which is probably a primitive form, showing some affinities towards *Rhabdotus*, and also to the *eques*-group of *Notonomus*. It is the only species of *Notonomus* with the point of the prosternum setose; these setæ are about six in number, the two lower ones being well down on the face of the intercoxal declivity, looking at the insect when laid on its back. Only the male is known; it will be interesting to find whether the apex of the abdomen in the female has six setæ, as in the *eques*-group, or not.

The *eques*-group.

Prothorax with posterior marginal puncture not at basal angle, nor on border. Elytra with basal border more or less dentate at humeral angles, third interstice with more than two punctures. Apical ventral segment in ♂ 2-punctate, in ♀ 6-punctate. Tarsi with upper surface striolate; four posterior tarsi with basal joint strongly costate on outer side, hind tarsi without spinules below costa of outer side of first joint.

The *eques*-group seems a natural one, probably of ancient origin. It shows slight affinities with the *sphodroides*-group, through *N. strzeleckianus* and allied species; and, also, vaguely towards the *opacicollis*-group, through *N. eques* and allied species. The *eques*-subgroup has remote affinities towards the *cupricolor*- and *parallelomorphus*-groups. Here, the first joint of the intermediate tarsi has the external costa spinulose on lower side, but in the hind tarsi there is no spinule. *N. eques* and closely allied species have the onychium of the tarsi setulose beneath; and, in *N. froggatti*, too, the onychium may have a single setule on each side beneath, but this is not invariable. *N. strzeleckianus*, *N. phillipsi*, and *N. longus* have the onychium glabrous beneath.

Table of Species.

1.(6)Intercoxal declivity of prosternum rounded, of mesosternum deeply concave.
2.(3)Head and prothorax black (or, at most, with a metallic flush on sides of pronotum near base)........ .... 2. *N. froggatti* Sl.
3.(2)Head and prothorax more or less metallic.
4.(5)Pronotum æneous........... .... 3. *N. strzeleckianus* Sl.
5.(4)Pronotum viridescent (also margin of elytra) .. 4. *N. phillipsi* Cast.
6.(1)Intercoxal declivity of prosternum flat, of mesosternum hardly concave.
7.(14)Tarsi with fifth joint setulose beneath.
8.(13)Eyes convex; prothorax with basal angles obtuse.
9.(12)Head black.
10.(11)Prothorax and elytra black (rarely with greenish flush near sides). Size large. (Length, 20-24 mm.)............. .... 5. *N. bodeæ* Sl.
11.(10)Prothorax and elytra with bright cupreous margins.................... .... 6. *N. rugitarsis* Sl.
12.(9)Head virescent. (Prothorax green towards sides, elytra with green margin).. .... 7. *N. spenceri* Sl.
13.(8)Eyes depressed; prothorax with basal angles marked. (Head, prothorax, and elytra æneous)................ .... 8. *N. eques* Cast.
14.(7)Tarsi with fifth joint glabrous beneath... .... 9. *N. longus* Sl.

2. *Notonomus froggatti* Sl.,(var. *N. atripennis* Sl.).—I have obtained more specimens of *N. froggatti* (all from the original

locality, Mount Kosciusko), and also more of the form for which I proposed the name *N. atripennis* (from original locality, Mount Buffalo). After examination of this new material, the differences between *N. atripennis* and *N. froggatti* so slight, that I am unable now to consider it a distinct species; I, therefore, sink it to the rank of a variety. The somewhat narrower form (especially of prothorax), absence of a green elytral margin, and less strongly developed humeral angles in *N. atripennis*, though noticeable, do not seem of actual specific value.

4. NOTONOMUS PHILLIPSI Castelnau.

Trans. Roy. Soc. Vict., 1868, p.212; Chaudoir, Ann. Mus. Civ. Genova, 1874, vi., p.580; Sloane, Proc. Linn. Soc. N. S. Wales, 1902, xxvii., p.279.

It seems advisable to offer a description of the species which I identify as *N. phillipsi* Cast. The name is an unfortunate one, in view of the older *N. philippi* Newm.; but I do not venture to change it, owing to the present state of the rules of nomenclature, which seem to countenance as valid, names, no matter how similar to older ones, if differing by a single letter.

♂. Elongate-oval. Head black; prothorax olivaceous with wide æneous-green margins; elytra dark bronze, with ninth interstice and lateral channel green; femora piceous, apex of tibiæ and tarsi reddish. Prothorax subquadrate (4·6 × 5 mm.), depressed, wider across base (3·9 mm.) than apex (3·5 mm.); sides obliquely narrowed to base without sinuosity; basal angles subrectangular; border wide and strongly reflexed towards base; posterior marginal puncture distant from base in lateral channel; lateral basal impressions deep. Elytra truncate-oval (10·7 × 6·2 mm.), depressed, strongly declivous to apex, lightly rounded (subparallel) on sides, strongly striate; interstices convex, third 5-7-punctate, tenth feebly developed near apex; lateral apical sinuosities well developed; basal border strongly dentate at humeral angles. Intercoxal declivity of prosternum rather narrow and rounded in middle, of mesosternum concave. Tarsi with fifth joint not spinulose beneath. Length, 16·5-17·7; breadth, 5·7-6·2 mm.

Hab.—Victoria: Bright (C. French).

Allied to *N. strzeleckianus* Sl., but differing by head smaller; elytra with margin green; interstices more strongly convex, third narrower, not swollen on apical declivity at position of posterior puncture; posterior femora far more strongly swollen in middle of lower side. From *N. rugitarsis* Sl., it differs by colour; prothorax more strongly narrowed to base, basal angles less obtuse; elytra more strongly declivous to apex, humeral angles far more strongly dentate; tarsi with onychium glabrous beneath.

5. Notonomus bodeæ, n.sp.

Robust, elliptical, parallel. Prothorax quadrate, depressed; basal angles obtuse; posterior marginal puncture distant from basal angle: elytra truncate-oval, strongly striate; interstices convex, third 5-punctate; humeral angles dentate: tarsi with upper surface longitudinally striolate; fifth joint setulose beneath. Black; pronotum sometimes with a faint bronzy tint on posterior part of sides; elytra sometimes with a virescent, or obscurely bronzed border overspreading ninth interstice and lateral channel.

Head moderate in size (4·3 mm. across eyes); eyes convex, prominent. Prothorax broader than long (6 × 6·4 mm.), wider across base (5 mm.) than apex (4·5 mm.); basal angles obtusely rounded; base lightly emarginate in middle; posterior marginal puncture placed considerably before base on inner side of lateral channel; border wide, especially towards base; median line lightly impressed; lateral basal impressions narrow, elongate, lightly arcuate; lateral basal spaces wide, lightly convex. Elytra truncate-oval (13·3 × 7·7 mm.); sides lightly rounded; lateral apical sinuosities wide, shallow; interstices convex, in ♂ very minutely shagreened (not opaque), in ♀ finely shagreened and rather dull, eighth interstice convex, wider than ninth, tenth feebly developed; basal border raised and strongly dentate at humeral angles; lateral border widely reflexed. Intercoxal declivity of prosternum flat, of mesosternum widely and very lightly concave. Apical ventral segment in ♂ with one, in ♀ with three setigerous punctures on each side. Length, 20-24; breadth, 6·5-7·7 mm.

Hab. – N.S.W.: Exeter (H. J. Carter). Colls. Carter and Sloane.

Allied to *N. rugitarsis* Sl., but differing by darker colour; wider prothorax; humeral angles of elytra more strongly marked, etc.

Note.—*N. bodeæ* and *N. rugitarsis* may be varieties of one variable species, but with the materials I have, without any connecting form, I prefer to consider them closely allied, but distinct species. Mr. Carter found this species common at Exeter, and through his kindness I have been able to examine an extensive series of specimens. This species is dedicated to Miss Bode, who first found it.

6. Notonomus rugitarsis, n.sp.

Elliptical, parallel, depressed. Prothorax quadrate; basal angles obtuse; posterior marginal puncture distant from basal angle: elytra truncate-oval, strongly striate; interstices convex, third 4- or 5-punctate; humeral angles dentate: tarsi longitudinally striolate on upper surface; fifth joint setulose beneath. Head and under surface black; disc of pronotum and elytra purple-black; pronotum with golden-green or coppery margins on sides and base; elytra with ninth interstice and lateral channel cupreous; tibiæ, tarsi, and antennæ piceous-red.

Head convex, moderate in size (3·6 mm. across eyes); front strongly bi-impressed behind clypeus; eyes prominent. Prothorax a little broader than long (5 × 5·3 mm.), widest before middle, wider across base (4·2 mm.) than apex (3·8 mm.); sides very lightly rounded, gently narrowed posteriorly; basal angles obtuse; border widely reflexed posteriorly; posterior marginal puncture placed considerably before base on inner side of lateral channel; lateral basal impressions deep, elongate; lateral basal spaces convex. Elytra truncate-oval (11·5 × 6·5 mm.), rather depressed behind scutellum; interstices roundly convex, eighth wider than ninth on basal half, tenth narrow, extending forward to the posterior third of elytra; lateral apical sinuosities strongly developed; basal border raised and dentate at humeral angles; lateral border widely reflexed. Intercoxal declivity of prosternum flat, of mesosternum lightly and widely concave. Male with one, female with three setigerous punctures on each side of apical ventral segment. Length, 20; breadth, 6·5 mm.

Hab.—N.S.W.: Eden (H. J. Carter). Colls. Carter and Sloane.

N. rugitarsis has the size and facies of *N. eques* Cast.; from which it differs by colour (head not metallic; disc of prothorax and elytra not æneous, and with the lateral margins brightly cupreous); prothorax with basal angles much more roundly obtuse, lateral basal spaces convex; elytra with interstices more convex and much more finely shagreened.

7. *N. spenceri* Sl.—The type-specimen (♀ in my Coll.) is the only one I have seen. It is closely allied to *N. rugitarsis* Sl., but differs by margin of prothorax and elytra green (not cupreous); form more convex; interstices of elytra much less convex (♀), basal border less raised at humeral angles. It has the tarsi with onychium spinulose beneath; apical ventral segment in ♀ 3-setose on each side.

Note.—A specimen (♀) ticketed Victoria, has been given to me by Mr. C. French, which differs from *N. spenceri* by elytra more depressed on disc, not margined with green (but becoming a dull coppery colour near sides), interstices more convex. It seems a variety, or perhaps a closely allied species.

9. Notonomus longus, n.sp.

♀. Elongate. Head small: prothorax narrow; basal angles marked; posterior marginal puncture on inner side of marginal channel opposite basal angle: elytra oval, strongly striate; interstices convex, 3-punctate: tarsi striolate on upper surface; fifth joint glabrous beneath. Head and under surface black; pronotum cupreous; elytra obscurely purple, becoming cupreous on sides towards apex, ninth interstice and margin golden-green; legs black, tibiæ, tarsi, and antennæ reddish-piceous.

Head 3·25 mm. across eyes, these convex but not prominent. Prothorax as long as broad (4·7 × 4·7 mm.), subdepressed, lightly rounded on sides, a little wider across base (3·6 mm.) than apex (3·3 mm,); basal angles subrectangular, obtuse at summit; border strongly reflexed on sides behind anterior marginal puncture, passing round angle on to base on each side; median line decidedly marked; lateral basal impressions elongate, rather shallow; lateral basal spaces widely and lightly convex; marginal channel narrow. Elytra oval (10·6 × 5·7 mm.), lightly convex, lightly rounded on sides, deeply striate; interstices convex, smooth (not shagreened), eighth wider than ninth, tenth feebly developed; lateral apical sinuosities light, wide; basal border strongly raised and dentate at humeral angles; lateral border widely reflexed. Intercoxal declivity of prosternum flat, of mesosternum hardly concave.

♀. With three setigerous punctures on each side of apical ventral segment. Length, 19; breadth, 5·7 mm.

Hab.—Victoria: Wood's Point (Sloane). Coll. Sloane.

A single specimen occurred to me at the top of "The Frenchman's Pinch," four miles north of Wood's Point, on the road to Jamieson, December 27th, 1912. From *N. eques* Cast., it may be readily distinguished by its narrower form; prothorax longer, with narrower marginal channel; elytra with interstices not shagreened. It resembles *N. phillipsi* Cast., (as identified by me) but differs by form more elongate; prothorax longer, narrower at base, differently coloured, basal angles more strongly marked, lateral basal spaces more convex; intercoxal declivity of prosternum flat, of mesosternum hardly concave.

The *satrapus*-group.

Head large. Prothorax subcordate, wider at apex than at base; basal angles obtuse; posterior marginal puncture in marginal channel (in *N. satrapus* considerably before basal angle, in *N. pluripunctatus* at the obtuse basal angle). Elytra with basal border not raised at humeral angles; interstices convex, third and seventh bearing setigerous punctures (sometimes, also the fifth), eighth wider than ninth at basal third. Intercoxal declivity of prosternum narrow and rounded in middle. First joint of four posterior tarsi with an external costa, the costa spinulose on lower side.

The *satrapus*-group is evidently an ancient one, judging by the setigerous punctures of the seventh interstice of the elytra. This character is also found in the Australian genus *Ceratoferonia*, and some of the large Trigonomides from New Zealand. Both species are from the mountains to the north of Gippsland, but I do not know a definite locality for either. They may be distinguished thus :—

Black; prothorax not ampliate at widest part; tarsi with onychium spinulose beneath.................................... 10.*N. satrapus* Cast.
Prothorax and elytra bronzy; prothorax ampliate at widest part; onychium glabrous beneath ....11.*N. pluripunctatus* Sl.

N. pluripunctatus Sl. After seeing some specimens of this species, and comparing the female with *N. satrapus* Cast., I confirm its validity.* One specimen has the fifth elytral interstice without punctures on one side.

The *sphodroides*-group.

Prothorax with posterior marginal puncture not on border. Elytra with basal border not dentate at humeral angles; third interstice bearing more than two punctures; eighth wider than ninth. Intercoxal declivity of prosternum rounded.

This group forms part of the main body of the genus, and can hardly be separated from the *vialaceus*-group, except by not having the posterior marginal puncture of the pronotum on the border at the basal angle. In the *sphodroides*-group, the four posterior tarsi have the first joint always costate. In *N. peroni*, *N. sphodroides*, *N. muelleri*, *N. angulosus*, *N. politulus and N. tubericaudus*, there is no spinule beneath the costa; in *N. kosciuskoanus*, the intermediate tarsi have the costa spinulose beneath, the posterior being non-spinulose; in *N. plutus*, *N. tenuistriatus*, *N. opulentus*, *N. metallicus*, *N. variicollis*, *N. carteri*, *N. arthuri*, and *N. taylori*, the first joint of the tarsi is spinulose, though sometimes the costa of the posterior tarsi is not spinulose in *N. variicollis*.

Table of Species.

1.(18)Pronotum with lateral channel wide and depressed near base.
2.(11)Prothorax truncate-cordate, hardly or not wider at base than apex.
3.(10)Head large; interstices of elytra convex near apex (not convex at apex in *N. tenuistriatus*).

---

* These Proceedings, 1903, p.602.

4.(7) Posterior marginal puncture of prothorax in lateral channel a little before basal angle.
5.(6) Elytra strongly striate; head metallic .... 12. *N. plutus* Cast.
6.(5) Elytra faintly striate; head black................ 13. *N. tenuistriatus* Sl.
7.(4) Posterior marginal puncture of prothorax at basal angle.
8 (9) Anterior tarsi with three basal joints not dilatate or squamulose beneath in ♂ .... 14. *N. peroni* Cast.
9.(8) Anterior tarsi with three basal joints dilatate and squamulose beneath in ♂ .. .. 15. *N. muelleri* Sl.
10.(3) Head small; interstices of elytra depressed at apex............... .... 16. *N. sphodroides* Dej.
11.(2) Prothorax subquadrate, decidedly wider at base than apex.
12.(17) Upper surface depressed; prothorax with sides oblique towards base.
13.(14) Basal angles of prothorax rectangular.............. 17. *N. angulosus* Sl.
14.(13) Basal angles of prothorax obtuse.
15.(16) Third interstice of elytra ordinary. .... 18. *N. politulus* Chaud.
16.(15) Third interstice of elytra greatly swollen at position of posterior marginal puncture.......................... ... 19. *N. tubericaudus* Bates.
17.(12) Upper surface convex; prothorax with sides strongly rounded towards base. (Posterior marginal puncture more distant from base than usual)........................ .... 20. *N. kosciuskoanus* Sl.
18.(1) Pronotum with lateral channel narrow at basal angle and extending to lateral basal impression.
19.(26) Prothorax with basal angles marked.
20.(23) Head and pronotum metallic.
21.(22) Posterior marginal puncture of prothorax at basal angle................ .... 21. *N. opulentus* Cast.
22.(21) Posterior marginal puncture of prothorax a little before basal angle .... 22. *N. metallicus* Sl.
23.(20) Head and pronotum black.
24.(25) Size large (16-21 mm.); prothorax lightly rounded on sides and lightly narrowed to base; elytra with eighth interstice convex....... .... 24. *N. variicollis* Chaud.
25.(24) Size small (13 mm.); prothorax strongly rounded on sides and decidedly narrowed to base; elytra with eighth interstice depressed... .... 25. *N. carteri* Sl.
26.(19) Prothorax with basal angles rounded off.
27.(28) Prothorax subcordate.................................... 26. *N. arthuri* Sl.
28.(27) Prothorax short, widest at middle, strongly and evenly rounded on sides.................. .... 27. *N. taylori* Sl.

12. *N. plutus* Cast., (= *N. frenchi* Sl.).—I collected numbers of a species of *Notonomus*, identical with that on which I founded

N. frenchi, at Warburton, on the Upper Yarra. I have no hesitation in referring these Warburton specimens to *N. plutus* Cast. Sometimes there are two punctures on the fifth interstice of the elytra, sometimes one, and sometimes none.

Hab.—Victoria: Warburton and Marysville, in damp, heavily timbered gullies.

N. crœsus Cast.—Specimens given to me by Mr. C. French, as from the Baw Baw Mountains, are probably *N. crœsus*. Chaudoir thought that *N. crœsus* Cast., and *N. plutus* were merely forms of one species; and, if I am right in my identification of *N. crœsus*, I concur. The form I take to be *N. crœsus* is differentiated from *N. plutus* by prothorax less strongly sinuate before base, basal angles less decidedly marked; elytra more deeply striate and less brightly coloured.

13. Notonomus tenuistriatus, n.sp.

♀. Elliptical, depressed. Head large; prothorax truncate-cordate; sides sinuate before base; basal angles rectangular; posterior marginal puncture in lateral channel a little before base: elytra lightly striate; interstices depressed, third 4-punctate, fifth 2-punctate, seventh 1-punctate.* Nitid; head black; prothorax nigro-chalybeous; elytra chalybeous, sometimes with purple flush towards sides; legs and antennæ piceous-black.

Head large (4 mm. across eyes), mandibles decussating, frontal impressions shallow, eyes convex. Prothorax broader than long (4·3 x 5·1 mm.), wider at apex (4·2 mm.) than base (3·6 mm.); sides rounded on anterior three-fourths, lightly sinuate at posterior fifth; anterior angles roundly obtuse; basal angles rounded at summit. Elytra depressed, oval (11 x 6·7 mm.), widest a little behind middle; lateral apical sinuosities well developed; basal border joining lateral border at humeral angle without interruption; striæ lightly impressed on disc, sixth and seventh obsolete, except towards apex; interstices depressed, eighth convex towards apex, tenth short. Intercoxal declivity of prosternum rounded in middle, of mesosternum concave. Length 19, breadth 6·7 mm.

---

* This puncture is sometimes lost.

Hab.—Victoria: Neerim. Type in National Museum, Melbourne.

A very distinct species, with affinities towards *N. plutus* Cast.; from which it differs by colour; striæ of elytra more lightly impressed, etc. It is hardly more strongly striate than *N. philippi* Newm., which it resembles in colour of elytra. The elytra are not firmly soldered together. This species evidently gives a hint of the ancient form, from which the *chalybeus*-group is descended. Three specimens (♀) have been examined.

Var. *recticollis* n. var.—Other specimens given to me by the late Mr. W. Kershaw (and also in the National Museum, Melbourne) are darker in colour, but equally polished; they also differ by having the prothorax more strongly sinuate on sides posteriorly, basal angles rectangular; striæ of elytra still more feebly impressed. This form is probably a closely allied species rather than a variety, but, owing to its exact locality being unknown, and the likelihood of connecting forms being found, I prefer, with the materials before me, (four specimens, ♂♀) to regard it as a variety of *N. tenuistriatus*.

14. *N. peroni* Cast.—A variable species, widely spread in the mountains of Victoria eastward from Melbourne. The following varieties may be noted:—

A. Viridescent, legs black. Eastern Gippsland (French).

B. Viridescent, legs reddish. Marysville (Sloane).

C. Cyaneous, elytra flushed with purple. Ferntree Gully and Warburton (Sloane).

D. Black. Bright (French).

16. *N. sphodroides* Dej.—In my Revision of 1902, I was altogether mistaken about this species, and identified a form of *N. dyscoloides* Motsch., as *N. sphodroides*. It is now apparent to me that *N. sphodroides* Dej., is the same as the viridescent species from the Otway Ranges, which, in my Revision, is placed as a variety of *N. accedens* Chaud.

Var. *accedens* Chaud.,(= *N. pristonychoides* Motsch.).—I have only one specimen that can be referred to *N. accedens* Chaud., viz., the one described in my Revision under *N. accedens*. I consider, still, that *N. pristonychoides* Motsch., is conspecific with *N. accedens*, though my specimen differs from the description of *N. pristonychoides* by having the third interstice of the elytra bipunctate, not tripunctate; but in my specimens of *N. sphodroides,* the number of punctures varies from two to as many as four.

17. NOTONOMUS ANGULOSUS, n sp.

♂. Oval, subdepressed. Prothorax subquadrate; basal angles rectangular; posterior marginal puncture at inner side of basal border near basal angle; elytra fully and deeply striate; interstices convex, third 2-punctate, eighth lightly convex, wider than ninth; humeral angles edentate. Black.

Head large (3·5 mm. across eyes); eyes convex. Prothorax broader than long (4 × 4·5 mm.), wider across base (3·8 mm.) than apex (3·5 mm.), depressed towards base; sides lightly rounded on anterior two-thirds, straightened posteriorly to meet base at right angles; border rather strongly reflexed, equal, hardly indicated on sides of base; lateral channel not reaching base; median line well marked; lateral basal impressions elongate, wide, sulciform at bottom; lateral basal spaces depressed near basal angles. Elytra truncate-oval (10 × 6 mm.), lightly longitudinally depressed along course of third interstice; lateral apical declivities well developed, tenth interstice hardly indicated. Intercoxal declivity of prosternum rounded in middle. Tarsi: anterior with three basal joints in ♂ dilatate and squamulose beneath; four posterior with first joint costate externally without spinules beneath costa. Length 16, breadth 6 mm.

Hab.—Victoria. Type (unique) in National Museum, Melbourne, ticketed "Gippsland."

A very distinct species, resembling *N. peroni* Cast., in the shape of the prothorax. The elytra are like those of *N. tubericaudus* Bates, but the third interstice is not swollen at position of posterior puncture. It is allied to *N. politulus* Chaud., and *N. tubericaudus* by form of elytra, intercoxal declivity of prosternum, and external side of first joint of the four posterior tarsi.

19. *N. tubericaudus* Bates.—Easily identified; being the only species with the third interstice strongly protuberant near apex. It

may be noted that in ♀, the border of the elytra has, on each side, a rather prominent triangular projection just behind the lateral apical sinuosities, a character found nowhere else in the genus.

21. *N. opulentus* Cast.,(= *N. bassi* Sl.).—I now perceive that, through not knowing *N. resplendens* Cast., the species with which Chaudoir compared *N. opulentus* in his "Supplement," of 1874, I identified *N. opulentus* Cast., wrongly in my "Revision." This error is regrettable, because I was thereby led into describing as new, under the name of *N. bassi,* what is evidently merely a form of *N. opulentus,* a species subject to considerable variation.

Var. *gippslandicus* Cast.—Chaudoir thought this only a form of *N. opulentus,* and I believe he was right. It is distinguished by its green colour. *Hab.*—Marysville (Sloane).

22. Notonomus metallicus, n.sp.

Elliptical-oval, convex. Prothorax narrow; base and apex of equal width (3·15 mm.); basal angles obtuse; posterior marginal puncture in marginal channel a little before the basal angle; elytra oval, strongly striate; third interstice 4-punctate; basal border joining lateral border without interruption at humeral angles. Head black; prothorax and elytra of a metallic copper-colour; femora black, tibiæ and tarsi reddish-piceous.

♂. Head small (3·15 mm. across eyes); eyes prominent. Prothorax longer than broad (4·7 x 4·5 mm.), lightly narrowed to base; sides lightly rounded, obliquely narrowed to base; basal angles obtuse; base arcuate on each side; border narrow, extending round basal angles on to base on each side; median line well marked; lateral basal impressions elongate, deep. Elytra oval (10 x 6·1 mm.), lightly rounded on sides; lateral sinuosities of apex wide, but rather deep; interstices convex, eighth depressed, wider than ninth, tenth short and feebly developed. Intercoxal declivity of prosternum narrowed in middle, of mesosternum strongly concave. Tarsi with onychium glabrous. Length 17·3, breadth 6·1 mm.

Hab.—N.S.W.: Bega. Colls., Carter and Sloane. (Given to me by Mr. H. J. Carter, as from Bega.)

This species is a little smaller than the measurements given by Chaudoir for *N. resplendens* Cast., and has not the margin of the elytra "of a beautiful red-gilt tinge," as said by Castelnau; otherwise it seems to agree better with Chaudoir's note on *N.resplendens* than any other species I know. No species that I have seen agrees thoroughly with the descriptions of *N. resplendens*. Judging from Chaudoir's remarks, that the lateral borders of the prothorax and elytra are narrower and less reflexed in *N. opulentus* than in *N. resplendens,* it would appear that *N. metallicus* has these borders too narrow for it to be *N. resplendens.*

The *excisipennis*-group.

Prothorax strongly rounded to base on sides; basal angles rounded; posterior marginal puncture distant from basal angle, not on border. Elytra fully striate; basal border not raised above lateral border at humeral angles; third interstice with two or three setigerous pores, eighth and ninth narrow, convex. First ventral segment bordered on external side, and behind metasternal episterna. Intercoxal declivity of prosternum rounded. Tarsi not striolate on upper surface; four posterior with first joint costate externally, costa not spinulose beneath; onychium glabrous beneath.

The affinity of the *excisipennis*-group seems towards *N. angustibasis* Sl., and the position of both these groups in the genus is doubtful. Two species have been described, which may be differentiated as under:—

Elytra very strongly sinuate on each side of apex; prothorax with sides flushed with purple...... 28.*N. excisipennis* Sl.
Elytra not unusually deeply sinuate on each side of apex; prothorax black............ .... 29.*N johnstoni* Sl.

The *angustibasis*-group.

Prothorax strongly sinuate on sides posteriorly; basal angles strongly marked; posterior marginal puncture distant from basal angle, not on border. Elytra fully striate; humeral angles dentate; third interstice with two setigerous pores. First ventral segment bordered on external side, and behind metasternal episterna. Intercoxal declivity of prosternum rounded. Tarsi not striolate on upper surface; first joint of four posterior costate externally; costa of intermediate spinulose beneath, of posterior very rarely with a single spinule; onychium glabrous beneath.

This group consists of one species, 30, *N. angustibasis* Sl., which is so distinct from all other described species, that I have felt compelled to constitute a group for its reception. It is variable in colour and facies, and is found in the coastal districts, from the Hunter to the Burnett River. I note the following varieties:—

A. Wider than type-form; prothorax much wider (5·5 × 5·4 mm.); Black. Length, ♀, 21 mm. *Hab.*, Tambourine Mountain. Given to me by Mr. R. Illidge.*

B. Smaller than type-form; prothorax narrower (4 × 3·5 mm.); elytra obscure purple-black. Length, 16 mm. *Hab.*, Bathurst. Given to me by Mr. F. H. Taylor.

The *atrodermis*-group.

Black. Head large. Prothorax subcordate; posterior marginal puncture in lateral channel near basal angle. Elytra with humeral angles marked, basal border slightly raised above lateral border at point of junction; third interstice with four setigerous pores; eighth narrower than ninth. Intercoxal declivity of prosternum flat; of mesosternum hardly concave. Tarsi with upper surface not striolate; four posterior tarsi with first joint costate externally, costa not spinulose beneath; onychium glabrous beneath.

31. *N. atrodermis* Sl., (1903) [= *N. rufipalpis* Sl., (not Castelnau), 1902] is a species that is equally out of place in the *sphodroides-* or the *australis*-group according to the system of classification herein adopted. It is found in Victoria, I believe, in the Healesville and Marysville Districts. Length, 15 mm.

The *opacicollis*-group.

Prothorax with disc either nitid, or opaque and strigulose; posterior marginal puncture near basal angle, but not on border. Elytra fully striate; basal border prominent at humeral angles; third interstice bipunctate. Intercoxal declivity of prosternum

---

* It is possible that *N. subiridescens* Chaud., may be conspecific with var. A.; this is a subject that requires investigation.

flat. Male with one, female with two, setigerous punctures on each side of apical ventral segment; those of the female near together, the outer one more distant than usual from lateral sinuosity of segment. Tarsi not striolate on upper surface; four posterior with external side costate, costa not spinulose beneath.

This is a satisfactory group, containing no species that seem out of place in it; from a geographical point of view, too, it is compact, occupying a single area in Northern New South Wales and Southern Queensland. The species are numerous, and their classification into species and varieties is a work that can be done only by someone with a full knowledge of the extent to which the leading species vary. Such a species as *N. nitidicollis* Chaud., is evidently variable, but only an accurate knowledge of the range of each form could enable anyone to form a true idea of the value of these variations; my information on the range and distribution is not complete in regard to any species of the group.

Table of Species.

1.(10)Elytra with eighth interstice depressed and much wider than ninth at middle of course.
2.(7)Pronotum transversely striolate.
3.(6)Elytra with second, fourth, and sixth interstices foveolate.
4.(5)Elytra with interstices 1-6 unequal on basal third (second, fourth, and sixth much wider than alternate ones and depressed, except just near base)...32. *N. tessellatus* Sl.
5.(4)Elytra with interstices 1-6 equal on basal third (convex in ♂, depressed in ♀)...33. *N. opacicollis* Chaud.
6.(3)Elytra without foveolate interstices........................ 34. *N. polli* Sl.
7.(2)Pronotum nitid, without decided transverse striolæ.
8.(9)Size large (20·5 mm.); prothorax shortly sinuate before the strongly marked basal angles.......................................36. *N. prominens* Sl.
9.(8)Size moderate (13-15·5 mm.); prothorax not sinuate on sides, basal angles obtuse.. 37. *N. illidgei* Sl.
10.(1)Elytra with eighth interstice narrow and convex.
11.(22)Pronotum nitid.
12.(21)Form ordinary; lateral apical sinuosities of elytra ordinary.
13.(20)Elytra at least with some metallic or submetallic tints.
14.(17)Head and prothorax with more or less metallic tints.
15 (16)Elytra with interstices convex and nitid in both sexes..............................38. *N. nitescens* Sl.

16.(15)Elytra with interstices depressed, or subdepressed, and opaque in ♀. ....39. *N. nitidicollis* Chaud.
17.(14)Head and prothorax black.
18.(19)Prothorax strongly rounded on anterior part of sides, strongly narrowed to base.................................40. *N. queenslandicus* Sl.
19.(18)Prothorax lightly rounded on anterior part of sides, lightly narrowed to base..41. *N. planipectus* Sl.
20.(13)Colour wholly black..42. *N. melas* Sl.
21.(12)Form narrow; lateral apical sinuosities of elytra deeply excised...... ....43. *N. wilcoxi* Cast.
22.(11)Pronotum opaque...44. *N. discorimosus* Sl.

32. Notonomus tessellatus, n.sp.

Oval. Prothorax opaque, transverse; sides shortly subsinuate before base; basal angles marked: elytra oval, striate; interstices unequal, second, fourth, and sixth much wider than the others, foveolate, third 2-punctate, eighth wider than seventh; humeral angles dentate. Head and prothorax black, lateral channel of prothorax virescent; elytra nitid and cupreous in ♂, opaque and dark purple in ♀; margin cupreous in both sexes.

Head small (3·15 mm. across eyes). Prothorax wide (4·15 × 5·25 mm.), depressed, much wider at base (4·3 mm.) than apex (3·2 mm.), transversely striolate and longitudinally shagreened; basal angles subrectanular, obtuse at summit; base emarginate in middle; posterior marginal puncture in marginal channel at basal angle; lateral channel wide; border thick, extending on to base on each side; lateral basal impressions narrow. Elytra wide, oval (10·5 × 6·4 mm.), depressed, strongly rounded on sides, deeply sinuate on each side of apex; first, third, and fifth interstice narrow; second, fourth, and sixth wide, closely covered with irregular impressions (these impressions extending nearly to base); seventh and eighth of nearly equal width (eighth a little wider), ninth very narrow, convex, seriate-punctate. Intercoxal declivity of prosternum and mesosternum flat. Length, 17·3; breadth, 6·4 mm.

Hab.—Queensland: Tambourine Mountain (H. J. Carter). Colls. Carter and Sloane.

Two specimens, taken by Mr. H. J. Carter, at Tambourine Mountain, in Southern Queensland, are before me. It is closely allied to

N. opacicollis Chaud., from which it differs by form wider; prothorax proportionately wider; elytra wider, more oval, interstices less convex, especially the second, fourth, and sixth, which are wide as far forward as the impressions extend (that is, nearly to the base), apical sinuosities strongly developed.

33. *N. opacicollis* Chaud.,(= *Orbitus purpureipennis* Motsch., and *Feronia purpureolimbata* Cast.) is evidently a species which varies considerably, and probably includes several races, or subspecies, some of which will probably be recognised under varietal names, when their geographical areas become clearly known. I offer the following notes :—

(1). Specimens from Acacia Creek, N.S.W., (six miles south from the Queensland Railway town, Killarney) vary in length from 14 to 17 mm. Elytra with a cupreous margin in both sexes, interstices with numerous foveoles on apical third; in ♂, of a subæneous-purple; in ♀, of an obscure purple-black; pronotum sometimes wholly black, sometimes tinged with green near basal angles.

(2). Specimens from Dorrigo are very similar to those from Acacia Creek in colour, but do not reach so large a size (15-15·5 mm.). Foveoles on the elytra fewer in number, and not extending so far forward; prothorax usually proportionately shorter, wider, less sinuate on sides near base, and with basal angles less rectangular.

(3). A specimen ticketed "Clarence River, Lea," is black, with merely a faint trace of a metallic margin on elytra. It has the prothorax more strongly sinuate before base, with the basal angles still more sharply marked, than the Acacia Creek specimens. Length, 15·5 mm.

(4). Specimens from Dunoon, on the Richmond River, are larger (16-18 mm.); black, the border of the elytra with merely a faint metallic tinge; prothorax wider than in the Acacia Creek specimens. The foveoles of the elytra extend forward beyond the anterior puncture of the third interstice.

N. rugosicollis Sl., now appears to me to be founded on an aberrant form of *N. opacicollis* Chaud., in which the foveoles of the elytra are wanting. If this form is constant, (only one specimen has yet been reported) it may be regarded as a distinct species, but I now feel doubtful about its constancy.

34. NOTONOMUS POLLI, n. sp.

♂. Elliptical, depressed. Prothorax lightly transverse; disc transversely striolate, not opaque; posterior marginal puncture on inner side of marginal channel a little before base: elytra truncate-oval, deeply striate; interstices convex, third 2-punctate, eighth depressed and much wider than ninth on basal half; humeral angles dentate. Upper surface bronzy (head faintly so); legs piceous.

Head 2·1 mm. across eyes. Prothorax depressed, broader than long (2·6 x 3 mm.), wider across base (2·3 mm.) than apex (2·15 mm); pronotum subnitid, closely covered with fine wavy striolæ; sides lightly rounded, lightly narrowed to base without juxta-basal sinuosity; basal angles obtuse; lateral border and channel wide posteriorly; median line strongly impressed; lateral basal impressions sulciform, elongate, uniting with basal channel at base. Elytra depressed, truncate-oval (6·3 x 3·3 mm.), lightly and evenly rounded on sides, strongly sinuate on each side before apex; interstices convex, 1-5 with summits a little flattened on disc, fifth with a foveiform puncture a little before middle, eighth about as wide as seventh towards base, ninth very narrow, tenth well developed, but short. Length, 11; breadth, 3·3 mm.

Hab.—N.S.W.: Richmond River. Unique in Coll. Sloane.

A remarkable species, which differs from all the others of the *opacicollis*-group, by the following characters in conjunction. Small size; pronotum transversely striolate, but not rendered opaque by longitudinal rugæ; eighth interstice of elytra much wider than ninth on basal half, second, fourth, and sixth interstices without foveæ. The well marked puncture of the fifth interstice is a most remarkable character; and, although it occurs on each elytron in my unique specimen, I do not feel sure that it may not be an individual variation rather than a feature of the species. Though *N. polli* seems to give a clue to *N. striaticollis* Cast., I cannot identify it as that species on account of its difference in colour, and thorax not "considerably longer than broad." This curious little species was among the Carabidæ of the Van de Poll Collection, as from the Richmond River.

36. Notonomus prominens, n.sp.

Elongate-oval, robust. Head moderate (3·75 mm. across eyes): prothorax subcordate; sides slightly sinuate before base; posterior marginal puncture a little before base on inner side of lateral channel: elytra deeply striate; interstices convex, third 2-punctate, eighth wide; humeral angles strongly dentate: fifth joint of posterior tarsi with four fine setules beneath. Nitid; prothorax with an obscure cupreous tinge; elytra cupreous (sometimes obscurely so); head, undersurface, and legs black, tarsi, palpi, and antennæ piceous.

Mentum with tooth wide, prominent, truncate at apex. Prothorax broader than long (4·65 × 5·75 mm.), broadest about middle, wider across base (4 mm.) than apex (3·75 mm.); sides lightly rounded, shortly sinuate just before basal angles; anterior angles not prominent, very obtuse, distant from neck; base emarginate in middle, lightly rounded on each side; basal angles marked, obtuse at summit; border reflexed, narrow anteriorly, wide posteriorly, extending on each side to lateral basal impressions, these narrow, deep, parallel; median line strongly impressed. Elytra truncate-oval (11·5 × 6·5 mm.), depressed on disc; apical curve lightly sinuate on each side; basal border strongly raised and prominent at humeral angles; striæ deep, simple; interstices not carinate on apical declivity, tenth moderately developed. Intercoxal declivity of prosternum and mesosternum flat. Length, 20·5; breadth, 6·5 mm.

Hab.—N.S.W.: Acacia Creek (Sloane). Coll. Sloane.

Two specimens (♂) occurred to Mr. H. J. Carter and me at Acacia Creek (six miles south from the Queensland Railway town, Killarney) in December. It is a member of the *opacicollis*-group, of which it is by far the largest species. The wide, eighth elytral interstice, and smooth prothorax together distinguish it from all the other species of the group, except *N. illidgei* Sl.

37. Notonomus illidgei, n.sp.

Elongate-oval. Head moderate (3 mm. across eyes): prothorax rather long; sides not sinuate; posterior marginal puncture on inner side of marginal channel near basal angle: elytra strongly striate; interstices convex in ♂, depressed in ♀, third 2-punctate, eighth much wider than ninth on basal half. Colour obscure, in ♀, black with a faint subviridescent tinge at sides of pronotum near base; elytra with ninth interstice and lateral channel cupreous; in ♂, head and prothorax with a faint cupreous tinge, elytra obscurely cupreous, lateral channel brightly so.

Prothorax broader than long (3·7 × 4·35 mm.), broadest about middle, wider at base (3·3 mm.) than apex (3); sides lightly and evenly rounded; anterior angles obtuse, not prominent; base truncate; basal angles obtuse (a little marked); lateral border a little wider towards base than apex, extending on each side to lateral basal impressions, these deep, narrow; median line strongly impressed. Elytra truncate-oval (8·4 × 5·1 mm.); apical curve lightly sinuate on each side; basal border strongly raised at humeral angles; striæ simple; interstices in ♂ strongly, in ♀ lightly convex near apex, tenth short. Intercoxal declivity of prosternum flat, of mesosternum hardly concave. Length, 13-15·5; breadth, 4·8-5·1 mm.

Hab.—Queensland: Dalveen (Sloane; December). Coll. Sloane.

Allied to *N. prominens* Sl., from which it differs by its smaller size; prothorax not so strongly rounded on sides, and not sinuate before basal angles, these less strongly marked, and with the border not thickened; onychium of tarsi not setulose beneath, etc. From all other allied species, it differs conspicuously by pronotum not transversely striolate, or by having the eighth interstice of elytra not narrow.

38. *N. nitescens* Sl.—Specimens from Ebor (Tillyard and Cox) are more brightly coloured; and have the prothorax less rounded on sides, less ampliate at widest part, and less strongly narrowed to both base and apex (3·5 × 3·8, apex 2·7, base 3·15 mm.). This form, from Ebor, should perhaps be regarded as a variety.

Var. *bellingeri* Sl.—After seeing the specimens mentioned above, I conclude that *N. nitescens* is a species which may vary sufficiently to include my *N. bellingeri*, though this is a point on which more data, than I possess, are needful.

39. *N. nitidicollis* Chaud.,(= *Feronia mastersi* Cast., = *F. impressipennis* Cast., = *N. purpureipennis* Macl., = *N. latibasis* Sl.).—I now have specimens which certainly represent *N. viridilimbatus* Cast., and others which are conspecific with *N. purpureipennis* Macl. After comparing these with my types (♀) of *N. latibasis*. and taking into consideration Chaudoir's note on *N. viridilimbatus* in his "Supplement" of 1874, I arrive at the conclusion that *N. latibasis* must be synonymous with *N. nitidicollis*; for *N. viridilimbatus* differs from *N. latibasis* exactly as it is said by Chaudoir to differ from *N. nitidicollis*. A recent examination of the types of *N. purpureipennis* Macl., in comparison with a specimen in my possession, compelled me to the belief that *N. purpureipennis* and *N. latibasis* are one species. Length, 13-15 mm.

Var. *viridilimbata* Cast.,(= *Feronia viridimarginata* Cast.).—This form has the facies of the typical form, but the prothorax with sides not subsinuate before basal angles, these angles more obtuse. Length, 15 mm. *Hab.*—Brisbane and Toowoomba (Carter).

Var. *viridicincta* Macl.,(= *N. nitidicollis* Sl., Revision, 1902). —Form narrower, prothorax more strongly sinuate at base, basal angles more decidedly marked. Length, 12·5 mm. *Hab.*—Gayndah.

Var. *violaceomarginata* Macl.—I have only a single specimen (♀). It is wider and more depressed, and has the eighth interstice of the elytra a little wider than in var. *viridilimbata* Cast., but I conclude that it should go under *N. nitidicollis* as a variety. It requires further study. Length, 16·5 mm. *Hab.*—Gayndah.

Var. *cyaneocincta* Macl.—*N. cyaneocinctus* Macl., agrees generally with var. *viridilimbata* Cast., but has the basal angles of the prothorax more obtuse. *Hab.*—Gayndah.

Var. *obtusicollis*, n.var.—Specimens (♂♀) from Coombungie (westward from Toowoomba) have been given to me by Mr. C. French. This form has the basal angles of the prothorax more rounded off than var. *cyaneocincta* Macl., with which I have compared it, but could not consider it identical. It differs from var. *viridilimbata* Cast., only by the unusually obtuse basal angles of the prothorax. Length, 15 mm.

41. *N. planipectus* Sl., var. *purpurata*, n.var.—The typical form of *N. planipectus* is from Tambourine Mountain, and is wholly black in colour; but a specimen, with the elytra of a beautiful purple, has been given to me by Mr. H. J. Carter, who took it near Murwillumbah, on the Tweed River. I can detect no other difference, worth noting, except the colour of the elytra, between this form and the typical form; it may well be considered a variety.

43. *N. wilcoxi* Cast.—In my Revision of 1902, I have indicated that I thought *N. subopaceus* Chaud., might prove to be only a variety of *N. wilcoxi* Cast. I have since then received four specimens from Mr. J. A. Kershaw, which agree very well with Castelnau's description of *N. wilcoxi*, and which are certainly not distinct from *N. subopacus*; therefore, I am confirmed in my belief that *N. subopacus* is a variety of *N. wilcoxi*.

The *violaceus*-group.

Prothorax with posterior marginal puncture on border at basal angle. Elytra with third interstice bearing more than two punctures. Intercoxal declivity of prosternum rounded.

This group is closely related to the *sphodroides*-group, from which it is differentiated by having the posterior marginal puncture of the prothorax on the border. *N. gippsiensis* and *N. rainbowi* are related to the *sphodroides*-group, and *N. violaceus* to the *australis*-group. Here, the four posterior tarsi may be either with or without spinules beneath the costa of the outer side of the basal joint. *N. æqualis*, *N. bakewelli*, and *N. tillyardi* have no spinule beneath the costa (in *N. tillyardi* the costa itself is obsolete). The other species have spinules beneath the costa, but, in *N. violaceus*, the spinules are not infrequently wanting on the hind tarsi, and sometimes, though rarely, also on the middle tarsi.

Table of Species.

1.(12)Prothorax with sides not sinuate before basal angles.

2.(9)Prothorax with basal angles obtuse, lateral border not widely reflexed just before basal angles.

3.(4)Prothorax suborbiculate, widest about middle, transverse, strongly and evenly rounded on sides, basal angles quite rounded off; black. .... 46. *N. rainbowi* Sl.

4.(3)Prothorax widest before middle, obliquely narowed to base.

5.(6)Prothorax strongly narrowed to base; black...47. *N. gippsiensis* Cast.

6.(5)Prothorax lightly narrowed to base, with at least metallic tints near base.

7.(8)Prothorax subquadrate(4·5 × 4·9 mm.); head black, pronotum greenish near lateral basal impressions; elytra black, sometimes with green margin....... .... 48. *N. æqualis* Sl.

8.(7)Prothorax narrow (5·3 × 5·5 mm.); head greenish, pronotum bronzy-green, elytra æneous...49. *N. banksi* Sl.

9.(2)Prothorax with basal angles marked, lateral border strongly reflexed posteriorly.

10.(11)Upper surface black................................... .....50. *N. macoyi* Sl.

11.(10)Upper surface cupreous or æneous . ...51. *N. besti* Sl.

12.(1)Prothorax with sides sinuate near base, basal angles rectangular.

13.(16)Elytra with eighth interstice depressed, and much wider than ninth towards base.

14.(15)Upper surface more or less metallic... ....52. *N. violaceus* Cast.

15.(14)Black...... ....53. *N. tillyardi* Sl.

16.(13)Elytra with eighth and ninth interstices subequal and convex........ ....54. *N. bakewelli* Sl.

47. *N. gippsiensis* Cast.—I found this species in Victoria, at Marysville and Jamieson; it is also found at Mount Buffalo and Talangatta.

50. *N. macoyi* Sl.,(= *N. howitti* Sl.), varies considerably in size and appearance. The interstices of the elytra are convex in ♂, depressed (rarely a little convex) in ♀. Sometimes, and more often in ♀ than in ♂, the prosternum is bordered along the whole of the anterior margin; in my Revision of 1902, too much importance was attributed to this character. *N. macoyi* occurred to me plentifully at Jamieson, on the upper Goulburn River, last De-

cember; and an examination of the specimens, obtained in that locality, enables me to declare, without doubt, that *N. howitti* Sl., is identical with *N. macoyi.* The tarsi have always the first joint of the intermediate pair costate externally, and with two spinules on the lower side of the costa; in the posterior pair, the first joint is costate externally, and usually, but not always, with a spinule on the lower side of the costa. Dimensions: 14·6-17·5 × 4·7-6·3 mm. *Hab.*—Victoria: Marysville and Jamieson (Sloane).

Note.—An error occurs in my original description of *N. macoyi*, where the head is said to be "4·1 mm. across eyes"; the true measurement is 3·1 mm., from a remeasurement of the type-specimen.

51. *N. besti* Sl.—The typical form is found on the mountains of the upper Yarra; it occurred to me at Warburton, in January. Var. *æneodorsis* Sl., differs from the typical form by its brassy-green colour.

53. Notonomus tillyardi, n.sp.

♂. Elliptical-oval, convex. Head large: prothorax cordate, strongly sinuate on each side near base; posterior marginal puncture on border at basal angle: elytra oval, strongly striate; interstices lightly convex. Black.

Head convex (4·3 mm. across eyes); eyes convex. Prothorax broader than long (4·7 × 5·6 mm.), widest before middle, narrower at base (3·75 mm.) than apex (4·3 mm.); sides strongly rounded on anterior three-fourths, strongly sinuate before base; basal angles strongly marked; border thick on sides, thickened at basal angle to receive posterior marginal puncture, extending along base on each side to lateral basal impression; median line strongly impressed; lateral basal impressions deep. Elytra parallel-oval (11 × 6·8 mm.), convex; lateral apical sinuosities hardly marked; third interstice with two or three punctures,* eighth lightly convex, wider than ninth on basal third, narrow and convex on posterior third, ninth lightly convex, tenth obsolescent; basal and lateral borders meeting at humeral angle with hardly any inter-

* In my unique specimen, there are two punctures on the right elytron, three on the left.

ruption. Intercoxal declivity of prosternum narrow in middle, of mesosternum concave. Length, 20; breadth, 6·8 mm.

Hab.—N.S.W.: Ebor (Tillyard). Unique in Coll. Sloane.

This large, black species is one of the most distinct in the genus, having the prothorax more strongly sinuate to the base than any other species. It is probably more allied to *N. violaceus* Cast., than to any other species. The anterior tarsi in ♂ are much less dilatate than in *N. violaceus* and *N. triplogenioides*. The four posterior tarsi have the first joint without any spinules beneath the external costa, which is obsolete on the hind tarsi.

The *parallelomorphus*-group.

Prothorax as long as broad; posterior marginal puncture on border at basal angle. Elytra simply striate; eighth interstice a little wider than ninth on basal half, ninth narrow. Intercoxal declivity of prosternum wide, flat. Tarsi not striolate on upper surface, first joint of four posterior tarsi costate externally, without spinules beneath costa. Apex of abdomen 6-setose in ♀.

A monotypic group, with relationships to both the *eques*- and *australis*-groups, but which it seems better not to associate with either.

55. *N. parallelomorphus* Chaud.,(=*N. opulentus* Sl., Revision, 1902).—I can now see that I made a mistake in considering *N. parallelomorphus* as a synonym of *N. opulentus* Cast., to which it has no particular affinity. This species has the apical ventral segment setose as in the *eques*-group, namely, ♂, 2-setose; ♀, 6-setose. The first joint of the anterior tarsi in ♀ is often squamulose beneath (this also occurs in *N. eques* Cast., and rarely in *N. bodeæ* Sl.); it is so in four out of nine specimens taken by me at Warburton and Marysville, Victoria.

The *australis*-group.

Prothorax with posterior marginal puncture on border at basal angle. Elytra with striæ crenulate; third interstice bearing more than two punctures. Intercoxal declivity of prosternum flat. First joint of four posterior tarsi costate externally, without spinules beneath costa.

The species of this group are closely allied to *N. violaceus*, but it has seemed best to constitute a separate group for them.

Table of Species.

1.(2)Prothorax with sides not sinuate posteriorly, basal angles obtuse.......
...........56. *N. colossus* Sl.
2.(1)Prothorax with sides sinuate posteriorly, basal angles marked.
3.(6)Elytra with humeral angles strongly dentate.
4.(5)Size large (21-25 mm.)....................................57. *N. australis* Cast.
5.(4)Size smaller (17-19 mm.)..... ....58. *N. crenulatus* Sl.
6.(3)Elytra with basal border not dentate at humeral angles....... ....
.... 59. *N. amabilis* Cast.

56. *N. colossus* Sl.—I took this species at Guyra and Ben Lomond, in December, 1910; and I have it also from Uralla.

57. *N. australis* Cast.,(= *N. æneomicans* Chaud.).—In Chaudoir's original description of *N. æneomicans*, the colour is given as "*plerumque viridimarginata thorace laetiore, plus minusve virescente;*" therefore, coloured as Castelnau's *Trigonotoma australis*, with which I believe it to be identical. *Hab.*—Narrara and Ourimbah (Sloane).

Var. *lapeyrousei* Cast., is the form found north of the Hunter River; it has the margins of prothorax and elytra cupreous. *Hab.*—Buladelah (Carter), Dorrigo (Tillyard).

58. *N. crenulatus* Sl., is a distinct species, rather than a variety of *N. australis* Cast. The humeral angles, though strongly marked, are not dentate as in *N. australis*, it is also smaller than *N. australis*. Length 17-19 mm. *Hab.*—Dorrigo (Sloane), Ebor (Tillyard).

The *kingi*-group.

Prothorax with posterior marginal puncture on border at basal angle. Elytra fully striate; third interstice 2-punctate (except in *N. dyscoloides* Motsch., where the number of punctures varies from two to four). Posterior tarsi with first joint as long as the two succeeding joints together; onychium glabrous beneath.

The species, which I have included in the *kingi*-group, are not at all nearly allied to one another, for I cannot suppose that the characters, by which they are associated together, are of great value for indicating close affinities. The Victorian species, *N. dys-*

coloides and *N. apicalis* are evidently related to one another, and show some relationship towards *N. minimus;* these three species are rather out of place in the group, but *N. victoriensis* seems to link them with *N. australasiæ*; therefore, I have placed them here to prevent the addition of another, to my already too numerous groups. The two Queensland species are isolated forms. The typical species belong to New South Wales.

Table of Species.

A. *Typical Species.*

1.(6)Intercoxal declivity of prosternum rounded. (Elytra with humeral angles not dentate).

2.(3)Lateral border of pronotum narrow, of elytra narrow near humeral angles; elytra lightly sinuate on each side of apex. (Black.)......... ....61.*N. scotti* Sl.

3.(2)Lateral border of pronotum widely reflexed, of elytra widely reflexed near humeral angles; elytra strongly sinuate on each side of apex.

4.(5)Black.... .... 62.*N. fergusoni* Sl.

5.(4)Metallic.... ....63.*N. marginatus* Cast.*

6.(1)Intercoxal declivity of prosternum flat.

7.(10)Elytra with eighth interstice depressed or subdepressed, much wider than ninth towards base.

8.(9)Striæ crenulate. (Length 22-24 mm.)....64.*N. triplogenioides* Chaud.

9.(8)Striæ simple. (Length 15-17 mm.)... ....65.*N. australasiæ* Chaud.

10.(7)Elytra with eighth interstice narrow, convex.

11.(18)Pronotum nitid.

12.(17)Elytra normally striate.

13.(14)Form elongate, depressed; pronotum widely margined. (Length 18 mm. Black) ....66.*N. lirageruz* Sl

14.(13)Form ordinary.

15.(16)Prothorax with basal angles marked; elytra with humeral angles strongly dentate.... ....67.*N. kingi* Macl.

16.(15)Prothorax with basal angles rounded off; elytra with humeral angles marked but not dentate........ ....68.*N. leai* Sl.

17.(12)Pronotum opaque.. .... 69.*N. doddi* Sl.

18.(11)Elytra with seventh interstice branching into three forward from apical curve................................ ....70.*N. sæpestriatus* Sl.

B. *Victorian subgroup.*

Size moderate (12-15 mm.).

Elytra with third interstice swollen at position of posterior puncture .. ..71.*N. victoriensis* Sl.

---

* I now regard *N. sydneyensis* Sl., as a var. of *N. marginatus*.

Elytra with third interstice not swollen at position of posterior puncture.
Elytra strongly striate ....72. *N. dyscoloides* Motsch.
Elytra finely striate, interstices depressed except at apex............
............73. *N. apicalis* Sl.
Size small (9 mm.), colour black.............................74. *N. minimus* Sl.

64. *N. triplogenioides* Chaud., var. *jervensis* Sl.—In my Revision of 1902, I described *N. jervensis* as a species distinct from *N. triplogenioides*. Mr. H. J. Carter found *N. jervensis* at Nowra, and an examination of his specimens convinces me that it is only a variety of *N. triplogenioides.*

67. *N. kingi* W. S. Macleay,(= *N. incrassatus* Chaud.).—In These Proceedings for 1907 (p. 365), I suggested that *Pœcilus kingi* W. S. Macleay, might well be taken to be *N. incrassatus* Chaud., and further consideration of the matter makes this conclusion seem inevitable.

69. Notonomus doddi, n.sp.

Oval. Prothorax subcordate; pronotum opaque, transversely striolate; posterior marginal puncture on border at basal angle: elytra deeply striate; interstices convex, third 2-punctate; inner humeral angles sharply marked: fifth joint of tarsi glabrous beneath. Black.

Head not large (3·2 mm. across eyes). Prothorax broader than long(4·15 x 5 mm.), wider across base(3·6 mm) than apex(3 mm.); sides rounded, very shortly sinuate just before basal angle; apex widely emarginate; anterior angles obtuse, but rather prominent; base lightly emarginate in middle; basal angles almost rectangular, obtuse at summit; border wide, especially posteriorly; lateral channel wide, becoming wide and depressed near basal angles; lateral basal impressions deep, not long; median line strongly impressed, reaching base. Elytra ovate (9·2 x 5·3 mm.), wide at base, lightly rounded on sides; lateral basal sinuosities well developed, stronger in ♀ than in ♂; basal border a little raised above lateral border at humeral angles; lateral border wide, reflexed; eighth interstice narrower than seventh, about twice as wide as ninth at basal third, tenth well developed. Intercoxal declivity of prosternum flat, of mesosternum hardly at all concave. Length, 14-16; breadth, 4·75-5·3 mm.

Hab.—Queensland: Herberton District (F. P. Dodd). Coll. Sloane.

An isolated species, at once differentiated from all others by having the pronotum opaque and transversely striolate, and the posterior marginal seta on the border at basal angle.

72. *N. dyscoloides* Motsch., [= *N. sphodroides* Sl., (1902), not Dejean].—A variable species in colour, size, and convexity of elytral interstices, also in the number of punctures on the third interstice; usually there are three or four of these punctures, but small specimens, from Marysville and the Baw Baw Mountains, have only two punctures; the elytra are generally longitudinally depressed along the course of the third interstice. The intermediate tarsi have the external costa of the first joint spinulose beneath, but the posterior tarsi have no spinule beneath the costa. It has not much affinity with any other species of the group in which I have placed it. The species most nearly allied to it seems to be *N. victoriensis* Sl. Specimens with violaceous elytra occurred to me at Warburton and Marysville; doubtless these represent *Pterostichus semiviolaceus* Cast. Length, 12·7-15 mm. Specimens from the Dandenong Ranges have the elytra more cyaneous, and are evidently the form which Castelnau distinguished under the separate name of *Pterostichus victoriæ*; this is the form I erroneously thought to be *N. sphodroides* Dej., in 1902; the material now before me indicates that this slightly differentiated form is not worthy of a varietal name. Length, 13-15 mm. Specimens from Marysville are smaller, and have the elytra with only two punctures on the third interstice. Three specimens are before me, taken near Keppel's Falls, on the Taggerty River; two of these (♂♀) have the elytra cyaneous, the other (♀) violaceous. It seems a variety. Length, 12-12·5 mm.

Var. *simulans* Chaud.—I have specimens from Victoria which differ from *N. dyscoloides* Motsch., by colour, in the same way that *N. simulans* is said to do; namely, elytra cupreous, with the border black. (It may be noted that *N. dyscoloides* has the border of the elytra black). I look upon my specimens as representing a variety of *N. dyscoloides,* rather than a distinct species. Length, 15 mm.

Hab.—Victoria: Emerald. National Museum, Melbourne, and Coll. Sloane.

73. Notonomus apicalis, n.sp.

Elongate-oval, rather depressed. Prothorax truncate-cordate; basal angles rectangular; elytra on disc feebly, at apex strongly striate; third interstice 2-punctate; humeral angles subdentate. Nitid; head, prothorax, and underparts black; elytra æneo-cupreous, margin black.

Head 2·4 mm. across eyes. Prothorax broader than long (3 × 3·5 mm.); base and apex of equal width (2·5 mm.); sides lightly rounded, shortly subsinuate just before base; border strongly reflexed posteriorly, continued on to base; posterior marginal puncture on border at basal angle; lateral basal impressions elongate; lateral basal spaces depressed. Elytra oval (7·2 × 4·3 mm.); basal border obtusely raised above lateral border at humeral angles; lateral apical sinuosities well developed; striæ lightly or faintly impressed on disc, more distinct near base, strongly impressed on apical declivity; first well marked for whole length, 4-8 obsolete or faintly impressed; interstices flat, except just near apex. Intercoxal declivity of prosternum flat, of mesosternum not concave. Four posterior tarsi with external side costate, and spinulose beneath costa. Length 12, breadth 4·3 mm.

Hab.—Victoria. National Museum, Melbourne (type), and Coll. Sloane.

I have to thank Mr. J. A. Kershaw for the opportunity of describing this species. It is allied to *N. dyscoloides* Motsch., though it has a superficial resemblance to the species of the *chalybeus*-group. The flat intercoxal declivity of the prosternum, and the elytra strongly striate on the apical declivity, where the interstices are raised, indicate its affinities, and preclude it from being placed in the *chalybeus*-group.

The *lateralis*-group.

Prothorax with posterior marginal puncture on border at basal angle; lateral basal impressions short, not reaching margin of base. Elytra strongly striate; basal border not, or very feebly, interrupted at point of junction with lateral border; third interstice with three or four punctures, eighth wider than ninth towards base. Four posterior tarsi without spinules beneath costa of external side of first joint; hind tarsi short, first joint not as long as the two succeeding joints together.

Table of Species.

1.(2)Elytra with ninth interstice depressed, not much narrower than eighth towards base, tenth hardly developed; tarsi with onychium setulose beneath.......................................78. *N. cylindricus* Sl.

2.(1)Elytra with ninth interstice very narrow, much narrower than eighth towards base; tenth well developed, elongate.

3.(4)Elytra with decided lateral apical sinuosities, disclosing apex of inner marginal plica.......................................79. *N. wentworthi* Sl.

4.(3)Elytra with lateral apical sinuosities obsolete, apex of inner marginal plica not visible. (Posterior tibiæ curved).........80. *N. lateralis* Sl.

78. Notonomus cylindricus, n.sp.

♀. Elongate, subcylindrical. Head large; prothorax subcordate; basal angles rounded; posterior marginal puncture on border at basal angles; elytra parallel, convex, strongly striate; humeral angles edentate; third interstice 4- or 5-punctate. Black.

Head convex (3·8 mm. across eyes); frontal impressions obsolete; clypeus bi-impressed; eyes with orbits reniform; postocular part of orbits well developed. Prothorax broader than long (4·5 × 4·9 mm.), widest before middle, convex; sides slightly rounded, roundly, obliquely narrowed to base; apex (3·9 mm.) wider than base (3·5 mm.); anterior angles not marked; basal angles obtuse; border well developed posteriorly, passing round basal angle to lateral basal impression on each side; lateral basal impressions deep, short; lateral basal spaces convex. Elytra much wider than prothorax (10·8 × 6·2mm.), very convex; lateral apical sinuosities well developed; interstices lightly convex, eighth a little wider than ninth towards base, tenth hardly indicated. Intercoxal declivity of prosternum wide, rounded, of mesosternum concave; metepisterna short. Four posterior tarsi with first joint costate on external side, without spinules below costa; hind tarsi with first joint shorter than two succeeding joints together; fifth joint setulose beneath. Length 18, breadth 6·2 mm.

Hab.—Australia: Type (unique) in National Museum, Melbourne, ticketed "Queensland."

A very distinct species, in a general way resembling *N. variicollis* Chaud., but more elongate, convex, and cylindrical, and with the posterior marginal puncture of the prothorax on the border. The short posterior tarsi seem to ally it with *N. lateralis* Sl., and *N. wentworthi* Sl., therefore, I have placed it in the same group as these species, but it does not appear to have more than a general relationship with them. It is readily distinguished from both *N. lateralis* and *N. wentworthi* by having the prothorax more cordate; elytra with basal border less raised at point of junction with lateral border, third interstice 4-punctate, ninth depressed and wider, tenth hardly developed, etc. Though the unique specimen in the National Museum, Melbourne, is ticketed "Queensland," it seems to me a southern form; and, for this reason, I think it possible that the habitat Queensland may have been attached to it, in error.

79. Notonomus wentworthi, n.sp.

Robust, parallel. Head large; prothorax subquadrate; basal angles obtuse; posterior marginal puncture on border at basal angle; elytra truncate-oval, strongly striate; interstices convex, third 3-punctate as in *N. lateralis* Sl., eighth wide, ninth very narrow; posterior tarsi short. Black.

Head convex (3 mm. across eyes); eyes (with orbits) reniform, prominent, deeply set in orbits posteriorly. Prothorax broader than long (3·8 x 4·3 mm.), lightly and evenly rounded on sides; apex and base of equal width (3 mm.); apex a little emarginate; basal angles roundly obtuse; lateral border even, narrow, thick; lateral basal impressions wide, short; lateral basal spaces convex. Elytra a little wider than prothorax (8·8 x 4·7 mm.), parallel, rather depressed on disc, strongly declivous on sides and apex; lateral apical sinuosities moderately developed; scutellar striole very short; basal border rather prominent, and a little raised above lateral border at humeral angles; tenth interstice narrow, elongate; lateral channel hardly widened near beginning of apical curve. Intercoxal declivity of prosternum wide, of mesosternum flat. Length 15·5, breadth 4·7 mm.

Hab.—N.S.W.: Blue Mountains (Mount Tomah, Fletcher; Kurrajong, Musson). Coll. Sloane.

In my Revision of 1902, this species was placed under *N. lateralis* Sl., but I now perceive that it is quite distinct. The male of *N. wentworthi* differs from the male of *N. lateralis* by eyes more prominent; elytra with lateral channel much narrower posteriorly, lateral apical sinuosities well developed, and disclosing the apex of the inner plica (in *N. lateralis*, the sinuosity is obsolete, and the inner plica is not visible) posterior tibiæ straight (not incurved on lower side), etc.; in the female, the same elytral differences occur in a far more decided form.

80. *N. lateralis* Sl.—Mr. H. J. Carter found this species at Mount Irvine, in the Blue Mountains; and, after seeing his specimens, it is evident to me that my original description was founded on normal specimens. When writing my "Revision," in 1902, I confused another species (*N. wentworthi*) with *N. lateralis;* this error was caused by my having only one specimen (♀) of *N. lateralis* and *N. wentworthi* for comparison, and I concluded that the very peculiar marginal development of the elytra in *N. lateralis* ♀, (which had been described in the original description of that species) was probably an individual deformity. In this, I was wrong; it is the normal form of the elytra in *N. lateralis* ♀. It may be noted, that what I called the "ninth stria," in the original description of *N. lateralis,* is really the marginal channel; there is a narrow, ninth stria between the ninth and tenth interstices, on the posterior half of the elytra.

The *mediosulcatus*-group.

Prothorax rounded on sides; basal angles rounded; posterior marginal puncture on border. Elytra with the four inner striæ deep, 5-7 obsolete, third interstice 2-punctate; humeral angles rounded. Prosternum with anterior margin bordered; intercoxal declivity rounded. Four posterior tarsi with first joint not costate, nor with upper spinules on external side; onychium glabrous beneath.

A monotypic group showing no near affinity to any other group, but with evident suggestions of being a connecting form between *Notonomus* and *Sarticus*.

81. *N. mediosulcatus* Chaud.,(= *Adetipa punctata* Cast., = *Omaseus occidentalis* Cast., = *O. satanas* Cast.) is the only species as yet known from South-Western Australia; it varies greatly in colour and appearance.*

The *chalybeus*-group.

Prothorax with posterior marginal puncture at basal angle. Elytra feebly striate; interstices depressed (including eighth at apex), third 2-punctate. Intercoxal declivity of prosternum rounded. Intermediate tarsi with first joint spinulose on outer side above usual row of external spinules; posterior tarsi often not similarly spinulose, sometimes with one upper spinule, external costa of first joint not well developed, sometimes obsolete; onychium glabrous beneath.

A satisfactory group, for which Motschulsky thought a generic name needful (*Ternox*). Chaudoir did not consider *Ternox* as distinct from *Notonomus;* and it seems to me that, if the separation of *Ternox* had to be supported by valid reasons, such reasons would not be easy to indicate; therefore, I follow Chaudoir in merging *Ternox* with *Notonomus*. This group gives indications of ancient relationships towards the *sphodroides*-group through *N. tenuistriatus* Sl., and also in a more shadowy way towards *N. mediosulcatus* Chaud.

Table of Species.

1.(4)Colour black.

2.(3)Elytra with humeral angles not raised; prothorax evenly rounded on sides, widest about middle ....82.*N. gravis* Chaud.

3.(2)Elytra with humeral angles strongly raised; prothorax rather obliquely narrowed to base, widest considerably before middle.................. ....83.*N. molestus* Chaud.

4.(1)Elytra virescent.

5.(6)Size large(17-21 mm.); elytra with basal border very little raised above lateral border at humeral angles.. ... .84.*N. philippi* Newm.

---

* Sloane, These Proceedings, 1898, p.478.

6.(5)Size small (13·5-15 mm.); elytra with basal border decidedly raised above basal border at humeral angles.

7.(8)Prothorax not sinuate on sides before basal angles. ....85. *N. chalybeus* Chaud.

8.(7)Prothorax lightly sinuate before basal angles.........86. *N. kershawi* Sl.

84. *N. philippi* Newm.,(= *Percus bipunctatus* Cast.).—The species which Castelnau named *Feronia* (*Percus*) *bipunctata* must certainly be considered to be the same as Newman's *Feronia philippi*, but I cannot now accept Chaudoir's view that it is synonymous with *F. chalybea* Dej., which is a smaller insect. *N. philippi* is common about Melbourne, and is found generally over the Yarra watershed; I have found it at Matlock, on the source of the Goulburn River. Length, 17-21 mm.

Var. *otwayensis* Sl.—Probably this is a distinct species, but more information than I possess of the spread of *N. philippi* westward from Melbourne, and more knowledge as to any intermediate forms being found, would be necessary before any definite opinion could be ventured upon.

Var. *arcuata*, n. var. Differs from *N. philippi* Newm., by size smaller, prothorax more strongly rounded, more roundly narrowed to base; basal angles rounded off, not marked; elytra more obvate, narrower towards base. From *N. gravis* Chaud., it differs by form less convex, elytra more or less chalybeous, more narrowed to base, basal border obtusely subdentate at humeral angles (a little raised above lateral border). Dimensions: head, 3·2 across eyes; prothorax, 3·8 × 4·6, apex 3·1, base 3·2; elytra, 9·7 × 5·8; length 16 mm.

Hab.—Werribee Gorge (westward from Melbourne). Colls. Dixon and Sloane.

I owe it to the kindness of Mr. J. E. Dixon, of Melbourne, that I have been able to examine three specimens of this variety, which he had found at Werribee Gorge. It might be considered a species closely allied to *N. philippi*, but I prefer to regard it as a variety of that species.

85. *N. chalybeus* Dej.—This species is found on King Island. Specimens sent to me by Mr. A. M. Lea, from King Island, agree

closely with Chaudoir's description of *N. chalybeus.* It differs from *N. philippi* Newm., by its smaller size. Black, with greenish-blue elytra. Length, 13-14 mm.

86. *N. kershawi* Sl., is extremely near *N. chalybeus* Dej., of which it is the representative on the mainland. It exactly resembles *N. chalybeus* in appearance and colour, but has the prothorax subsinuate before the basal angles, which are more strongly marked; the humeral angles of the elytra, too, are more prominent. *Hab.*—Victoria: Princetown (Sloane), Portland (J. E. Dixon).

The *lesueuri*-group.

Prothorax with posterior marginal puncture on border at basal angles. Elytra strongly and fully striate; third interstice 2-punctate, eighth and ninth subequal, eighth convex. Intercoxal declivity of prosternum flat. Metepisterna longer than is usual in the genus. Four posterior tarsi without spinules beneath costa of external side of first joint; hind tarsi shorter than usual in the genus; onychium glabrous beneath.

This is a terminal group; by its short posterior tarsi, and some other characters, it approaches the *lateralis*-group. The two species may be separated thus:—

Elytra with humeral angles edentate...... .....87. *N. lesueuri* Cast.
Elytra with humeral angles dentate................88. *N. miles* Cast.

N. miles, as identified by me in my "Revision" of 1902, may not be the species which Castelnau described. I am unable to decide that Chaudoir's description of *N. miles* Cast., in his "Supplement," could not have been founded on the species I identified as *N. miles,* but, when we consider that Chaudoir separated *N. lesueuri* from all the other species of *Notonomus,* on account of its elongate metepisterna; and that, in the same paper, he treated of *N. miles* very fully, it seems difficult to think that the true *N. miles* has elongate metepisterna. My present view is, that the true *N. miles* is a species allied to *N. kingi* Macl., and not *N. miles* Sloane, but, to prevent changes in nomenclature on insufficient evidence, I now leave the matter as formerly decided by me,* till the examination

* These Proceedings, 1902, p.323.

of specimens from the Clyde River, N.S.W., enables the point to be settled definitely.

INDEX AND LIST OF SPECIES.

Names which have an asterisk prefixed to them, are those of species which are unknown to me in nature.

Names which are not noticed in the body of the present paper, are synonyms which have been treated of in my Revision of 1902.

Varieties are indexed here, the same as synonyms, and have the numbers of the species on which they are dependent, attached.

	Sp. No.
minimus Sl.	74
mitchelli Cast.	65
molestus Chaud.	83
montanus Cast.	82
montanus Rainb.	46
muelleri Sl.	15
nitescens Sl.	38
nitidicollis Chaud.	39
nitidicollis Sl.	39
obsoletus Motsch.	83
obtusicollis Sl.	39
occidentalis Cast.	81
opacicollis Chaud.	33
opacistriatus Sl.	89
opulentus Cast.	21
opulentus Sl.	55
otwayensis Sl.	84
parallelomorphus Chaud.	55
peroni Cast.	14
philippi Newm.	84
phillipsi Cast.	4
planipectus Sl.	41
politulus Chaud.	18
polli Sl.	34
pluripunctatus Sl.	11
plutus Cast.	12
pristonychoides Motsch.	16
pristonychoides Chaud.	30
prominens Sl.	36
punctatus Cast.	81
purpuratus Sl.	41
purpureipennis Motsch.	33
purpureipennis Macl.	39
purpureolimbatus Cast.	33
queenslandicus Sl.	40
rainbowi Sl.	46
*resplendens Cast.	23
rufipalpis Sl.	31
rugitarsis Sl.	6
rugosicollis Sl.	33
sæpestriatus Sl.	70
satanas Cast.	81
satrapus Cast.	10
satrapus Sl.	11
scotti Sl.	61
*semiplicatus Cast.	77
semiviolaceus Cast.	72
simulans Chaud.	72
spenceri Sl.	7
sphodroides Dej.	16
sphodroides Sl.	72
*striaticollis Cast.	35
strzeleckianus Sl.	3
*subiridescens Chaud.	75
subopacus Chaud.	43
subvilis Cast.	72
sydneyensis Sl.	63
tasmanicus Cast.	18
taylori Sl.	27
tenuistriatus Sl.	13
tessellatus Sl.	32
tillyardi Sl.	53
triplogenioides Chaud.	64
tubericaudus Bates	19
variicollis Chaud.	24
victoriæ Cast.	72
victoriensis Sl.	71
violaceus Cast.	52
violaceomarginatus Macl.	39
viridicinctus Macl.	39
viridilimbatus Cast.	39
viridimarginatus Cast.	39
wentworthi Sl.	79
wilcoxi Cast.	43

ON A CASE OF NATURAL HYBRIDISM IN THE GENUS *GREVILLEA* [N.O. PROTEACEÆ].

By J. J. Fletcher.

[Paper withdrawn, by permission of the Council, for the incorporation of observations on some additional material, corresponding with that described by Mr. Bentham in the Flora Australiensis, not previously seen.]

ORDINARY MONTHLY MEETING.

AUGUST 27th, 1913.

Mr. W. W. Froggatt, F.L.S., Vice-President, in the Chair.

Mr. CHARLES BADHAM, B.Sc., University of Sydney, was elected an Ordinary Member of the Society.

The Donations and Exchanges received since the previous Monthly Meeting (30th July, 1913), amounting to 9 Vols., 85 Parts or Nos., 13 Bulletins, 5 Reports, and 1 Pamphlet, received from 53 Societies, etc., were laid upon the table.

REVISION OF THE AUSTRALIAN *CURCULIONIDÆ* BELONGING TO THE SUBFAMILY *CRYPTORHYNCHIDES*. Part XII.

By Arthur M. Lea, F.E.S.

This Part deals with the balance of the genera allied to *Poropterus*. A large number of them have the base of the head more or less strongly depressed, and with two to five emarginations (sometimes of considerable depth) on the forehead, a peculiarity that, with few exceptions, appears to be confined to the group. In consequence of the lateral emarginations, the eyes often appear as if they were not embedded in the head; usually when this is the case, they are bent over on top. When the forehead is strongly sinuous, the base is often bald and shining, and the tarsi are usually narrow and shining. In those in which it is simply depressed at the base, the central portion is often densely squamose, and rather strongly convex, whilst the base itself is coarsely punctured and opaque, but not squamose; though in some species it is shining. But to see these parts clearly, the head must usually be removed from the body.

The rostrum is usually the length of the prothorax; it is never straight, but seldom strongly curved; it has always a more or less shallow groove on each side above the scrobe. The eyes are usually small, ovate, and coarsely faceted.

The metasternum is always (except in *Eufaustia*) shorter than the basal segment of abdomen, and is usually much shorter. Its episterna are always narrow, and sometimes the median portion is entirely concealed. In *Scolyphrus,* they are almost, whilst in *Hoplodecilaus* they are entirely without a triangular inner projection, In some genera, they are entirely absent, or at least not traceable; in a few only, the triangular projection is the only part left. This, in *Myrtesis* and *Cedilaus,* is of an unusual size.

In many, the suture between the first and second abdominal segments is soldered together, and curved across middle, although usually deep at the sides. When it is deep and straight, the second segment is seldom much longer than the third. The three apical ones are frequently strongly narrowed by the elytra.

In the majority of species, the hind femora do not extend to the apex of the abdomen, their grooving is often indistinct (especially on the front part), and the dentition is sometimes variable in a genus, and is even sometimes sexually variable. In *Tetengia,* the legs, and in *Cedilaus,* the tibiæ, are remarkable.

The majority of the genera are apterous; in *Onidistus,* one species is apterous, whilst the others are winged. In *Tragopus,* the wings, though present, are too small to be used for flight.

The colour and clothing are not of much use for purposes of identification. The species are nearly all black, except for the antennæ and tarsi. The clothing is frequently of a muddy-brown, is often slightly variable amongst individuals of a species, and is usually easily abraded; moreover, owing to their habits, the clothing is often caked with mud. Wherever possible, at least one specimen of a species was abraded before the description of that species was drawn up. Not infrequently the clothing conceals important structural features, especially on the under-surface.

In many of the species, there are a few shining sutural granules on the basal half of the elytra; these are sometimes hollow, and are seldom constant in the species, or even on the different sides of an individual.

A number of the genera, particularly some of those towards the end, do not appear to be satisfactorily placed, but I cannot suggest a better location for them. The main difference between the *Poropterus* and the *Chætectetorus* groups lies in the metasternum; in the latter group it is usually long, frequently longer than the basal segment of abdomen and with very distinct and often wide episterna.

The following table is arranged solely for convenience of identification:—

A. Pectoral canal terminated at or on abdomen... MYRTESIS.
AA. Canal terminated before abdomen.
  B. Mesosternal receptacle open.
    a. Rostrum short and wide...... .... EUFAUSTIA.
    aa. Rostrum rather long and thin.

b. Forehead sinuous.
c. Forehead trisinuate, scutellum absent.... PSEUDONIDISTUS.
cc. Forehead quadrisinuate, scutellum present.. ONIDISTUS.
bb. Forehead not sinuous.
d. Apex of rostrum not resting in a special receptacle...................................... CYCLOPOROPTERUS.
dd. Apex so resting.............................. POROPTERINUS.
BB. Mesosternal receptacle cavernous (sometimes just perceptibly so).
C. Tarsi linear.................................... SCOLYPHRUS.
CC. Tarsi with third joint wider than second (sometimes not by much) and bilobed.
D. Inner projection of metasternal episterna large, triangular, and isolated.......... CEDILAUS.
DD. Inner projection not as in D.
E. Scutellum present.
e. Head convex, forehead not sinuous.
f. Femora dentate.
g. Eyes coarsely faceted.................. ANILAUS.
gg. Eyes finely or moderately faceted.
h. Suture between two basal segments of abdomen curved......... OUROPOROPTERUS.
hh. This suture straight................ OMYDAUS.
ff. Femora edentate.
i. Eyes finely faceted.... .... PTEROPOROPTERUS.
ii. Eyes coarsely faceted.
j. Metasternal episterna not traceable............................... EXITHIOIDES.
jj. Metasternal episterna traceable throughout.
k. Prothorax longer than wide.... PSEUDOMYDAUS.
kk. Prothorax transverse.
l. Elytra trisinuate at base....... ORTHOPOROPTERUS.
ll. Elytra not trisinuate........... POROPTERCULUS.
ee. Head depressed at base, the forehead usually sinuous.
m. Club decidedly elongate............. AUSTRECTOPSIS.
mm. Club sometimes moderately long, but never very long.
n. Suture between two basal segments of abdomen more or less indistinct.
o. Metasternal episterna not traceable throughout....................... EXITHIUS.

oo. Metasternal episterna so traceable.
p. Emargination of mesosternal receptacle transverse............... EURYPOROPTERUS.
pp. Emargination longitudinal....... TEPALICUS.
nn. Suture between two basal segments of abdomen distinct throughout.
q. Femora dentate.
r. Scape inserted nearer base than apex of rostrum....... .... METHIDRYSIS.
rr. Scape inserted nearer apex than base .... NOTOCALVICEPS.
qq. Femora edentate.
s. Hind femora not passing elytra.. ŒMETHYLUS.
ss. Hind femora passing elytra.
t. Femora grooved.................. .. STENOPOROPTERUS.
tt. Femora not grooved........ ...... ILLIDGEA.
EE. Scutellum absent, or at least not traceable.
F. Base at sides of prosternum excavated for reception of front femora .... TETENGIA.
FF. Base of prosternum not so excavated.
G. Head depressed at base, or forehead sinuous.
u. Metasternal episterna not traceable throughout.
v. Femora dentate................ ..... POROPTERELLUS.
vv. Femora edentate................ .. BRACHYPOROPTERUS.
uu. Metasternal episterna traceable throughout.
w. Eyes finely faceted.
x. Femora edentate... .... PACHYPOROPTERUS.
xx. Femora dentate........... ..... PALETONIDISTUS.
ww. Eyes coarsely faceted.
y. Femora dentate......... .... TERPOROPUS.
yy. Femora edentate.
z. Femora not grooved....... ..... ROPTOPERUS.
zz. Femora grooved.
a. Scape inserted nearer apex than base of rostrum......... CAIRNSICIS.
aa. Scape inserted nearer base than apex.................... ECILDAUS.

GG. Head convex, forehead not sinuous.
H. Eyes finely faceted.
b. Femora grooved.
c. Metasternal episterna traceable throughout... TRAGOPUS.
cc. Episterna not so traceable.. .... IMALIODES (in part).
bb. Femora not grooved.
d. Hind femora passing elytra............... GLYPTOPOROPTERUS.
dd. Hind femora not passing elytra......... NEODECILAUS.
HH. Eyes coarsely faceted.
I. Suture between two basal segments of abdomen more or less indistinct.
e. Hind femora not passing elytra........... NICONOTUS.
ee. Hind femora passing elytra.
f. Eyes small.. TENTEGIA.
ff. Eyes large...................................... SALCUS.
J. Femora not grooved.
g. Hind femora passing elytra............ ANCHITHYRUS.
gg. Hind femora not passing elytra....... MICROCRYPTORHYNCHUS.
II. Suture between two basal segments of abdomen distinct throughout.
JJ. Femora grooved.
K. Metasternal episterna traceable throughout.
h. Femora dentate........................ HOPLODECILAUS.
hh. Femora edentate...................... ZENOPOROPTERUS.
KK. Metasternal episterna not traceable throughout.
L. Base of prothorax truncate...... .. GYMNOPOROPTERUS.
LL. Base bisinuate........................ IMALIODES (in part).

Genus NEODECILAUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.81.

NEODECILAUS PICUS Lea, *l.c.*

Hab.—Queensland.

NEODECILAUS GRATUS Lea, *l.c.*, p.82.

Hab.—Queensland.

Genus CEDILAUS Lea, *l.c.*, p.83.

CEDILAUS AMBIGUUS Lea, *l.c.*, p.84.

Hab.—New South Wales.

Genus Hoplodecilaus Lea, *l.c.*

Hoplodecilaus marmoratus Lea, *l.c.*, p.85.

Hab.—West Australia.

Genus Imaliodes Pascoe, Trans. Ent. Soc. Lond., 1870, p.410.

Head large and partially concealed. Eyes with facets of variable size. Rostrum moderately long. Scape shorter than funicle; club ovate, subcontinuous with funicle. *Prothorax* moderately or not at all transverse. *Scutellum* absent.* Elytra ovate, wider than prothorax, shoulders distinctly or not at all produced. *Mesosternal receptacle* strongly raised, basal portion large; cavernous. Metasternum very short; episterna not traceable. *Abdomen* moderately large, all the sutures very distinct. *Legs* of variable length; femora thick or rather thin, grooved and dentate or not; tibiæ short. Elliptic-ovate, strongly convex, squamose, feebly or not at all tuberculate, apterous.

This genus is rather closely allied to *Poropterus,* and, like that genus, is variable in a number of features that are usually constant amongst congeners; the grooved femora will at once distinguish it from *Poropterus.* I venture to unite *Drassicus* with *Imaliodes,* as the character of the shoulders relied on by Mr. Pascoe, appears to be of only specific importance.

Femora edentate.
  First joint of funicle longer than second.......................... *edentatus.*
  Vice versa...... .... *frater.*
Femora dentate.
  Eyes coarsely faceted.
    Shoulders distinctly projecting.................................. *terreus.*
    Shoulders feebly projecting; legs short .... *subfasciatus.*
    Shoulders not projecting; legs long .... *ovipennis.*
  Eyes finely faceted.
    Elytra nodulose.. *scitulus.*
    Elytra spotted .... *nigricornis.*

Imaliodes subfasciatus Pasc.; Mast. Cat., Sp.No.5452.

Not very densely clothed with brown scales, rather longer on prothorax and legs than elsewhere.

* *I. nodulosus* is said to have a scutellum.

Head not very coarsely but somewhat rugosely punctate. Rostrum shining; moderately densely punctate at base and apex, sparsely elsewhere. *Prothorax* strongly contracted near apex. Elytra widest at about middle; seriate-punctate, punctures large, subquadrate and rather deep. *Femora* very stout, indistinctly dentate. Length, 7 mm.

Hab.—New South Wales: Illawarra, Burrawang.

Mr. Pascoe described and figured this species as having a feeble postmedian fascia; of two specimens before me, one has such a fascia, but, on the other, it is not at all traceable.

IMALIODES TERREUS, Pasc.; *l.c.* No.5453.

♂. Densely clothed with muddy-brown scales, usually small and depressed, but mixed with stouter and longer ones, and very dense on under surface and legs.

Eyes rather coarsely faceted. Rostrum stout; coarsely punctate at base and apex. Antennæ stout; second joint of funicle considerably longer than first. *Prothorax* scarcely transverse. *Elytra* widest just behind base, shoulders tuberculate and projecting, just behind base on each side a feeble tubercle, which is connected with each shoulder by an oblique ridge; seriate-punctate, punctures large, not very close together. *Femora* very stout, indistinctly dentate. Length, 7 mm.

Hab.—Queensland: Wide Bay.—New South Wales: Clarence River.

IMALIODES NIGRICORNIS Pasc.; *l.c.* No.5529.

Drassicus nigricornis Pasc.

♂. Densely clothed with muddy-brown scales, becoming much paler on under-parts; upper surface with four transverse series of small whitish spots; one on middle of prothorax, one at basal third of elytra, one beyond middle, and one near apex.

Eyes finely faceted. Rostrum with punctures concealed except at apical fifth. Antennæ inserted at apical third of rostrum. *Prothorax* feebly transverse. *Elytra* ovate-cordate; with series of large, subquadrate, partially concealed punctures. *Femora* rather stout. Length, 5½-7 mm.

♀. Differs in having the rostrum rather less, but still, coarsely punctate, the sculpture less hidden by clothing, and the antennal insertion more distant from apex.

Hab.—Queensland.—New South Wales: Tweed and Richmond Rivers.

The small whitish spots are sometimes traceable with difficulty, or are even entirely absent; sometimes two small spots are present on the head; the subbasal series on the elytra consists of three spots on each side; the postmedian series is bisinuate, and consists of about ten spots.

IMALIODES SCROFA Pasc.; *l.c.* No.5451.

Hab.—West Australia.

IMALIODES NODULOSUS Pasc.; *l.c.* No.5450.

Hab.—Queensland.

IMALIODES ILLOTUS Pasc.; *l.c.* No.5527.
Drassicus illotus Pasc.

Hab.—Queensland.

IMALIODES INFAUSTUS Pasc.; *l.c.* No.5528.
Drassicus infaustus Pasc.

Hab.—Queensland.

IMALIODES EDENTULUS Lea, Deutsch. Ent. Zeitschr., 1910, p.523.

Hab.—Queensland.

IMALIODES OVIPENNIS Lea, Trans. Roy. Soc. S. Aust., 1912, p.86.

Hab.—Queensland.

IMALIODES FRATER Lea, *l.c.* p.87.

Hab.—Queensland.

IMALIODES SCITULUS Lea, *l.c.* p.86.

Hab.—New South Wales.

Genus ANCHITHYRUS Pascoe, Ann. Mus. Civ. Gen. (2), ii., 1885, p.257.

Head partially visible from above. Eyes rather small, coarsely or moderately coarsely faceted. Rostrum of moderate length.

Scape inserted nearer base than apex of rostrum, much shorter than funicle. *Prothorax* convex, transverse, sides strongly rounded. *Scutellum* absent. *Elytra* subcordate, strongly convex. *Mesosternal receptacle* strongly raised in front, sides more or less incurved, emargination semicircular; cavernous. Metasternum much shorter than following segment; episterna indistinct. *Abdomen* rather small, sutures distinct. *Femora* very long, neither grooved nor dentate, hind ones passing elytra; tibiæ straight or almost straight. Subelliptic, convex, squamose, apterous.

The above diagnosis has been drawn up from three Australian species. The original diagnosis is somewhat faulty, and on it alone they would not have been referred to the genus. But as Dr. Heller figures* a species (*A. laticollis*) remarkably close in general appearance, and undoubtedly congeneric with *A. muticus,* it was considered advisable to place them provisionally in *Anchithyrus.* Dr. Heller's figure will give a very good idea of *A. muticus,* but the following remarks in his description do not apply to that species: "rostro . . . carina mediana vix perspicua; prothorace . . . elytris latioribus; elytris . . . pone medium fascia nebulosa transversa; femoribus granulatis."

Prothorax and elytra with regular and very distinct shining granules .... *muticus.*
Elytra with small clusters of granules on the interstices........ *caliginosus.*
Without granules........ *reticulatus.*

ANCHITHYRUS MUTICUS Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.174.

Hab.—New South Wales, Queensland.

ANCHITHYRUS CALIGINOSUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.88.

Hab.—Queensland.

ANCHITHYRUS RETICULATUS Lea, *l.c.*

Hab.—Queensland.

---

* Abh. Mus. Dresd., 1900, p.41, fig.19.

Genus SCOLYPHRUS Pascoe, Ann. Mag. Nat. Hist., xiii., 1874, p.413.

Head small. Eyes moderately faceted. *Prothorax* flat or almost so. *Scutellum* absent. *Elytra* subovate, base trisinuate. *Mesosternal receptacle* thick, feebly raised, cavernous. Metasternum narrow, episterna rather wide, but narrow in middle, inner projection almost absent. *Abdomen* large; two basal segments very large, suture distinct only at sides, but traceable across middle. *Legs* rather long and not very thin; femora edentate, feebly grooved; tarsi thin, third joint no wider than second. Apterous.

In *S. obesus,* the eyes are rather finely, in *S. semipunctatus* rather coarsely faceted. The narrow tarsi will suffice to distinguish the genus from most of the allies of *Poropterus;* from that genus it may be distinguished by the soldering together of the two basal segments of abdomen. Both species appear to be rare; they are dull black, the antennæ only being feebly diluted with red.

Prothorax as long as wide .... *obesus.*
Prothorax transverse .... *semipunctatus.*

SCOLYPHRUS OBESUS Pasc.; Mast. Cat., Sp.No.5448.

Rather sparsely clothed with stout scales, forming feeble clusters on prothorax and elytra.

Rostrum with a moderately distinct median carina; with moderately large but irregular and shallow punctures. *Prothorax* somewhat angular, as long as wide; disc without, the sides with, shallow punctures. *Elytra* ovate, much wider than prothorax, basal third or fourth with large punctures of which the largest are basal, and the next largest sutural. Length, 18 mm.

Hab.—Queensland: Port Denison and Bowen.

A large dingy insect with peculiar elytral punctures, and with the prothorax shaped as in many of the species belonging to *Paleticus.*

SCOLYPHRUS SEMIPUNCTATUS, n.sp.

Moderately densely clothed with scales of a dingy brown, but uniform shade; upper surface with stout scales scattered about, and one in each puncture.

Rostrum with two grooves on each side above scrobes, and all of which are continued to between antennæ, and leave three carinæ, the middle one of these is shining; apical half shining, and very finely punctate. Scape thickened at apex, the length of funicle; funicle with the second joint distinctly longer than the first. *Prothorax* distinctly transverse, feebly convex, sides almost equally rounded, apex not much narrower than base; sides with a few, the disc without punctures. *Elytra* ovate, not much wider than prothorax, widest near base; basal half with transverse rows of large punctures, all (except a few of the basal and apical rows, that are smaller), being of equal size and at equal distances; a shining granule on each side of the scutellar region. Posterior femora extending almost to apex of abdomen. Length, 7 mm.

Hab.—New South Wales: Richmond River.—Queensland: Mount Tambourine.

The claws are long and very sharp. The punctures of the elytra are reminiscent of those of many of the *Cleridae.*

PACHYPOROPTERUS, n.g.

Head rather large. Eyes finely faceted. Rostrum moderately long and curved. Antennæ rather thin; scape inserted nearer apex than base of rostrum, the length of funicle; two basal joints of the latter elongate; club ovate, subcontinuous with funicle. *Prothorax* transversely subglobular. *Scutellum* absent. *Elytra* ovate, shoulders rounded. *Mesosternal receptacle* feebly raised, walls almost equal throughout, emargination almost V-shaped, cavernous. Metasternum short, episterna distinct throughout. *Abdomen* large, sutures distinct. *Legs* moderately long; femora not very stout, neither grooved nor dentate. Elliptic-ovate, convex, squamose, fasciculate, apterous.

This genus is proposed for the *Poropterus satyrus* of Pascoe. It is distinguished from *Poropterus* by the distinct, although narrow, metasternal episterna; from *Platyporopterus* to which it is closer, by the episterna, distinct abdominal sutures, and by the femora.

PACHYPOROPTERUS SATYRUS Pasc.; Mast. Cat., Sp.No.5439.
Poropterus satyrus Pasc.

♂. Black, antennæ and apical joints of tarsi of a dingy red. Densely clothed with small, pale, fawn-coloured, overlapping scales, in places variegated with darker ones, those on the elytra form feeble velvety patches; with scattered longer scales, that form four feeble fascicles on prothorax, and are seriately arranged on elytra.

Head with dense but comparatively small punctures; usually with a feeble irregular median carina. Rostrum the length of prothorax, moderately densely and regularly, but not very coarsely punctate; with a very feeble median carina, or impunctate line. Prothorax with strongly rounded sides; with small, normally concealed punctures; across middle several very feeble tubercular elevations. *Elytra* ovate, considerably wider than prothorax; with a feeble but distinct subhumeral projection; seriate-punctate, punctures normally concealed, comparatively small and distant, becoming very small posteriorly; generally with a few feeble granules in scutellar region. Length, 12-18 mm.

♀. Differs in being larger and wider, rostrum with smaller and sparser punctures, and without the median impunctate line. The base of the elytra is also less distinctly trisinuate.

Hab.—Tasmania; widely distributed, but rather rare.

The clothing has been described from a specimen in perfect condition; on many specimens it is of a dingy muddy-brown; the velvety patches on the elytra are frequently not traceable, and are never constant in disposition. The prothoracic fascicles are often abraded. On an occasional specimen the elytra are feebly fasciculate.

Genus POROPTERELLUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.89.

POROPTERELLUS INTERCOXALIS Lea, *l.c.* p.90.

Hab.—Queensland.

Genus GLYPTOPOROPTERUS Lea, *l.c.*, p.90.

GLYPTOPOROPTERUS ASPER Lea, *l.c.* p.91.

Hab.—New South Wales.

Genus ILLIDGEA Lea, *l.c.* p.92.

ILLIDGEA 16-TUBERCULATA Lea, *l.c.*, p.93

Hab.—Queensland and New South Wales.

Genus OMYDAUS Pascoe, Journ. Linn. Soc., 1871, p.198.

Head moderately large. Eyes ovate, finely or moderately faceted. Rostrum moderately long and rather thin. Scape the length of or slightly shorter than funicle. *Prothorax* slightly transverse,* base bisinuate. *Scutellum* small. *Elytra* not much wider than and about twice the length of prothorax, base trisinuate, shoulders produced. *Mesosternal receptacle* raised in front, as long as wide, sides incurved to base; cavernous. *Metasternal episterna* distinct throughout. *Abdomen* rather large, sutures deep and straight. *Legs* rather short and stout; femora stout, the front ones acutely, the others feebly dentate. Subelliptic, squamose, non-tuberculate, apterous.

Apparently allied to *Methidrysis*, but the head not foveate, and the antennæ very different, and it is probably allied to *Poropterus,* although (as pointed out by Mr. Pascoe), the metathoracic episterna are distinct. The colour of all the species is an opaque black, with the antennæ, and claw-joints dingy red; they all have a distinct median prothoracic carina, and usually the head is carinate; the clothing appears to be easily abraded.

Abdomen with second segment decidedly elevated above third.
  Posterior angles of prothorax produced. .... *subfasciculatus.*
  Posterior angles almost rectangular....... .... *contractus.*
Abdominal segments level.
  Prothorax longer than wide................................. *impressicollis.*
  Prothorax transverse.
    Alternate interstices of elytra elevated .... *fuliginosus.*
    Alternate interstices scarcely visibly elevated.
      Large punctures of elytra clearly defined............ *oblongopunctatus.*
      Large punctures of elytra more or less confluent... *confusus.*

OMYDAUS FULIGINOSUS Boisd.; Mast. Cat., Sp.No.5472.

Cryptorhynchus fuliginosus Boisd.; *Acalles immansuetus* Boh.; *Omydaus plinthoides* Pasc.

Rather sparsely clothed with stout ochreous and sooty scales, each (except some on elytra) set in a puncture.

* In *O. impressicollis*, it is slightly longer than wide.

Head coarsely punctate; with a distinct median carina; eyes finely faceted. Rostrum slightly inflated between base and antennæ; coarsely punctate. *Prothorax* moderately convex; with a distinct median carina; with dense, large, round, and rather shallow punctures. *Elytra* elongate-subcordate, with series of large, deep, oblong punctures, becoming smaller and more rounded towards sides and disappearing posteriorly; interstices punctate, behind each puncture subgranulate, third and fifth moderately but distinctly (the seventh less noticeably) raised. *Tibiæ* feebly striated, the front pair rather strongly bisinuate beneath, subapical tooth indistinct. Length, 8¾-10 mm.

Hab.—New South Wales: Illawarra.

Each of the punctures on the interstices appears to have been impressed, so that a small posterior portion is raised, these portions are sometimes polished, so that the elytra appear subgranulate.

Cryptorhynchus fuliginosus Boisd., is placed in Master's Catalogue as a synonym of *Rhynchænus luridus* Fabr., as is also *Acalles immansuetus* Bohem. Dr. Boisduval's description is insufficient for the identification of *C. fuliginosus,* but fortunately the type is still extant. M. Lesne recently examined it, and sent some notes and sketches of it that have been reproduced in these Proceedings.* From these, it can be confidently identified as *O. plinthoides.* It is also *A. immansuetus,* but whether *Rhynchænus luridus* or not seems doubtful.† It can scarcely, however, be the *A. luridus* known to Mr. Pascoe, as he states‡ that that species belongs to *Poropterus.*

OMYDAUS SUBFASCICULATUS Lea, Trans. Roy. Soc. S. Aust, 1912, p.94.

Hab.—New South Wales.

OMYDAUS CONTRACTUS Lea, *l.c.*

Hab.—New South Wales.

* For 1900, pp.538 and 540, Pl. xxx., figs.5-7.

† I have not seen M. Olivier's description and figure.

‡ Ann. Mag. Nat. Hist., June, 1874, p.415.

OMYDAUS IMPRESSICOLLIS Lea, *l.c.*, p.95.

Hab.—New South Wales.

OMYDAUS CONFUSUS Lea, *l.c.*, p.96.

Hab.—New South Wales.

OMYDAUS OBLONGOPUNCTATUS Lea, Mitt. Zool. Mus. Berlin, 1911, p.199.

Hab.—New South Wales.

Genus PSEUDOMYDAUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.96.

PSEUDOMYDAUS TENUIS Lea, *l.c.*

Hab.—New South Wales.

Genus POROPTERINUS Lea, *l.c.*, p.98.

POROPTERINUS TRILOBUS Lea, *l.c.*

Hab.—New South Wales.

Genus POROPTERCULUS Lea, *l.c.*, p.99.

POROPTERCULUS SUBNITIDUS Lea, *l.c.*, p.100.

Hab.—West Australia.

Genus PTEROPOROPTERUS Lea, *l.c.*

PTEROPOROPTERUS LACUNOSUS Lea, *l.c.*, p.101.

Hab.—Queensland.

Genus TRAGOPUS Schönh., Gen. et Spec. Curc., iv., Pt.1,p.356, Genus No.335.

Head rather large. *Eyes* very finely faceted. *Rostrum* moderately long and wide, almost straight. *Scape* inserted nearer apex than base of rostrum; two basal joints of the latter elongate. *Prothorax* subconical. *Scutellum* absent. *Elytra* oblong-ovate, strongly convex. *Mesosternal receptacle* strongly elevated, each side strongly produced in front; cavernous. *Metasternal episterna* very narrow. *Abdomen* moderately large, sutures distinct. *Legs* very long and thin; femora grooved and dentate. Elliptic, subcylindrical, nontuberculate, winged.

I am not acquainted with the typical form of this genus, or with any other, except the one described below, and which agrees with Schönherr's diagnosis. The sides of the mesosternal receptacle are pointed, and produced to beyond the middle of the front coxæ, these being slightly depressed to allow of their passage; in the majority of the genera, these points (when present), usually touch the hind margin of the coxæ. The wings are much too small to be of any use in flight; they are, however, of the typical weevil-form, and with all the parts perfect. A similar case of minute and useless, although perfectly formed, wings, may be seen in the Tasmanian *Prostomus scutellaris.*

TRAGOPUS PLAGIATUS Pasc.; Mast. Cat., Sp.No.5461.

Sparsely clothed with small greyish or whitish scales, giving the derm a dingy appearance, and condensed on the sides of the elytra into two feeble oblique stripes, one at basal third, and one at apical third.

Head with neither large nor dense punctures. *Prothorax* with small and indistinct punctures. *Elytra* scarcely wider than prothorax, parallel-sided to near apex; with series of rather large but shallow punctures; three sutural interstices on each side, from near base to beyond the middle, with small, feebly shining, transverse ridges or granules. *Legs* very long. Length, 14 mm.

Hab.—Queensland: Wide Bay, Cairns.

The elytral markings (especially the hind one) are usually feebly defined, and the scales are dense only at sides of abdomen. Even the claws are black. The hind femora just perceptibly pass the apex of the elytra in the ♂, and are level with it in the ♀.

TRAGOPUS TUBEROSUS Bohem.; *l.c.*, No.5462.

I have not seen this species; as it is described as having a scutellum and stout femora, it is probably not congeneric with the preceding one.

Genus NICONOTUS Pascoe, Trans. Ent. Soc. Lond., 1870, p.468.

Head feebly convex. *Eyes* coarsely faceted. *Rostrum* moderately long. *Scape* inserted much closer to apex than base of rostrum; funicle thin; club elongate-ovate. *Prothorax* transverse, base strongly bisinuate. *Scutellum* apparently absent. *Elytra* subovate, not much wider than prothorax. *Mesosternal receptacle* feebly raised, base wider than sides, cavernous. *Metasternal episterna* narrow but traceable throughout. *Abdomen* rather large, suture between first and second segments deep on the sides, but curved and rather feeble across middle. *Femora* not very stout, grooved, dentate or not; tarsi slender, shining and almost glabrous above. Short, suboblong, convex, squamose, punctate, tuberculate, apterous. Allied, but not very closely so, to *Paleticus*.

Femora dentate.. *tarphioides*.
Femora edentate .... *stenotarsus*.

NICONOTUS TARPHIOIDES Pasc.; Mast. Cat., Sp.No.5490.

♂. Black, antennæ and tarsi red. Densely clothed with roundish, light brown scales, which almost entirely conceal the derm; prothorax with stouter and darker scales scattered about, and forming six fascicles, four across middle and two at apex; elytra with fascicles on the alternate interstices, but especially on the third and fifth, largest on third near base.

Head with dense punctures, which are concealed, except on vertex. Rostrum coarsely punctate, with four grooves and three ridges behind antennæ. *Prothorax* rather strongly transverse. *Elytra* subcordate, sides from basal fifth to apical third almost parallel; alternate interstices elevated, and in places subtuberculate; with series of large punctures, not very close together, and each containing a scale. *Femora* moderately (the posterior feebly) dentate. Length, 8 mm.

♀. Differs in having the rostrum longer, without grooves or ridges, apical two-thirds polished and slightly punctate, and the antennæ inserted not quite so close to the apex.

Hab.—Queensland: Moreton Bay.—N. S. Wales: Tweed River.

NICONOTUS STENOTARSUS, n.sp.

♂. Black, antennæ (club infuscate) and tarsi red. Very densely clothed with scales of an uniform shade of brown, but varying from round and depressed to elongate and suberect, on the rostrum continued to antennæ; prothorax feebly fasciculate, elytra with elongate scales crowning the tubercles and rather thickly distributed on the sides.

Head with punctures concealed, except on extreme vertex. Rostrum in front of antennæ coarsely punctate and subopaque, behind them with the sculpture concealed. *Prothorax* slightly transverse, apex and sides rounded; with rather large and sparse punctures, which are more or less concealed. *Elytra* subcordate, sides rounded; each with two large and long tubercles on the third interstice, one at basal third, and one (the larger) terminating at summit of posterior declivity; with series of large, distant punctures on foveæ, and each of which contains a scale. *Femora* shallowly grooved and edentate. Length, 7 mm.

Hab.—New South Wales: Richmond River.—Queensland: Mount Tambourine.

The four, large, elytral tubercles render this a remarkably distinct species; the tarsi are considerably thinner than in the preceding species, and the outlines of the prothorax and elytra are more rounded.

Genus SALCUS Pascoe, Journ. Linn. Soc., 1869, p.447.

Head very small. *Eyes* large, moderately coarsely faceted. *Rostrum* long and rather thin. *Antennæ* rather long. *Prothorax* widely transverse, base truncate, and much wider than apex. *Scutellum* absent. *Elytra* closely applied to, and with an outline continuous with, that of prothorax. *Mesosternal receptacle* feebly raised, cavernous. *Metasternal episterna* (except for the triangular inner projection) entirely concealed. *Abdomen* moderately large; suture between two basal segments feebly traceable across middle, intercoxal process very wide (wider than fourth). *Legs* long; femora sublinear, grooved, dentate or not. Elliptic or briefly ovate, strongly or moderately convex, squamose, non-tuberculate, apterous.

This genus is remarkable for the small head, close application of the prothorax and elytra, and very wide intercoxal process. The species described below are certainly congeners, but differ to a remarkable extent in shape, and in the femora. Mr. Pascoe described the three intermediate segments of the abdomen as being subequal, but, in this, he was certainly wrong, the second segment being, in reality, as long as the third and fourth combined, as may be distinctly seen in *S. latissimus*; but, in *S. elevatus*, it is excavated along the middle, leaving the posterior half of the same shape and appearance as the two following ones, so that, on a cursory examination, the three segments really do appear to be equal in length.

In Australia, the genus is confined to Queensland, but several species occur in New Guinea and the Malay Archipelago.

Femora dentate, elytra without epipleural fold.......... *elevatus*.
Femora edentate, elytra with epipleural fold............ *latissimus*.

SALCUS ELEVATUS Pasc.; Mast. Cat., Sp.No.5495.

Upper surface with moderately long greyish scales, not very densely distributed, and giving the surface a very dingy appearance.

Elliptic, strongly convex. *Head* sparsely punctate. Rostrum very feebly incurved to middle; feebly (subseriately behind antennæ) punctate, and without scales, except at extreme base and sides. *Prothorax* not twice as long as wide, with scattered punctures, each of which contains, and is entirely concealed by, a scale. *Elytra* about once and one-third as long as wide; seriate-punctate, punctures never very close together, small about suture, but becoming very large towards sides. Basal segment of *abdomen* coarsely and irregularly punctate; second oblique, across its middle deeply excavated so that (except at sides) it appears to be divided into two parts. *Femora* distinctly grooved, dentate, teeth of front pair small, of the four hind ones very small. Length, 5½-8 mm.

Hab.—Queensland: Port Bowen, Cairns, Barron Falls, Barnard Island.

The elytra are strongly convex and without trace of an epipleural fold.

A specimen from Cooktown is almost entirely abraded on the upper surface. It appears to be rather wider than the specimens above described, and has the prothorax distinctly punctate, the elytra with larger punctures, and the head more coarsely punctate. It agrees exactly with Mr. Pascoe's description of *S. globosus*, except as to the clothing (but this, as stated above, is certainly abraded); but it possesses femoral teeth, which are not mentioned by him, although possibly overlooked on account of their small size.

SALCUS LATISSIMUS Pasc.; *l.c.*, No.5497.

Upper surface densely clothed with fine silken setæ or pubescence, becoming squamose on sides and under parts; very dense and pale on flanks of mesosternum, and on apical segments of abdomen.

Briefly ovate, moderately convex. *Head* densely and coarsely punctate. Rostrum long; densely and coarsely punctate throughout, but especially behind antennæ, where also several very feeble carinæ may be traced. *Prothorax* more than twice as wide as long, strongly rounded on each side in front, impunctate. *Elytra* wider than long (7 x 6½ mm.), widest about middle; seriate, towards sides striate-punctate, punctures of moderate size but more or less concealed; interstices wide, the sixth and seventh decidedly curved beyond the middle. Basal segment of *abdomen* with rather small punctures, except for some coarse ones in a strong basal impression; second oblique, moderately depressed (scarcely excavate) and rather coarsely punctate across middle. *Femora* very feebly grooved, edentate. Length, 8; width, 7 mm.

Hab.—Queensland : Port Bowen, Mount Dryander.

The shape of this species is very suggestive of *Hybomorphus*; the epipleural fold is, however, rounded, and not abruptly inwardly oblique as in that genus. Mr. Pascoe described the length as varying from 3½ to 4¾ lines. He states that "the first abdominal suture is not traceable, or rather is replaced by a large, deep, irregular impression," evidently having mistaken the impression on the intercoxal process for the suture.

Three specimens, from Cairns, differ in being smaller (6½ mm.), the elytra more suddenly dilated about the middle, and with stronger punctures.

SALCUS GLOBOSUS Pasc.; *l.c.*, No.5496.

I have not been able to identify this species positively, but I think it quite possible that it has been redescribed by Mr. Pascoe as *S. elevatus.*

Hab. - Queensland.

Genus TENTEGIA Pascoe, Ann. Mag. Nat. Hist., xii., 1873, p.283.

Head rather small. *Eyes* small, coarsely faceted. *Rostrum* moderately short, and stout. *Antennæ* rather stout. *Prothorax* large, transverse, base almost truncate, apex narrowly produced and subtubular. *Scutellum* absent. *Elytra* wide and short, widest and usually suddenly dilated immediately behind shoulders. *Mesosternal receptacle* flat, feebly raised; slightly or moderately cavernous. *Metasternal episterna* not traceable. *Abdomen* with the basal segment large; second about half the size of first, its suture with it distinct and deep at sides, not at all or feebly traceable across middle; three apical segments depressed, strongly narrowed by elytra. *Legs* long; femora feebly grooved, dentate or not; tarsi narrow, third joint moderately or not at all bilobed, the width of, or slightly wider than, second. Briefly subovate, moderately convex, punctate, granulate, setose, feebly squamose, apterous.

I have six species under examination, but unfortunately not one of them is *T. favosa.* I believe that they belong to *Tentegia*, although the eyes in all are ovate (not "rotundatus"). In all of them the third tarsal joint is the width of (or slightly wider than) the second, but it is not usually simple. The intercoxal process is so wide that the hind coxæ are forced out almost to the elytra. The genus is remarkable for its short broad form, wide intercoxal process of abdomen, dentition of femora, curved femora and tibiæ, and thin tarsi; the prothorax and elytra, at their bases, leave a space (invisible from above) in which the two front femora can rest; the hind ones are curved so as to embrace the elytra posteriorly, but are distinctly continued beyond the apex. Its nearest ally is probably *Salcus.*

Although, to my knowledge, I have not seen *Acalles bisignatus*, I refer it to *Tentegia* without hesitation.

Elytral interstices without granules.............................. *tortipes*.
Elytra granulate.
  Hind femora distinctly and acutely dentate .... *ingrata*.
  Hind femora edentate or almost so.
    Abdomen with but one complete row of foveæ on second segment.. *anopla*.
    Abdomen with two complete rows on second segment.
      Prothorax with four small spots of white scales. .. . *quadrisignata*.
      Prothorax without spots.
        Rostrum with longitudinal elevated ridges........... *Spenceri*.
        Rostrum without elevated ridges .. .. *quadriseriata*.

TENTEGIA INGRATA Faust, Stett. Ent. Zeit., 1892, p.182.

Each puncture with a single short seta; prothorax with four small patches (not always traceable) of smaller and whitish setæ transversely placed.

Head with large, shallow, round punctures. Rostrum feebly curved, stout; behind antennæ with three moderately distinct and slightly raised carinæ; the interspaces with punctures somewhat similar to those on head, but irregular in size, and not in four regular rows; in middle, slightly behind antennæ, considerably larger than elsewhere. *Prothorax* with dense, shallow and clearly defined honeycomb-like punctures, the sides of which are thickened so as to appear like small (and almost shining) irregular spaces; with four shallow foveæ across middle. *Elytra* wider than prothorax, and apparently wider than long;* with a rather large and granulate tuberculiform process behind each shoulder; with series of comparatively small and distant punctures, the interstices irregularly and feebly raised (the alternate ones at base more noticeably so) and transversely irregular, with small shining granules. *Under surface* with large, shallow punctures, much larger (and forming two transverse rows) on second abdominal segment than elsewhere. *Femora* subserrate below, pos-

* An oblique sutural line, from base to apex of elytra, measures $7\frac{3}{4}$ mm., or exactly the same as the greatest width, but, at the sides, the extreme length is but $6\frac{1}{2}$ mm.

terior curved, the four posterior strongly and acutely dentate, the anterior feebly. Length, 10½ mm.

Hab.—Queensland: Endeavour River.

I cannot quite follow Herr Faust in regarding the third tarsal joint as entire.

TENTEGIA SPENCERI Blackb., Horn Exped. to Cent. Aust., Pt. ii., Zool., 1896, p.298.

Each puncture with a single, short seta, each granule on elytra also with one; the elytra, in addition, with small and obscure greyish scales.

Head with large, round, shallow punctures. Rostrum with smaller punctures than on head, and more irregular, but bearing three distinct carinæ in middle, and a somewhat curved one on each side, which posteriorly curves round so as to margin the eye. *Prothorax* with dense, large, round, shallow, honeycomb-like and almost regular punctures. *Elytra* not much wider than prothorax, base feebly sinuous; behind each shoulder, a granulate and feebly tuberculiform process; with regular series of large, round punctures on foveæ, becoming larger and deeper at sides; interstices with almost perfectly regular series of comparatively large granules, the alternate ones scarcely visibly raised at base. Two basal segments of *abdomen* densely foveate, the foveæ of the second not in two regular rows. Front *femora* with a small subapical node, but scarcely dentate, the others feebly dentate but the teeth invisible from most directions. Length, 7½ mm.

Hab.—Central Australia: Illamurta, Rudall's Creek.—N. W. Australia.

The specimen described is a cotype. Another, from the northwest, has the elytra rather densely clothed with muddy-brown, stout setæ, and dingy, whitish, setose scales. The subapical lower tooth of the front tibiæ is rather longer than usual, and, in conjunction with the terminal hook, causes them to appear semicircularly emarginate.

TENTEGIA PARVA Blackb., *l.c.*, p.299.

This species is noted as having an acute tooth on each side of the femora (but less distinct on the hind pair), the elytra scarcely callose below the shoulders, and the interstices "tuberculato-rugulosis." It should be very distinct.

Hab.—Central Australia.

TENTEGIA FAVOSA Pasc.; Mast. Cat., Sp.No.5479.

This, the typical species, is unknown to workers outside of the British Museum. It is one of the smallest species in the genus, and is apparently allied to *T. Spenceri*, but differs in being smaller, and by having "elytris . . . . interstitiis grosse tuberculatis, tuberculis setuligeris."

Hab.—West Australia.

TENTEGIA BISIGNATA Pasc.; *l.c.*, No.5464.
Acalles bisignatus Pasc.

This species is certainly congeneric with *T. ingrata* and *T. quadrisignata* (neither of which has the rostral punctures or foveæ in four distinct rows) if not actually conspecific with one of them. It was with considerable hesitation, therefore, that the latter was described as new; but as Pascoe made no mention of elytral clothing, and stated that the prothorax had but two spots, I ventured to do so. Faust did not mention prothoracic spots in *T. ingrata*, but these are less distinct than in *T. quadrisignata*, and sometimes cannot be traced.

Hab.—Queensland.

TENTEGIA SANA Faust, Stett. Ent. Zeit., 1892, p.181.

This appears to be a small (5 mm.), densely setose species, the prothorax with a waved median carina, and the elytra with conical granules.

Hab.—Queensland.

TENTEGIA BASALIS Faust, *l.c.*, p.181.

This species appears to be close to *T. anopla* and *T. quadriseriata*; from the former, it should be distinguished by the second and fourth interstices supplied with granulate tubercles at the base, and by its dentate femora; and from the latter, by having a depressed median line on the prothorax instead of a waved carina.

Hab.—Queensland.

TENTEGIA QUADRISIGNATA Lea, Deutsch. Ent. Zeit., 1910, p.520.

Hab.—New South Wales; Queensland.

TENTEGIA ANOPLA Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.173.

Hab.—New South Wales.

TENTEGIA QUADRISERIATA Lea, Trans. Roy. Soc. S. Aust., 1912, p.102.

Hab. Queensland.

TENTEGIA TORTIPES Lea, *l.c.*

Hab.—Northern Territory of Australia.

Genus ANILAUS Pascoe, Trans. Ent. Soc. Lond., 1870, p.477.

Head of moderate size. *Eyes* ovate, coarsely faceted. *Rostrum* rather long. *Scape* slightly shorter than funicle. *Prothorax* strongly transverse, apex very suddenly narrowed. *Scutellum* small and transverse. *Elytra* not much wider than prothorax. *Mesosternal receptacle* almost flat, cavernous. *Metasternum* very short, episterna not traceable. *Abdomen* large, sutures distinct; two basal segments large. *Femora* comparatively thin, grooved and dentate, teeth of the front pair very large, triangular, and acute. Widely oblong, elliptic, flattened, squamose, apterous.

The affinities of this genus are not very obvious. Mr. Pascoe regarded it as belonging to the *Chætectetorus*-group (although aberrant). I prefer to regard it as belonging to the *Poropterus*-group; its nearest ally appears to be *Tentegia*. It is to be noted that, whilst Mr. Pascoe says, "The eye is less coarsely faceted than in some of the allied genera," he, nevertheless, tabulates it amongst those having "Eyes coarsely faceted."

Alternate interstices of elytra raised........................ *sordidus.*
Interstices regular.... .... *costirostris.*

ANILAUS SORDIDUS Pasc.; Mast. Cat., Sp.No.5525,

Very densely clothed with muddy-grey scales; with stout, subspathulate scales interspersed rather thickly, especially on prothorax and alternate interstices of elytra.

Rostrum rather coarsely punctate in front of antennæ; behind them the sculpture (except for a median carina) concealed. *Pro-*

thorax evidently coarsely punctate, but the punctures entirely concealed; with a narrow, shining, median carina. *Elytra* not much longer than wide; with series of large concealed punctures; third and fifth interstices strongly raised, and becoming subtuberculate at summit of posterior declivity. Length, 4 mm.

Hab.—Queensland : Wide Bay, Gayndah.

Mr. Pascoe describes the prothorax as being "in medio transversim subtrigibboso." In the specimens under examination, there is a very feeble tubercular elevation on each side of the middle; and a few scales, across the median carina, cause an appearance as of another feeble elevation.

ANILAUS COSTIROSTRIS Lea, Trans. Roy. Soc. S. Aust., 1912, p.103.

Hab.—Queensland.

Genus MYRTESIS Pascoe, Journ. of Ent., ii., 1865, p.430.

Head convex. *Eyes* rather coarsely faceted. *Rostrum* very long, thin, and curved. *Antennæ* thin. *Prothorax* transverse, base almost truncate. *Scutellum* very minute or invisible. *Elytra* short, wide, and convex. *Pectoral canal* narrow and deep, terminated at, or on, basal segment of abdomen. *Mesosternal receptacle* slightly raised in front, but very distinctly behind, separating the four hind legs, its apex feebly cavernous. *Metasternum* very short; its episterna not traceable, except the interior inner projection of each; this is large, triangular, and convex. *Abdomen* small. *Legs* long or moderately long; femora distinctly grooved, edentate. Briefly ovate, convex, squamose, tuberculate, apterous.

An unusually distinct genus, rendered so by the very long and thin rostrum, which causes the pectoral canal to terminate at, or on, the abdomen, the receptacle being carried along to receive it when at rest (not forming part of the metasternum and abdomen, although their surface is depressed beneath it), and belonging entirely to the mesosternum. The genus appears to have no close allies, the nearest, perhaps, being *Salcus*.

Pectoral canal extending to apex of first abdominal segment .. .. *nasuta.*
Pectoral canal extending to near middle of first abdominal segment... .... *caligata.*
Pectoral canal terminated at abdomen................................ *pullata.*

MYRTESIS CALIGATA Pasc.; Mast. Cat., Sp.No.5564.

Clothed with muddy-brown, setose scales, denser on legs than elsewhere; each elytron in middle of base with an obscure patch of pale scales; prothorax with four feeble fascicles across middle.

Head densely punctate. Rostrum very long and thin, extending to between base of posterior coxæ; basal half with punctures in almost regular series, apical half with sparser punctures. *Prothorax* with numerous tubercular elevations, most of which are hollow; with a distinct narrow median carina. *Elytra* as wide as long, depressed along suture; with numerous tubercular elevations, each of which is hollow, bears a seta, and has a small polished space behind; with series of large punctures, which are more or less interrupted by the tubercles. *Pectoral canal* extending to middle of basal segment of abdomen. Length, $6\frac{1}{2}$ mm.

Hab.—Queensland.—New South Wales: Richmond River.

Two specimens are under examination, both appearing to be female.

MYRTESIS NASUTA Lea, Trans. Roy. Soc. S. Aust., 1912, p.104.

Hab.—Queensland.

MYRTESIS PULLATA Lea, *l.c.*, p.105.

Hab.—Queensland.

Genus CYCLOPOROPTERUS Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.169.

CYCLOPOROPTERUS MYSTICUS Lea, *l.c.*, p.170.

Hab—West Australia.

Genus TETENGIA Lea, Trans. Roy. Soc. S. Aust., 1912, p 106

TETENGIA SOLENOPA Lea, *l.c.*

Hab.—West Australia.

Genus TEPALICUS Lea, *l.c.*, p.107.

TEPALICUS SEMICALVUS Lea, *l.c.*, p.108.

Hab.—Queensland.

Genus ŒMETHYLUS Pascoe, Trans. Ent Soc. Lond., 1870, p.482.

Head moderately large. *Eyes* finely faceted. *Rostrum* moderately long and not very thin. *Antennæ* rather thin. *Prothorax* conical, apex produced, base bisinuate, *constriction shallow*, ocular lobes prominent. *Scutellum* elongate. *Elytra* subconical, base much wider than prothorax, shoulders angular. *Mesosternal receptacle* moderately large, raised in front, cavernous. *Metasternum* slightly shorter than the following segment; episterna distinct but very narrow in middle. *Abdomen* not very large, sutures distinct. *Legs* rather short; femora linear, grooved, edentate. Angular, strongly convex, squamose, winged.

Mr. Pascoe regarded this genus as being allied to *Cryptorhynchus*, but it differs from *C. Lapathi* (the typical species of that genus) in the decidedly cavernous mesosternal receptacle, in the much narrower metasternal episterna, abdomen, etc. Both the known species have the head depressed at the base, a character common to many of the allies of *Poropterus*, and seldom seen in other sections.

Prothorax ridged, the ridges produced at apex....... *triangularis.*
Prothorax bituberculate at apex........................ *lumbaris.*

ŒMETHYLUS LUMBARIS Pasc.; Mast. Cat., Sp.No.5537.

A very distinct species, readily identifiable from the original figure (Trans. Ent. Soc. Lond., 1870, Pl.7, fig.3).

Hab.—Queensland : Wide Bay, Port Denison, Townsville.

Œ. TRIANGULARIS Lea, Mitt. Zool. Mus. Berlin, 1911, p.199.

In error, printed *Amethylus.*

Hab.—New South Wales, Queensland.

Genus OUROPOROPTERUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.109.

OUROPOROPTERUS DIURUS Lea, *l.c.*

Hab.—New South Wales.

Genus BRACHYPOROPTERUS Lea, Proc. Roy. Soc. Vict., 1907, p.182.

The two known species of this genus may be thus tabulated:—

Second segment of abdomen transversely depressed in middle *apicigriseus*.
Second segment not so depressed.... .... *vermiculatus*.

BRACHYPOROPTERUS APICIGRISEUS Lea, *l.c.*, p.182.

Hab.—King Island.

BRACHYPOROPTERUS VERMICULATUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.110.

Hab.—New South Wales.

Genus EURYPOROPTERUS Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.171.

The known species of this genus may be tabulated thus:—

Abdomen with second segment small............. .... *tenuifasciatus*.
Abdomen with second segment large
Elytra tuberculate........ .... *annulipes*.
Elytra non-tuberculate.
Shoulders rounded.............................. ....*funereus*.
Shoulders oblique .... *angularis*.

EURYPOROPTERUS ANNULIPES Pasc.; Mast. Cat., Sp.No.5486.
Petosiris annulipes Pasc.

Derm entirely concealed by small sooty scales; on the prothorax, stouter scales scattered about, and forming six more or less distinct fascicles. Under surface and legs with whitish scales scattered about, and forming a distinct ring on each of the tibiæ, and two on each of the femora.

Rostrum rather stout and curved; basal half with coarse normally concealed punctures, apical half shining and with rather coarse punctures. *Prothorax* with four rather large obtuse tubercles across middle. *Elytra* considerably wider than prothorax, shoulders tuberculiform; with tubercles of various sizes and shapes, the largest on each side of scutellar region; with series of large subquadrate punctures, becoming smaller and rounded posteriorly. *Femora* moderately stout, in male feebly dentate, in female edentate. Length, 5½-7½ mm.

Hab.—N.S.W.: Armidale, Glen Innes, Tenterfield.—Queensland: Rockhampton.

A short, robust, and rather strongly tuberculate species. When clothed, the punctures of the prothorax are entirely concealed. In addition to the sooty scales of the upper surface, there is frequently a narrow median prothoracic stripe of brown scales. The front femora have two pale rings, but these are usually much less distinct than those of the hind ones.

EURYPOROPTERUS FUNEREUS Lea, Mém. Soc. Ent. Belge, xvi. 1908, p.171.

Hab.—New South Wales.

EURYPOROPTERUS ANGULARIS Lea, *l.c.*, p.172.

Hab.—New South Wales, Victoria, South Australia.

EURYPOROPTERUS TENUIFASCIATUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.111.

Hab.—New South Wales.

Genus EXITHIUS Pascoe, Trans. Ent. Soc. Lond., 1870, p.207.

Head partially or quite concealed from above. Eyes coarsely faceted. Rostrum moderately long and rather wide. Antennæ rather stout; scape inserted about middle of rostrum, much shorter than funicle. *Prothorax* feebly or moderately transverse. *Scutellum* small, but usually distinct, sometimes absent. *Elytra* not much wider than, and about twice the length of prothorax; shoulders rounded or produced. *Mesosternal receptacle* strongly raised in front, the raised portion narrow, and connected with the base by a carina. *Metasternum* very short; episterna traceable only at base and apex. *Abdomen* rather large, none of the sutures deep, that between first and second segments distinct at sides, but feeble and curved across middle. *Legs* rather stout; femora grooved and dentate.* Ovate or elliptic-ovate, squamose, fasciculate, tuberculate, apterous.

This genus was proposed by Mr. Pascoe to receive his *E. capucinus* (unfortunately a synonym of *Cryptorhynchus cariosus*);

* Except in *E. sculptilis*.

and with it, I associate *Poropterus musculus* and some other species. Mr. Pascoe regarded *Exithius* as allied to *Chætectetorus*, but, for various reasons,† he appears, in this, to have been in error. All the species have the derm of an opaque black or piceous-black, with the antennæ and tarsi of a more or less dingy red.

All the known species occur either in Tasmania, or in mountainous parts of the mainland; and they are to be found under bark (usually of dead trees), or crawling over logs and fences after sunset.

A. Head with forehead trisinuate.
  a. Prothorax dilated towards and widest close to apex.... *cariosus*.
  aa. Prothorax rounded in front.
    b. Shoulders strongly projecting.
      c. Elytra less than twice the length of prothorax..... *ferrugineus*.
      cc. Elytra more than twice the length of prothorax... *musculus*.
    bb. Shoulders rounded.
      d. Prothorax very densely punctate...................... *conspiciendus*.
      dd. Prothorax with sparse punctures of large size.... *sculptilis*.
AA. Head with forehead not trisinuate.
  B. Mesosternal receptacle not suddenly elevated.
    e. Punctures of head clearly defined..... .... *inamabilis*.
    ee. Punctures of head confused............................ ... *brevis*.
  BB. Mesosternal receptacle suddenly elevated.
    C. Largest elytral fascicles subapical .... *loculosus*.
    CC. Largest elytral fascicles subbasal.
      D. Prothorax with pale scales along middle .... *simulator*.
      DD. Prothorax without pale scales along middle...... *fumatus*.

Exithius cariosus Er.; Mast. Cat., Sp.No.5541.

Cryptorhynchus cariosus Er.; *Exithius capucinus* Pasc., *l.c.*, No.5526.

The shape of the prothorax, well drawn in the figure accompanying Mr. Pascoe's description of *E. capucinus,* renders this species remarkably distinct. The large scales are frequently condensed to form fascicles, at least two of which are always traceable on the prothorax. The prevailing colour of the scales on the upper surface and flanks is a dingy ochreous-brown; occasionally there is a triangular patch of whitish scales on the flanks of the

† These Proceedings, 1909, p.593.

prothorax, sometimes there is a pale transverse patch of scales on the elytra at the summit of the posterior declivity, rarely there is an oblong patch of pale scales continuous from the base of the elytra to the summit of the posterior declivity. There are always two fascicles between the eyes, which are usually (but not invariably) composed of pale, sometimes snowy-white, scales. The clothing of the under surface is also variable, but the three apical segments are always sparsely clothed. Length, $5\frac{2}{3}$ mm.

Hab.—Tasmania, widely distributed, and common.

EXITHIUS MUSCULUS Pasc.; *l.c.*, No.5433.
Poropterus musculus Pasc.

Densely clothed with scales varying from muddy-grey to sooty-black. Prothorax with six fascicles, elytra with a fascicle on each tubercle.

Head densely punctate throughout; forehead very distinctly but not deeply sinuate. Rostrum coarsely punctate and opaque in male, shining and with smaller punctures in female. *Prothorax* moderately transverse, sides rounded. *Elytra* with shoulders strongly projecting on to prothorax; with feeble, scattered, tubercular elevations, except along suture. Two basal segments of *abdomen* with dense, round punctures. *Femora* feebly dentate in male, very feebly in female. Length, $5\frac{1}{4}$ mm.

Hab.—Tasmania, widely distributed and common.

The strongly projecting shoulders render this a very distinct species.

EXITHIUS FERRUGINEUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.112.

Hab. Tasmania.

EXITHIUS CONSPICIENDUS Lea, *l.c.*, p.113.

Hab.—Tasmania.

EXITHIUS LOCULOSUS Lea, *l.c.*

Hab.—New South Wales.

EXITHIUS SCULPTILIS Lea, *l.c.*, p.114.

Hab.—New South Wales.

EXITHIUS INAMABILIS Lea, *l.c.*, p.118.

Hab.—New South Wales.

EXITHIUS BREVIS Lea, *l.c.*

Hab.—New South Wales.

EXITHIUS SIMULATOR Lea, Mitt. Natur. Mus. Hamburg, 1909, p.202.

Hab.—Queensland, New South Wales.

EXITHIUS FUMATUS Lea, *l.c.*

Hab.—Queensland.

Genus EXITHIOIDES Lea, Trans.Roy.Soc.S.Aust.,1912,p.116.

EXITHIOIDES PUNCTATUS Lea, *l.c.*

Hab.—New South Wales.

Genus EUFAUSTIA Lea, *l.c.*, p.117.

EUFAUSTIA MIRABILIS Lea, *l.c.*, p.118.

Hab.—New South Wales.

Genus ONIDISTUS Pascoe, Trans. Ent. Soc. Lond., 1870, p.465.

Head with four more or less distinct foveæ or excavations. *Eyes* large, finely faceted. Rostrum long and thin. Antennæ rather slender. *Prothorax* transverse, base strongly bisinuate. *Scutellum* small, more or less transverse. *Elytra* subcordate, not much wider than, and but little more than twice the length of prothorax; base trisinuate. *Mesosternal receptacle* slightly raised, walls of base and of the anterior edges thinner than elsewhere; emargination V-shaped; open.* Metasternum shorter than basal segment of abdomen; episterna distinct. *Abdomen* large. *Femora* subpedunculate, not grooved, strongly and acutely dentate. Briefly elliptic or elliptic-ovate, convex, squamose, punctate, winged or apterous.

Mr. Pascoe, in describing the genus, said that he had a species from New Caledonia, and imagined that Montrouzier had described several others. I have only Australian ones under observation, all of which are from Queensland, or the northern coastal districts of New South Wales. *Onidistus* is a very distinct genus, but is allied to *Palèticus,* from which it may be distinguished by the open, or at least but feebly cavernous, mesosternal receptacle, and strongly

* In *O. subfornicatus*, although apparently open, it is in reality very slightly cavernous, as may be seen on probing it with a pin.

dentate femora. Of the three species here recorded, *O. subfornicatus* has the receptacle slightly cavernous, *O. araneus* has it nearly open at the apex, whilst in *O. nodipennis* it is widely open. In *O. araneus,* the wings are absent; in the others, they are present. In *O. nodipennis,* the metasternum is not much shorter than the following segment; whilst, in the two others, it is but little more than half as long.

Alate.
  Mesosternal receptacle slightly cavernous............... *subfornicatus.*
  Receptacle widely open.................... .... *nodipennis.*
Apterous.. .... *araneus.*

ONIDISTUS NODIPENNIS Pasc.; Mast. Cat., Sp.No.5484.

Clothed with brown scales of small size, but which almost entirely conceal the derm; with larger and paler scales scattered about and forming feeble fascicles on the elytra, and still more feeble ones on the prothorax.

Head shallowly quadri-impressed. Rostrum long, thin, and shining; towards base punctate, and with a feeble median carina. *Prothorax* with two very feeble tubercular elevations in middle. *Elytra* with series of moderately large punctures, not very close together, and posteriorly becoming very small; each side of suture, near base, with three shining granules; third interstice with two tubercular elevations; elsewhere with scarcely traceable elevations. *Mesosternal receptacle* widely open throughout. *Wings* present. Length, 6mm.

Hab.—Queensland: Cairns.

Mr. Pascoe remarks having seen a variety of this species from Illawarra.

ONIDISTUS ARANEUS Pasc.; *l.c.,* No.5483.
O. odiosus Pasc.; *l.c.,* No.5485.

Closely covered with minute muddy-grey scales, which are individually scarcely traceable, but which entirely conceal the derm; legs with stout and paler scales, prothorax with reddish subsetose scales in front, becoming stouter towards base; elytra with pale spathulate scales, forming regular series on the interstices.

Head distinctly quadri-impressed. Rostrum long and thin (stouter in ♂ than in ♀); densely punctate at sides of base in ♂ (sparsely in ♀). Scape inserted nearer apex than base of rostrum in ♂, vice versa in ♀. Prothorax without tubercular elevations. *Elytra* with two or three, irregular, transverse series of very large punctures or foveæ on basal fourth, elsewhere with feeble series of punctures, which are entirely concealed; each side of suture at base with from one to four, small, shining granules. *Mesosternal receptacle* narrowed posteriorly, but open throughout. Wings absent. Length, $4\frac{1}{3}$-$6\frac{3}{4}$ mm.

Hab.—Queensland—New South Wales: Tweed and Richmond Rivers.

In the "big scrub" country, specimens of this species may be obtained on almost every log and stump. The small, sutural granules are variable in numbers and position on different specimens, and even on the different elytra; occasionally all are absent.

This species was labelled as *O. araneus* in the Macleay Museum, but since Pascoe described the elytra as *"impunctatis,"* I thought it possible that some error in numbering had been made, and that the species was really not *O. araneus.* But on applying to the British Museum for information, Mr. C. J. Gahan wrote, "The type has some large punctures on disc close to base, and some rather smaller ones at the sides, extending back a short distance from the base. The punctures on the disc are very distinct on a second specimen associated with the type."

Mr. Arrow sent a co-type of *O. odiosus* for examination; it is simply a small specimen of *O. araneus.*

The species differs from the preceding one in being considerably wider, legs longer, tibiæ thinner, rostrum shorter, elytra non-tuberculate, etc., besides in the length of metasternum, and absence of wings.

ONIDISTUS SUBFORNICATUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.119.

Hab.—Queensland.

Genus PSEUDONIDISTUS Lea, *l.c.*, p.120.

PSEUDONIDISTUS CORDATUS Lea, *l.c.*, p.121.

Hab.—Queensland.

Genus PALETONIDISTUS Lea, *l.c.*, p.122.

PALETONIDISTUS TRISINUATUS Lea, *l.c.*

Hab.—New South Wales.

Genus METHIDRYSIS Pascoe, Trans. Ent. Soc. Lond.,1870, p.467.

Head, with four excavations or foveæ. *Eyes* large, rather coarsely faceted. *Rostrum* long and thin, strongly curved. *Antennæ* rather slender; scape much shorter than funicle, inserted much closer to base than apex of rostrum. *Prothorax* subquadrate, sides rounded in front, base bisinuate. *Scutellum* small and distinct. *Elytra* wider than prothorax. *Mesosternal receptacle* feebly raised, emargination U-shaped; cavernous. *Metasternal episterna* narrow and distinct. *Abdomen* with sutures deep and straight. Femora stout, dentate, feebly grooved; tarsi thin, third joint not very wide, but deeply bilobed. Elliptic, convex, squamose, tuberculate, apterous.

The elytral punctures and granules, the tarsi and the frontal excavation leave no doubt that the genus is rather closely allied to *Paleticus*, but the abdomen with all the sutures straight and deep, and the very short scape, are decidedly unusual for that position.

METHIDRYSIS AFFLICTA Pasc.; Mast. Cat., Sp.No.5489.

Prothorax sparsely clothed with brownish scales, irregular in shape and size; elytra with similar but larger scales, denser at base and sides, and leaving an almost nude space in middle, sides and apex with longer and paler scales.

Head with a feeble median carina. Rostrum long and very decidedly curved at base; with four punctate basal grooves, which are partially concealed, but leave a distinct median carina. Apical two-thirds feebly punctate. *Prothorax* slightly longer than wide, basal two-thirds almost parallel-sided, and with abrupt walls; with scattered punctures of moderate size, but each of which contains, and is almost, or quite, concealed by, a scale. *Elytra* subcordate, about once and one-half the width, and scarcely twice the length of prothorax, with series of distant large punctures or foveæ, becoming very small posteriorly; each side of suture at base with about four small shining granules; interstices with several feeble tubercular and squamose elevations, but towards base two large and distinct tubercles on each side; one on third interstice at base, and one on the fifth slightly behind it; each side at summit of posterior declivity with a small tubercle. Hind *femora* longer than the others, but each with a rather large, triangular tooth. Length, $5\frac{3}{4}$-$7\frac{1}{2}$ mm.

Hab.—Queensland—New South Wales: Richmond River.

Mr. Pascoe gives the length as four lines; none of my (ten) specimens quite attain that length, but if the head were drawn out and measured, some of them would exceed it. The nude space on the elytra commences at about the basal third, is not quite continuous to apex, and is widest at about the summit of the posterior declivity.

Genus ECILDAUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.123.

ECILDAUS PERSONATUS Lea, *l.c.*, p.124.

Hab.—Queensland.

ECILDAUS MELANCHOLICUS Lea, *l.c.*, p.125.

Hab.—New South Wales.

ECILDAUS GLABRICORNIS Lea, *l.c.*

Hab.—New South Wales.

Genus NOTOCALVICEPS Lea, *l.c.*, p.126.

NOTOCALVICEPS PUNCTIPENNIS Lea, *l.c.*, p.127.

Hab.—Queensland.

NOTOCALVICEPS RARUS Lea, *l.c.*, p.128.

Hab.—New South Wales.

Genus STENOPOROPTERUS Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.167.

STENOPOROPTERUS CANALICULATUS Lea, *l.c.*, p.168.

Hab.—New South Wales, Queensland.

Genus Terporopus Lea, Trans. Roy. Soc. S. Aust., 1912, p.129.

Terporopus tenuicornis Lea, *l.c.*

Hab.—Queensland.

Genus Austrectopsis Lea, *l.c.*, p.131.

Austrectopsis oblongus Lea, *l.c.*, p.131.

Hab.—Queensland.

Genus Roptoperus Lea, Proc. Roy. Soc. Vict., 1907, p.184.

Prothorax as long or almost as long as wide.
 Head ringed at base. .... *occidentalis.*
 Head not so ringed............... .... *tasmaniensis.*
Prothorax distinctly transverse........................... *terræ-reginæ.*

Roptoperus tasmaniensis Lea, *l.c.*, p.185.

Hab.—Tasmania and King Island.

Roptoperus terræ-reginæ Lea, Trans. Roy. Soc. S. Aust., 1912, p.132.

Hab.—Queensland.

Roptoperus occidentalis Lea, *l.c.*, p.133.

Hab.—West Australia.

Genus Cairnsicis Lea, *l.c.*, p.133.

Cairnsicis opalescens Lea, *l.c.*, p.134.

Hab.—Queensland.

Genus Zenoporopterus Lea, *l.c.*, p.135.

Zenoporopterus mirus Lea, *l.c.*

Hab.—New South Wales.

Genus Orthoporopterus Lea, Deutsch. Ent. Zeitschr., 1910, p.521.

Orthoporopterus elongatus Lea, *l.c.*, p.522.

Hab.—New South Wales, Queensland.

Genus GYMNOPOROPTERUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.136.

GYMNOPOROPTERUS PICTIPES Lea, *l.c.*, p.137.

Hab.—Queensland.

Genus MICROCRYPTORHYNCHUS Lea, Proc. Roy. Soc. Vict., 1907, p.194.

The described species of this genus may be tabulated as follows:—

Elytra with two fascicles .... *echinatus.*
Elytra without fascicles
  Prothorax and elytra almost parallel-sided .... *cylindricollis.*
  Prothorax and elytra each inflated in middle .... *pygmæus.*

MICROCRYPTORHYNCHUS PYGMÆUS Lea, *l.c.*, p.195.

Hab.—Tasmania and King Island.

MICROCRYPTORHYNCHUS ECHINATUS Lea, Trans. Roy. Soc. S. Aust 1912, p.137.

Hab.—New South Wales.

MICROCRYPTORHYNCHUS CYLINDRICOLLIS Lea, *l.c.*, p.138.

Hab.—West Australia.

THE GEOLOGY AND PETROLOGY OF THE GREAT SERPENTINE BELT OF NEW SOUTH WALES.

Part I.

By W. N. Benson, B.A., B.Sc.

(Plates xx.-xxi.)

Introduction.

The Great Serpentine Belt of New South Wales is one of the most remarkable features to be encountered in the study of the palæozoic geology of the State. Its presence has been known for many years, owing to the association of the serpentine with mineral deposits of economic value, and the outlines of several occurrences were roughly shown in the first official geological map of 1875, based mainly on data collected by the late Rev. W. B. Clarke. Chief among those who have reported on various portions of this belt, have been Messrs. Anderson(**1**), Clarke(**2**), David(**3**), Jaquet(**4**), Odernheimer(**5**), Pittman(**3**), Stonier(**6**), Stutchbury(**7**), and Ulrich(**8**), but lack of opportunity prevented any of these writers from making a detailed study, or attempting any well-founded generalisations. Mr. W. Anderson(**1**) has given the only petrographical account of the ultrabasic rocks (1888), while to Mr. G. A. Stonier(**6**) is due the suggestion of the Upper Carboniferous as the era of the intrusion of these rocks (1895). The tectonic complexity of the associated formations, their great thickness and similarity over wide areas, and also the dearth of determinative fossils, has led to conflicting estimates of their age and relationships, perforcedly based on insufficient data. A great advance was made in 1899, in the recognition, by Professor David and Mr. Pittman, of a great thickness of radiolarian jaspers, cherts and tuffs associated with Middle Devonian coral limestones. Apart from these investigations, the area might be considered virgin ground.

The object in the mind of the present author, when first commencing work, was the purely petrological investigation of the ultrabasic rocks; but, as the work progressed, a study of the geology of the associated formations was found necessary in order to determine the age of the intrusions; and so many additional and important problems presented themselves, that the work has evolved into a general survey of the geological history of the whole region.

Considerable help has been derived from the earlier writings, particularly in directing the attention to localities of interest. To Mr. Donald Porter, of Tamworth, is due the suggestion that the work should be commenced at Bowling Alley Point, which has proved to be the "key" district; in many other points, also, his intimate local knowledge has been most helpful.

Except where otherwise stated, all the fossils have been determined by the New South Wales Government Palæontologist, Mr. W. S. Dun, to whom the author's best thanks are due.

In the following pages, an account will be given of the general geology of the Serpentine Belt, drawn from a study of about two thousand square miles of country, involving six months' field work. Half of this time was spent in the examination of the Bowling Alley Point and Nundle area of about one hundred square miles. Of this, a fairly detailed topographical and geological map was prepared during a plane table-survey; the official two-inch land-survey map being deficient in many details, in part of the area, and totally lacking in the remainder. The contours are based on aneroid observations. This will be given with Part ii. of this work.

The larger, northern portion was surveyed much more rapidly, the official one-inch land-survey maps being sufficiently detailed. It was impossible, in the time available, to obtain complete verification of many of the points suggested, and further work will, doubtless, call for some modifications of the account here given, particularly in the intricate area around Bingara; but nevertheless, it is believed that the general description is in the main correct, and may be admitted, at least, as a working hypothesis.

The geological map is mainly original, but owes something to the following sources:—

From the unpublished charts in the Office of the Geological Survey, have been copied part of the granite boundary east of Bingara, part of the boundary of the Jurassic sandstone near Warialda, part of the boundaries of the basalt near Rocky Creek, and part also of the boundaries of serpentine and limestone east of Manilla. The distribution of the basalt and Tertiary gravels, near Bingara, is taken from the reports of Messrs. Stonier and Anderson. While the volcanic geology of the Nandewar Mountains has been taken direct from the maps published by Dr. Jensen(**9**); the boundaries of the Carboniferous and Permo-Carboniferous in that region have been somewhat modified, but were laid down, with his approval, after a discussion, with him, of the knowledge recently gained.

The detailed account of the geology and topography of this area has been withheld for the present, in the hope of obtaining further information. The petrographical portion of the work was carried out in the Sedgwick Museum, Cambridge, by permission of Professor Hughes, to whom the author is indebted for many kindnesses. Thanks also are due to Professor Bonney, for his helpful interest in the work, etc., to Dr. Arber, for palæobotanical information, and to Dr. Flett, and Dr. Hinde for checking the author's deductions from certain microscope slides. To Mr. Harker, the writer is indebted for invaluable help and advice throughout, and, in particular, for ideas as to the relation of igneous action to tectonic conditions, suggested by a most stimulating series of lectures on "Igneous Action in Britain." The chemical analyses were made in the Mineralogical Laboratory at Cambridge, under the helpful guidance of Dr. Hutchinson.

Chapter i.

General Geology and Topography.

The area to be described lies north and south of Tamworth, an agricultural centre on the main line from Sydney to Brisbane, 280 miles from the former. For the greater part, it forms the slopes and foothills which separate the plateau of New England from the Western Plains, and their long southward extension, known as the Liverpool Plains.

The main river in the area is the Namoi, which, leaving the plateau by a rugged gorge, flows directly through the foothills out on to the Liverpool Plains. It receives, as tributaries, the Peel River from the south, and the Manilla from the north, both of which have followed a semisubsequent course in the slope, and the latter of which has several markedly obsequent subtributaries. To the north, the main river is the Gwydir, which also leaves the plateau in a gorge, and passes directly on to the Western plain, being joined by subsequent tributaries, such as the Horton River and Hall's Creek. The evolution of this drainage-system is most complex.

From Warialda, in the north of the area, to Tamworth, is about 100 miles, and 30 miles further, in the same direction, bring one to Nundle, the southermost township in the area studied. The serpentine line extends this whole length, and has been reported, at various points, for about 40 miles still further to the south. These last occurrences have never been studied geologically. There can be little doubt that the belt extends also north of Warialda, but it is there covered by Jurassic sandstone. It may, however, be stated with confidence, that this great feature is not far short of 200 miles in length, and runs nearly straight in a direction about 20° west of north. It divides the region into two sharply distinguished portions, there being seldom much difficulty in deciding whether a particular specimen has been derived from the eastern or the western side of this line. (Certain exceptional rocks and localities, where confusion may arise, will be described later.) To the west of the serpentine-line, the rocks consist of radiolarian, banded cherts, limestones and tuffs, with bands of spilite-lava in the lower horizons, of heavy agglomerates, or fine-grained mudstones in the middle horizons, passing up into very distinctive conglomerates. Near the serpentine-line, they are always steeply inclined, generally with an easterly dip, but further away, *i.e.*, from five to ten miles to the west of the line, they may be less highly inclined, be horizontal, or dip more or less steeply to the west. East of the serpentine, the strata are all greatly altered by pressure They consist of slaty siliceous rocks, reddish banded cherts, and red jaspers in which the traces of radiolaria can be faintly discerned, highly cleaved and altered spilite, sheared tuffs or tuffaceous breccia, and rarely schistose conglomerate. Here and there lenses of very crystalline limestone are present. The radiolarian jaspers are the main features, and form very prominent and continuous bands adjacent and parallel to the serpentine-line. The whole is riddled with quartz-veins, which are very poorly developed in the western portion.

The term "serpentine-line" has been employed for the marked line of fault separating these two portions, for though the serpentine rock does not form a continuous band, it is developed chiefly in this particular line, forming a row of intrusions, which may vary in length from 100 yards to 30 miles, and in width, from a few inches to nearly two miles. And wherever serpentine occurs not on this line, it lies in the more disturbed rocks to the east, forming sill-like masses there also. In only two or three minor and exceptional instances has serpentine been found lying to the west of this line, and, as will be explained, these occurrences are not anomalous.

In spite of this apparently sharp definition, the eastern and western series are not entirely distinct. Among the rocks of the eastern series, the metamorphosed equivalents of some western rocks can be clearly seen, and, moreover, we may trace one horizon which passes across the line from the unaltered west into the altered east. The facts clearly show that, at the close of a long period of sedimentation, heavy orogenetic pressure came from the east, folding and metamorphosing the eastern series, but becoming less and less effective towards the west. This pressure culminated in the formation of a great plane of overthrust faulting (which is unusually steep). This relieved the western side from this pressure it was suffering, before the series had suffered any notable dynamic metamorphism. The great fault-plane was the main channel of ascent of the ultrabasic magma. The many intrusions to the east came up along the many fault-planes in the shattered eastern block, while the few intrusions of peridotite, west of the main line, have been proved to lie in subsidiary fault-planes, such as would be expected to occur here and there by the main great overthrust.

The sedimentary formations developed prior to the folding may be classified as follows:—

Formation.	Age.	Maximum Thickness.
(*f.*) Rocky Creek Conglomerates	Lower	2,000ft. +
(*e.*) Burindi Mudstones........................	Carboniferous	1,500ft.
(*d.*) Barraba or Nundle Series	Upper Devonian ...	13,000 ft. +
(*c.*) Baldwin Agglomerates....................	Do. do. ..	3,000 ft. +
(*b.*) Tamworth or Bowling Alley Series....	Middle Devonian .	10,000 ft. +
(*a.*) Woolomin Series.......	Lower Devonian(!)	Unknown.

These are all apparent thicknesses. It has been impossible, as yet, to determine how far they may have been increased by strike-faulting, which is undoubtedly present.

A brief description of these may now be given.

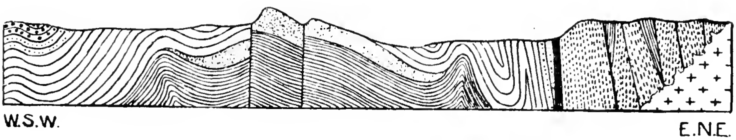


Fig. 1*a*.—Generalised Section, Northern Type, about 30 miles long.

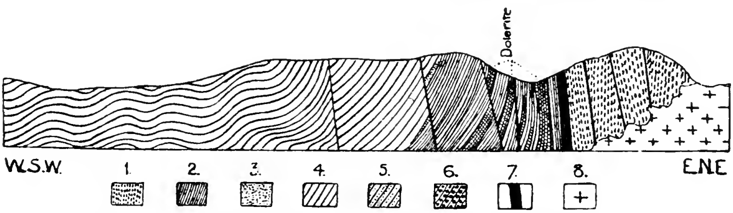


Fig. 1*b*.—Southern Type, about 20 miles long.

1. Woolomin Series.
2. Tamworth Series.
3. Baldwin Agglomerate.
4. Barraba Mudstone.
5. Burindi Mudstone.
6. Rocky Creek Conglomerate.
7. Serpentine.
8. Granite.

(*a*) The lowest beds of the series are the Woolomin Beds. These occur exclusively on the eastern side of the serpentine-line, and, therefore, are always greatly altered. Their most noticeable feature is the presence of a well-defined zone of red, unbanded jasper, in which traces of radiolarian remains are frequently visible. In addition to this, the series contains a very large amount of altered spilitic rocks, schistose tuffs, slates, phyllites, and hornstones. The whole series is intersected by numerous quartz-veins. The relation of these beds to the Tamworth Beds is probably one of strict conformity. In the region north-east of Manilla, where the Tamworth Beds are believed to occur east of the serpentine-line, there is no suggestion of any discordance between them and the enclosing Woolomin Beds; moreover, the occurrence, in each, of spilitic lavas and radiolaria, argues that they are merely different portions of one sedimentation-series. It will need a long and intricate study, both microscopically and in the field, to delimit properly these two formations; and until that is accomplished, it seems best to indicate on the map, with one hachuring, the whole of the eastern series, making reservations in the text. The bulk of the eastern series is probably of Lower Devonian age.

(*b*) The Tamworth Beds are those that have been studied in most detail, particularly by Professor David and Mr. Pittman(3), who gave a section showing their occurrence at Tamworth. The most typical and complete section appears to be developed at Bowling Alley Point, however, and of this the following is the order:—

Thickness.	
3,300ft.	Upper Tuff-breccias.
2,000ft.	Upper Banded, Radiolarian Claystones (with Spilites).
20-150ft.	Limestones.
4,000ft.	Lower Tuff-breccias.
600ft.	Lower Banded, Radiolarian Claystone.
10,000ft.	

The thickness, however, is only very roughly determined, and it is very probable that considerable repetition has occurred. In coming very small posteriorly; each side of suture at base with about four small shining granules; interstices with several feeble tubercular and squamose elevations, but towards base two large and distinct tubercles on each side; one on third interstice at base, and one on the fifth slightly behind it; each side at summit of posterior declivity with a small tubercle. Hind *femora* longer than the others, but each with a rather large, triangular tooth. Length, $5\frac{3}{4}$-$7\frac{1}{2}$ mm.

Hab.—Queensland—New South Wales: Richmond River.

Mr. Pascoe gives the length as four lines; none of my (ten) specimens quite attain that length, but if the head were drawn out and measured, some of them would exceed it. The nude space on the elytra commences at about the basal third, is not quite continuous to apex, and is widest at about the summit of the posterior declivity.

Genus ECILDAUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.123.

ECILDAUS PERSONATUS Lea, *l.c.*, p.124.

Hab.—Queensland.

ECILDAUS MELANCHOLICUS Lea, *l.c.*, p.125.

Hab.—New South Wales.

ECILDAUS GLABRICORNIS Lea, *l.c.*

Hab.—New South Wales.

Genus NOTOCALVICEPS Lea, *l.c.*, p.126.

NOTOCALVICEPS PUNCTIPENNIS Lea, *l.c.*, p.127.

Hab.—Queensland.

NOTOCALVICEPS RARUS Lea, *l.c.*, p.128.

Hab.—New South Wales.

Genus STENOPOROPTERUS Lea, Mém. Soc. Ent. Belge, xvi., 1908, p.167.

STENOPOROPTERUS CANALICULATUS Lea, *l.c.*, p.168.

Hab.—New South Wales, Queensland.

Genus TERPOROPUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.129.

TERPOROPUS TENUICORNIS Lea, *l.c.*

Hab.—Queensland.

Genus AUSTRECTOPSIS Lea, *l.c.*, p.131.

AUSTRECTOPSIS OBLONGUS Lea, *l.c.*, p.131.

Hab.—Queensland.

Genus ROPTOPERUS Lea, Proc. Roy. Soc. Vict., 1907, p.184.

Prothorax as long or almost as long as wide.
Head ringed at base.. *occidentalis.*
Head not so ringed.. *tasmaniensis.*
Prothorax distinctly transverse.. *terræ-reginæ.*

ROPTOPERUS TASMANIENSIS Lea, *l.c.*, p.185.

Hab.—Tasmania and King Island.

ROPTOPERUS TERRÆ-REGINÆ Lea, Trans. Roy. Soc. S. Aust., 1912, p.132.

Hab.—Queensland.

ROPTOPERUS OCCIDENTALIS Lea, *l.c.*, p.133.

Hab.—West Australia.

Genus CAIRNSICIS Lea, *l.c.*, p.133.

CAIRNSICIS OPALESCENS Lea, *l.c.*, p.134.

Hab.—Queensland.

Genus ZENOPOROPTERUS Lea, *l.c.*, p.135.

ZENOPOROPTERUS MIRUS Lea, *l.c.*

Hab.—New South Wales.

Genus ORTHOPOROPTERUS Lea, Deutsch. Ent. Zeitschr., 1910, p.521.

ORTHOPOROPTERUS ELONGATUS Lea, *l.c.*, p.522.

Hab.—New South Wales, Queensland.

Genus GYMNOPOROPTERUS Lea, Trans. Roy. Soc. S. Aust., 1912, p.136.

GYMNOPOROPTERUS PICTIPES Lea, *l.c.*, p.137.

Hab.—Queensland.

Genus MICROCRYPTORHYNCHUS Lea, Proc. Roy. Soc. Vict. 1907, p.194.

The described species of this genus may be tabulated as follows :—

Elytra with two fascicles.................................... *echinatus.*
Elytra without fascicles
  Prothorax and elytra almost parallel-sided.. .... *cylindricollis.*
  Prothorax and elytra each inflated in middle...... ..... *pygmæus.*

MICROCRYPTORHYNCHUS PYGMÆUS Lea, *l.c.*, p.195.

Hab.—Tasmania and King Island.

MICROCRYPTORHYNCHUS ECHINATUS Lea, Trans. Roy. Soc. S. Aust. 1912, p.137.

Hab.—New South Wales.

MICROCRYPTORHYNCHUS CYLINDRICOLLIS Lea, *l.c.*, p.138.

Hab.—West Australia.

THE GEOLOGY AND PETROLOGY OF THE GREAT SERPENTINE BELT OF NEW SOUTH WALES.

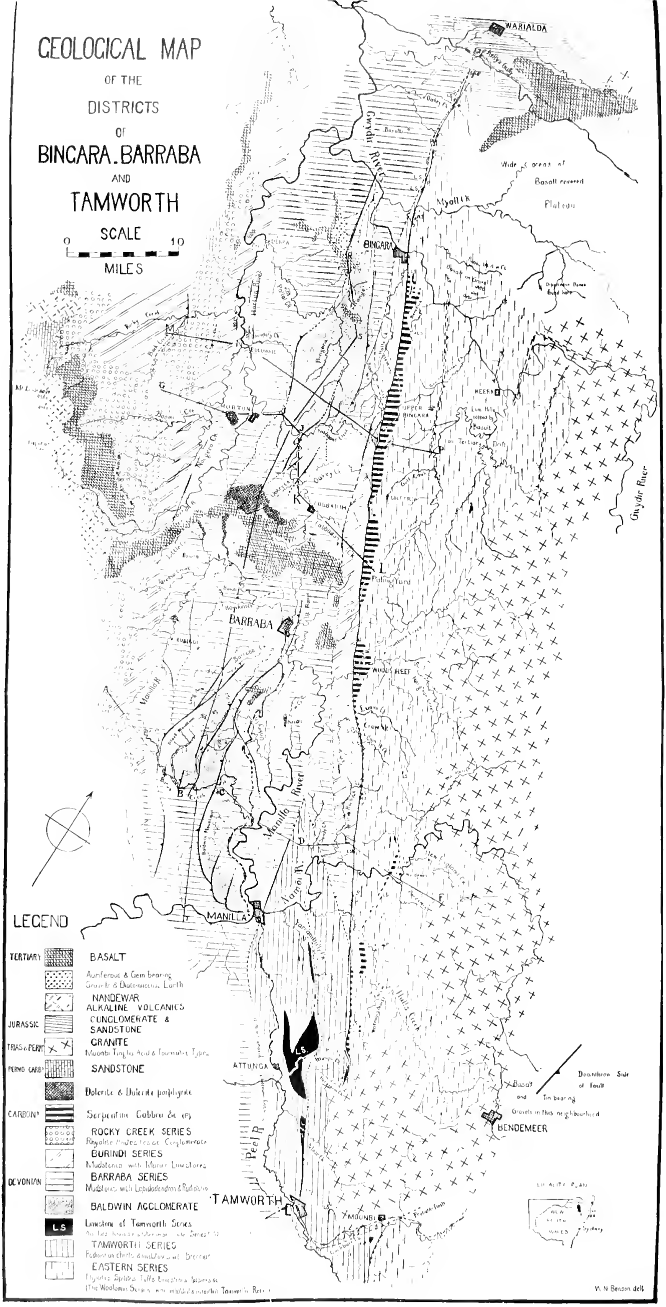
Part I.

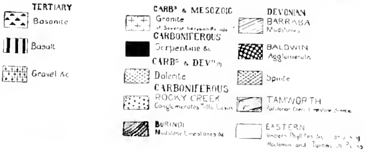
By W. N. Benson, B.A., B.Sc.

(Plates xx.-xxi.)

Introduction.

The Great Serpentine Belt of New South Wales is one of the most remarkable features to be encountered in the study of the palæozoic geology of the State. Its presence has been known for many years, owing to the association of the serpentine with mineral deposits of economic value, and the outlines of several occurrences were roughly shown in the first official geological map of 1875, based mainly on data collected by the late Rev. W. B. Clarke. Chief among those who have reported on various portions of this belt, have been Messrs. Anderson(**1**), Clarke(**2**), David(**3**) Jaquet(**4**), Odernheimer(**5**), Pittman(**3**), Stonier(**6**), Stutchbury(**7**), and Ulrich(**8**), but lack of opportunity prevented any of these writers from making a detailed study, or attempting any well-founded generalisations. Mr. W. Anderson(**1**) has given the only petrographical account of the ultrabasic rocks (1888), while to Mr. G. A. Stonier(**6**) is due the suggestion of the Upper Carboniferous as the era of the intrusion of these rocks (1895). The tectonic complexity of the associated formations, their great thickness and similarity over wide areas, and also the dearth of determinative fossils, has led to conflicting estimates of their age and relationships, perforcedly based on insufficient data. A great advance was made in 1899, in the recognition, by Professor David and Mr. Pittman, of a great thickness of radiolarian jaspers, cherts and tuffs associated with Middle Devonian coral limestones. Apart from these investigations, the area might be considered virgin ground.


GEOLOGICAL MAP
OF THE
DISTRICTS
OF
BINCARA. BARRABA
AND
TAMWORTH
SCALE
0
10
MILES
LEGEND
TERTIARY
BASALT
Auriferous & Gem bearing Gravels & Diatomaceous Earth
NANDEWAR ALKALINE VOLCANICS
JURASSIC
CONGLOMERATE & SANDSTONE
TRIAS & PERM
GRANITE
PERMO CARB
SANDSTONE
Dolerite & Dolerite porphyrite
CARBON
Serpentine Gabbro &c (P)
ROCKY CREEK SERIES
BURINDI SERIES
Mudstones with Minor Limestones
DEVONIAN
BARRABA SERIES
Mudstones with Lepidodendron & Radiolaria
BALDWIN AGGLOMERATE
Limestone of Tamworth Series
TAMWORTH SERIES
EASTERN SERIES
WARIALDA
BINGARA
UPPER BINGARA
KEERA
BARRABA
MANILLA
ATTUNGA
TAMWORTH
MOUNBI
BENDEMEER
WOODS REEF
Gwydir River
Manilla River
Namoi R.
Peel R.
Myall Ck
Halls Creek
Wide areas of Basalt covered Plateau
Downthrow Side of Fault
Basalt and Tin bearing Gravels in this neighbourhood
LS
W. N. Benson delt.



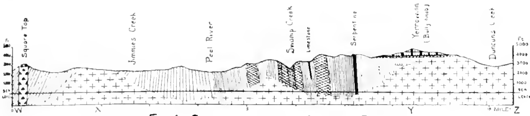


Fig. 1 Section across Nundle District.

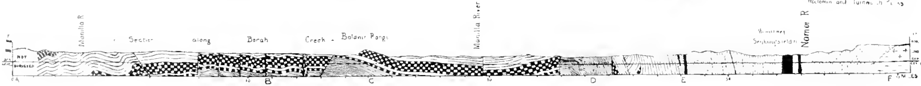


Fig. 2. Section from head of Manilla R to New England Plateau

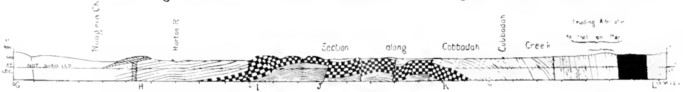


Fig 3. Section through Horton and Cobbadah

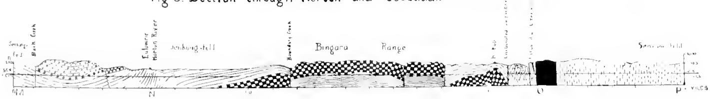


Fig 4. Section from Back Creek to Keera Senkungsfeld

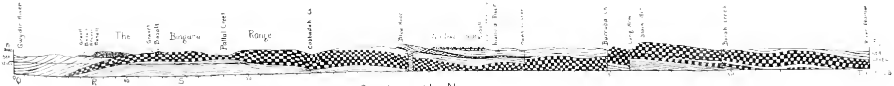


Fig 5. Generalised Section from the Gwydir to the Namoi.

particular, the area of the Lower Tuff-breccias is so full of intrusions of dolerite, that it is, in all probability, much disturbed. The uppermost member of this Series, in the Bowling Alley Point district, lies directly below the Nundle Series, the southern equivalent of the Barraba Beds. It is interstratified with thin beds of chert and shale, contains *Lepidodendron australe* and radiolaria, and, in microscopical structure, is very similar to the rock of the Baldwin agglomerate, but more finely granulated. The Upper, Banded Cherts are also interstratified with tuff, showing very peculiar relations with it. Occasionally there are small lenses of limestone, and numerous flows of spilite; one of which is very continuous, and several hundred feet thick in one place. The limestones are intermittently developed, generally in one horizon associated with spilite and breccia. The Lower Cherts and Breccias are similar to those above, but are more free from spilite in the Bowling Alley Point region. It is not yet clear how far the Upper Series is distinct from the Lower Series, or may be a repetition of it.

The section at Tamworth, described by Messrs. David and Pittman, commences at the top of the Lower Breccias, and includes the remainder of the Series. For this, they give a thickness of 9,260 feet, or about the same thickness as the whole of the Bowling Alley Series. The dip, which is very steep at Bowling Alley Point and Tamworth, lessens at Attunga; and the great thickness (1,000 feet or more) reported for the Moor Creek limestone, is probably incorrect. The widening of outcrop is due chiefly to change of dip. The limestones of Tamworth and Moor Creek are really a repetition, by folding and faulting, of the main line of limestone, which passes northwards from Moonbi to the higher part of Attunga Creek. Beyond this, it appears to pass into the eastern side of the serpentine-belt, and may be traced northwards to the latitude of Crow Mountain. Probably the continuous band of limestone, from Bingara to Warialda, belongs to this horizon. The fact that the grey, even medium-grained, andesitic tuff, so common in the Nundle-Barraba Series, is absent from the Tamworth Series in its typical form, is often a useful distinguishing feature.

The following are the fossils found in the several occurrences of limestone; and these have been claimed by Mr. Etheridge(10) as indicating a Middle Devonian age for the Tamworth Series:—

The fossil-localities are grouped as under :—

i. Parishes of Cuerindi and Attunga (fossils determined by W. S. Dun).

ii. Moor Creek and Tamworth (R. Etheridge).

iii. Moonbi (R. Etheridge).

iv. Bowling Alley Point and Nundle (W. S. Dun).

v. Crawney (W. S. Dun).

	i.	ii.	iii.	iv.	v.
Favosites gothlandica Lam., ...	...	x	x	x	x
F. basaltica, var. *moonbiensis* Eth.fil.	...	...	x	...	x
F. salebrosa Goldfuss	...	x	...	x	x
F. squamulifera Eth.fil., ...	...	x	...	...	...
F. multitabulata Eth.fil., ...	...	...	x	x	x
F. sp., cf. *forbesi* Ed. et H., ...	...	x	...	...	...
F.(?) *pittmani* Eth.fil., ...	...	...	x	?	...
F.(?) *crummeri* Eth.fil., ...	...	x	...	..	x
F. reticulata Blainv., ...	..	x	...	...	...
F. sp.nov.	x	...	...	...	...
Stromatopora sp.	...	?	...	x	x
Diphyphyllum porteri Eth.fil., ...	...	x	...	...	x
D. robustum Eth.fil., ...	...	x	...	...	...
D. sp.nov.	...	...	...	...	x
Sanidophyllum davidis Eth.fil., ...	...	x	...	...	x
Tryplasma, sp.nov.	x	...	...	...	x
Spongophyllum giganteum Eth.fil.,	...	x	...	...	x
Actinocystis(?) *cornubovis* Eth.fil.,...	...	x	...	...	x
Cyathophyllum obtortum Ed. et H.,	...	x	...	...	...
C. sp.nov.	x	...	...	...	x
Cystiphyllum australicum(?) ...	...	...	...	...	x
Microplasma parallelum Eth.fil., ...	x	...	...	...	x
Heliolites porosa Goldfuss ...	x	x	...	x	x
Syringopora auloporoides De Kon.,	...	x	...	?	x
S. porteri Eth.fil.	...	x	...	...	...

	i.	ii.	iii.	iv.	v.
S. sp.nov.	x	...	...	...	...
S. novæcambrensis Eth.fil., ..	?	...	...	...	...
Litophyllum konincki Eth.fil., et F.	x	x	...	x	x
L. sp.nov.(?)	x	...	...	...	...
Alveolites subæqualis Ed. et H. ...	...	x	...	...	...
A. sp.	...	x	...	x	x
Phillipsastræa, sp.nov.	x	...	...	x	...
Endophyllum schlüeteri Eth.fil. ...	...	...	...	...	x
Atrypa reticularis var.	...	...	...	...	x
A. sp.	...	...	...	x	...
Pelecypoda indet.	...	...	...	...	x
Euomphalus, sp.nov.	...	...	...	...	x
Crinoid stem-ossicles	x	x	x	x	x
Lepidodendron australe McCoy ...	...	x	...	x	...

The radiolaria, in the Tamworth Beds, were studied by Dr. G. J. Hinde, who described fifty-three species, all of them new, belonging to twenty-nine genera, of which four were new(**11**).

(*c*) The Baldwin Agglomerates lie conformably below the Barraba Series. They are of the same nature as the bands of tuffaceous agglomerate that lie in the latter, and are merely coarser in grain. They consist of fragments or boulders, up to a foot in diameter, of granite, and quartz-porphyry, keratophyres, trachytes, spilites, porphyritic andesites (holocrystalline or pumiceous) augite-diorite porphyrites, quartz-dolerites, radiolarian chert, or cherty tuffs, and fragments of limestone containing determinable fossils: *Heliolites, Syringopora,* and *Stromatopora* have been noted. The pebbles are included in a matrix of andesitic or spilitic, tuffaceous nature. Here and there, they pass into tuffaceous breccias, indistinguishable from those of the Tamworth Series. In the Bingara district, they are interbedded with radiolarian cherts, and contain flows of rapidly chilled, porphyritic spilite of a very basic character. In places, there are lenticles of finer-grained tuff in the coarse agglomerate, and these are of great assistance in determining the true bedding-plane. In a few places, *Lepidodendron aus-*

trale has been found in these rocks. The thickness of this Series is unknown. A thickness of 1,300 feet has been observed in the Baldwin Mountain, and 3,000 feet in Cobbadah Creek Gorge, but even here, the basal beds have not been seen. The especial feature of these beds, physiographically, is their great resistance to erosion, and consequent high relief.

No certainty has yet been arrived at, with regard to the manner in which these beds rest on the underlying Tamworth Series. The only junctions between them, studied so far, are those near Tamworth. These have been claimed by Professor David and Mr. Pittman(3) to show an unconformity of a very marked character, but the observations of the writer, on two of the three junctions, show that it is exceedingly difficulty to obtain a true angle of dip for the agglomerates (so much are they jointed), unless a pebble-band is present; and where this is seen, its dip is parallel to that of the Tamworth Beds directly below it. But, as the Tamworth Beds warp rather rapidly in this region, considerable care must be taken in examining them. The observations will be detailed later. The third area described as an unconformity, the writer unfortunately did not visit, but the evidence of the first two, throws some doubt on this last determination.

The apparently marked, lithological unconformity between the Baldwin Series and the underlying Tamworth radiolarian beds, calls for some remark. An unconformity is brought about by the intervention, between the deposition of two series, of a considerable length of time, during which the conditions have more or less completely altered. The character of the overlying beds has thus no necessary relation to that of the lower beds. Should the deposition, however, have continued while the change of conditions was in progress, and this change have been oscillatory, certain zones interstratified in one series will show indications of the conditions that will be predominant in a higher series, or, conversely, will recall the dominant conditions of lower series. There will be no absolute and sharply defined final break in the character of the sedimentation. Now the Baldwin Agglomerates differ merely in coarseness of grain, from the breccias of the Tamworth Series. The component rock-fragments, and broken mineral-grains are strikingly similar to those of the Tamworth breccia. They are interstratified with similar spilite-flows, and, in several instances, are interbedded with fine radiolarian chert and tuff, almost indistinguishable from the rocks that predominate in the Tamworth Beds. Further, the Barraba Beds, which lie conformably on the Baldwin Beds, exemplify perfectly this lithological criterion of conformity, for they contain interstratified bands of coarse, tuffaceous agglomerate or breccia, quite analogous to that of the Baldwin agglomerate, though not quite so coarse. There is, thus, a complete conformity during oscillatory change of conditions, from the Tamworth Series through the Baldwin Beds to the Barraba Series

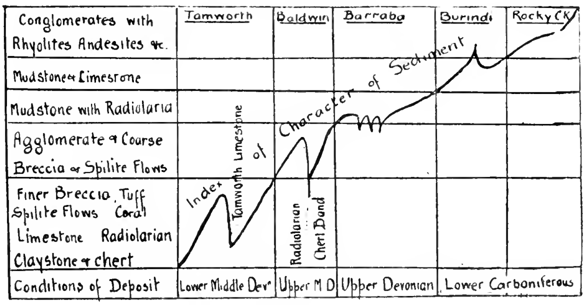


Fig.2.

(text-fig. 2). In the Nundle region, the Baldwin Agglomerates are absent, or represented by a thin band merely, of rather coarse breccia; and, above and below this, the Bowling Alley and Nundle Series lie in perfect conformity with each other. These two Series are identical with the Tamworth and Barraba Beds further north. There seems, then, sufficient grounds for dissenting from the interpretation put on the Tamworth junctions by Messrs. David and Pittman. It should be noted that their conclusion was not a very definite statement, for in the concluding remarks they say, "If the one bed of conglomerate observed near Tamworth be not referable to the Radiolarian series, as appears probable, the whole of the strata are remarkably fine-grained. . . ."

The Baldwin Agglomerates occur in the Bingara Range, rising from below the Barraba Series on the Gwydir River. They continue southwards, bordered by powerful faults on the east and west. Disappearing below the Barraba Beds in the region of Cobbadah and the Manilla River, they rise again to form the Black Mountain and Baldwin Ranges, which are cut off to the west by powerful faults; and dipping to the east, they pass, in a syncline, below the lower Manilla River, and rise again to form Pyramid Hill, above the town of Manilla. From here southwards, they have not been noted, until one comes to the three small occurrences on Cleary's Selection, near Tamworth. Southwards thence, they seem to die out rapidly. They are not seen south of Black Jack, unless the few yards thick, of rather coarse tuff that separates the Bowling Alley from the Nundle Series, may be considered their representative, as its lithology would suggest.

(*c*) The Barraba Series lies conformably above the Baldwin Agglomerates. They are the most wide-spread division of the Palæozoic rocks west of the serpentine-line. They consist of banded shales and mudstones, containing radiolaria, with slightly coarser-grained layers free from these fossils. Interbedded with these, are fine or coarsely grained bands of acid or intermediate tuff, or, rarely, conglomerate bands are present. More frequent, however, are wide or narrow zones of a tuffaceous agglomerate, recalling the Baldwin Agglomerates. In places, there are masses of rocks that might be classed as grauwackes; these are particularly well developed south and east of Cobbadah, and in the Nundle district. There are frequently also large or small lenticles of blue argillaceous limestone, which is quite free from organic remains. Throughout, *Lepidodendron australe* is particularly abundant. Indeed, the distinction between the Barraba Series and the Burindi Series, lies largely in the absence of *L. australe* (and radiolaria) from the latter. Stonier reported *L. australe* to occur with the Carboniferous Marine Beds at Burindi(6), but this is not confirmed by later collections.

As previously stated, these beds form the greater part of the area mapped, and extend far to the west of the serpentine, forming the Liverpool Plains, and the hills between the Peel River and Goonoo Goonoo. Their thickness is doubtless very great, but has not been proved, as nowhere have the top and bottom been seen in one section, nor can due allowance be made for strike-faulting, owing to the absence of horizons of reference. A thickness of about 8,000 feet is apparently developed between the fault east of Burindi and the marine beds to the west, and an apparent thickness of about 13,000 feet occurs between the Peel River and Squaretop by Nundle.

(*d*) The Burindi Series lies conformably above these mudstones, and it has not yet been possible to draw a sharp distinction between them. They consist of a fine, dark grey, fissile mudstone, with bands of tuff of an andesite nature, and occasionally a rather coarsely grained, tuffaceous breccia. Here and there are thin bands of limestone, composed almost entirely of crinoid-ossicles, and other beds largely oolitic. The formations have a very wide extent. They are found in the north, on Slaughterhouse Creek, near Gravesend, and thence, traced southwards, occur to the east of the Rocky Creek Series, all along its development. Just beyond the limits of the area studied, it is very well developd at Somerton, where a considerable thickness of highly fossiliferous limestone was found by Mr. Stonier(**6**). From information gathered, it would appear to cover a considerable area running north-west of here, appearing from beneath the syncline of Rocky Creek conglomerate that lies west of Burindi. Fossils have been found at Rangira, which probably belong to this Series, but they have not yet come under scientific notice. Further south, there is an extension parallel to the Rocky Creek conglomerates. Marine fossils have been collected near Goonoo Goonoo and Gundy, and are developed in great amount in the Paterson-Clarencetown area, north of Newcastle, as studied by Messrs. J. B. Jaquet and L. F. Harper (**12**). There are also other areas of development to be considered. Along the western margin of the serpentine, stretching from the head of Hall's Creek to the Namoi River, is a line of similar mudstones and tuffs, which contain Carboniferous fossils. The southernmost occurrence is near the Namoi River, and consists of a lenticle of limestone about 100 yards in length, entirely composed of crinoid-remains, and, except for its greater width, completely analogous to the limestones at Burindi. Further north, at Crow Mountain, there is a series of fossils of the same facies as those of Burindi also. These were first noted by Stonier(6d). North again, however, there is an occurrence of quite a different facies, in the shape of a lenticular mass of limestone, composed chiefly of *Lithostrotion*. These indicate a Carboniferous age for these rocks. It is probable, though not at present capable of proof, that these last are on a rather lower horizon in the Carboniferous, than the Burindi and Crow Mountain fossil-beds.

The mudstones, with oolitic limestones, on Oakey Creek, south of Warialda, probably belong to the Burindi Series also.

These areas adjacent to the serpentine are, without doubt, repetitions of those further west, nipped into the older Barraba rocks during the period of folding.

The following are the determinative fossils that have been recognised in this belt of marine Carboniferous rocks.

In this list, D indicates a determination made by Mr. W. S. Dun, E by Mr. R. Etheridge, Jun., K by Professor De Koninck (in 1875), and S by Mr. S. Stutchbury, in 1853-5. The various localities studied (with the collectors) are as under:—

i. Slaughterhouse Creek ...	Carne.
ii. Pallal and Eulowrie ...	Stutchbury, Cullen, Porter.
iii. Rocky Creek	Pittman.
iv. Burindi	Benson.
v. Crow Mountain... ...	Stonier, Cullen, and Benson.
vi. Somerton, Carroll, etc. ...	Stonier, Cullen, Porter.
vii. Paterson, Clarencetown, and Dungog.	Clarke, Waterhouse, Cullen, and others.

The last area is the most fully studied Carboniferous locality in New South Wales, and is added for the sake of comparison. Only such forms as occur elsewhere, also, have been mentioned, so that, for this locality, the list is incomplete.

	i	ii.	iii.	iv.	v.	vi.	vii.
CŒLENTERATA.							
Cladochonus tenuicollis	...	E	...	D	...	D	K
Cyathophyllum sp.	D	...	...	...	...	...	K
Zaphrentis culleni	...	E	...	D	...	...	E
Z. sumphueus	...	...	...	...	...	E	...
Z., other species	D	...	...	...	D	...	K
Amplexus, sp.ind.	...	E	...	...	...	...	...
Lophophyllum minutum	...	...	...	...	...	..	*K
L., cf. *corniculum*	...	...	...	D	...	...	K
Lithostrotion columnare	...	E‡	...	...	...	...	...
L. irregulare	...	...	...	...	...	...	†K
Turbinolopsis	...	S	...	...	...	...	...
Syringopora syrinx	...	E§	...	...	...	...	...
S. sp.	D	...	...	...	...	‖	K
Michelinia sp	...	D	...	...	...	E	...
Trachypora	...	...	...	...	...	...	D
CRINOIDEA.							
Platycrinus sp.	...	S	...	...	...	...	...
Actinocrinus sp.	...	...	...	...	D	...	D
Cyathocrinus sp.	...	S	...	...	...	...	K
Metablastus	...	...	...	...	...	...	¶
Crinoid ossicles (in all localities) ..	x	x	x	x	x	x	x
BRYOZOA.							
Fenestella propinqua	...	K	...	...	...	...	K
F. multiporata	..	...	...	...	...	...	D
F., other species	D	D	D	D	D	D	K
Thamniscus sp.	...	D	...	...	...	...	...
Dendricopora hardyi	...	K	...	...	...	...	K
Glauconome bipinnata	...	S	...	...	...	...	...
Retepora sp.	...	S	...	...	...	...	...
R. laxa	...	...	...	...	D	...	...
Rhombopora sp.	...	D	...	...	D	...	...
Polypora sp.	...	...	...	...	?D	...	K
Stenopora sp.	..	...	...	...	...	...	D

* From Colo Colo River.

† From Manning River.

‡ Probably also at Hall's Creek.

§ Probably also at Hall's Creek, Lithostrotion limestone.

‖ Possibly *S. novæcambrensis* (Eth.fil.) is of Burindi age, and may occur south of Crow Mountain.

¶ Taylor, T. G., Proc. Linn. Soc. N. S. Wales, 1906, xxxi., p.52.

	i.	ii.	iii.	iv.	v.	vi.	vii.
*BRACHIOPODA.							
Lingula	...	...	...	...	D	...	...
Orbicula sp.	...	S	...	...	...	...	...
Orbiculoidea nitida	...	...	...	...	..	...	D
Productus semireticulatus... ...	...	...	...	D	...	D	K
P. undatus	...	...	...	D	...	...	K
P. barringtonensis	...	...	...	...	...	...	D
P. aculeatus	...	K	...	...	...	...	K
P. cf. *grandicosta*	...	...	...	...	...	...	D
P. cf. *pustulosus*	...	...	...	D	...	...	D
P. cf. *spinulosus*	...	...	...	D	...	...	...
P. cf. *muricatus*	...	...	...	...	...	D	...
P. cf. *murchisoni*	...	...	...	...	...	D	...
P. cf. *longispinus*	...	...	...	...	...	D	D
P., other species	...	D	D	D	D	..	...
Daviesiella sp.(?)	...	...	...	...	D	...	...
Chonetes laguessiana	...	K	...	...	...	...	K
Leptæna (*Strophomena*) *rhomboidalis*, var. *analoga*	...	S	...	D	D	D	D, K
L., other species	D	S	...	...	...	...	...
Orthotetes crenistria	...	..	...	D	D	D	D, K
Orthis (*Schizophoria*) *resupinata* ...	...	S, K	...	D	D	D	D, K
Orthis (*Rhipidomella*) *australis* ...	...	...	D	...	D	D	D, K
Orthis, other species	...	...	...	D	...	...	...
Spirifera disjuncta	...	S	...	...	...	...	...
S. striata	...	...	...	D	...	D	D
S. bisulcata	...	...	...	D	..	...	K
S. lata...	...	...	...	?D	D	...	D
S. humerosa	...	cf. D	...	...	...	D	...
S. pinguis	...	..	...	...	...	D	D, K
S. convoluta	...	S	...	...	...	...	...
S., other species...	D	D	D	D	...	D	K
Syringothyris exsuperans	...	D	...	...	..	...	D, K
S. cf. *cuspidata*	...	...	...	D	...	...	K
Spiriferina cristata	...	...	...	...	...	...	D
Dielasma hastata	...	K	...	...	...	D	D, K
Rhynchonella sp.	D	...	...	...	...	...	K
R. pleurodon	...	...	...	...	...	...	D
Hypothyris	...	S	...	...	...	...	...
Retzia sp.	...	...	...	D	...	...	...

* For a list of the Brachiopoda of the Clarencetown Series, see Dun, W. S., Records Geol. Survey, N. S. Wales, 1902, vii., pp.72-93, Pls.21-23.

	i.	ii.	iii.	iv.	v.	vi.	vii.
Reticularia lineata	..	...	...	D	...	...	D
Athyris sp.	...	..	...	D	D	...	...
Actinoconchus planosulcatus ...	...	...	..	D	...	...	E
Atrypa sp.	...	S	...	...	...	...	...
PELECYPODA.							
Allorisma	...	...	...	...	...	...	D
Orthonota sp.	...	S	...	...	...	...	...
Cardinia	...	...	...	...	...	...	D
Nucula sp.	...	S	...	...	...	...	..
Mytilus sp.	...	S	...	...	...	...	...
Posidonia sp.	...	S	...	...	...	...	...
Pteronites(?) *tanipteroides*... ...	...	...	...	...	...	E	...
P. pittmani	...	...	...	...	...	E	...
Pterinea	...	...	...	...	...	...	D
Avicula sp.	...	S	...	...	...	...	K
Pecten sp.	...	S	...	...	...	...	...
Entolium aviculatum	...	...	...	...	...	D	?E
Aviculopecten sp.	...	...	...	...	...	D	K
A. cf. *granulosus*	...	...	...	...	...	...	D
Edmondia sp.	...	...	...	D	...	...	...
SCAPHOPODA.							
Dentalium sp.	...	...	...	...	...	D	K
GASTROPODA.							
Bellerophon sp.	...	S	D	...	...	...	D
Euomphalus sp....	...	S	D	...	...	...	E
Worthenia canaliculata	...	...	...	...	...	E	...
Loxonema sp.	...	S	D	...	...	D	K
L babbindoonensis	...	...	...	...	...	D	...
Macrocheilus sp....	...	S	D	...	...	...	K
Orthonychia, sp.nov.	...	...	D	...	...	...	...
Platyceras altum	...	S, K	...	...	...	...	...
PTEROPODA,							
Indefinite species	...	S	D	...	...	...	...
Conularia	...	...	...	...	...	...	D
CEPHALOPODA.							
Orthoceras sp.	...	S	...	...	...	...	D
O. cf. *martinianum*	...	...	...	...	...	...	D
TRILOBITA.							
Phillipsia grandis	...	...	...	...	...	E	...
P. dubia	...	...	...	...	...	...	D
Other species	...	S	...	D	D	...	K

Plantæ.—*Lepidodendron australe* has been reported from Burindi and Eulowrie, but is to be very doubtfully referred to the Carboniferous Marine Series.

Lepidodendron veltheimianum has been recorded from Clarencetown (Ann. Rept. Dept. Mines for 1898, p.167).

The thickness of the fossiliferous marine beds, at Burindi, is about 1,000-1,500 feet, but it is not yet possible to define their lower limit. In the Clarencetown area, Messrs. Jaquet and Harper suggested that the Marine Series, volcanics, and conglomerates (equivalent of the Rocky Creek Beds), together amount to 19,000 ft. in thickness(11), but there is probably repetition here.

(*a*) The Rocky Creek Conglomerates form one of the most persistent horizons in New South Wales. They consist of heavy conglomerates containing pebbles of acid igneous rocks, granite, aplites, quartz-porphyries, rhyolites, etc., with trachytes, dacites, and andesites. These conglomerates are interbedded with flows of rhyolite, trachyte or andesite, of a similar nature to that of the pebbles in the conglomerate, together with beds of tuff of the same variety of composition, passing into tuffaceous and gritty sandstones. They occur, in the north, in the Slaughterhouse Creek Ranges, and extend thence south to Rocky Creek, and the eastern slopes of the Nandewar Mountains, pass west of Burindi, and are cut out near the head of the Manilla River. They commence again further to the south, beyond the limits of the map given, and may be followed thence from the south-west of Goonoo Goonoo, past Gundy down into the districts of Gosforth, Paterson, and Clarencetown in the vicinity of Maitland and Newcastle. This intermittent line of outcrop is thus roughly parallel to the serpentine-line, lying from 20-40 miles west of it, and extending for 200 miles. The beds have also a considerable lateral extension to the west, for the intricate series of Carboniferous volcanic rocks, recently described by Messrs. Walkom and Browne(13) at Pokolbin, 50 miles south-west of Newcastle, undoubtedly belong to this series. With the exception of the last rocks, and those developed at Clarencetown, no part of this huge extent of conglomerates and volcanics has been studied in any detail as yet.

The fossil content of this series is small. In the northern portion, near Slaughterhouse Creek, Mr. G. A. Stonier(6c) found some leaf-fragments resembling *Rhacopteris*. In the continuation of these beds down into the Newcastle region, a larger flora is developed, the following being the chief species :—

Calamites (*Archæocalamites*) *radiatus* Feistmantel.
Lepidodendron veltheimianum Feist.
L. volkmannianum Feist.
L. dichotomum Feist.
Knorria Feist.
Cyclostigma australe Feist.; n.s.
C. kiltorkense (?) Feist.
Anemites ovata Arber, Dun, = *Rhacopteris inæquilatera* Feist.
Rhacopteris intermedia Feist., Dun; n.s.
R.(?) *rœmeri* Feist.
R. septentrionalis Feist.; n.s.
Archæopteris wilkinsoni Feist.; n.s.
Cardiopteris polymorpha Dun.
Sphenopteris clarkei Dun; n.s.
Sphenophyllum sp., Feist., = *Anemites*(?) sp., Dun.

In the above list, the names given are those of the palæobotanists who recognised the occurrence of the several species in New South Wales; n.s., indicates that the species was not known elsewhere. Mr. Arber has kindly pointed out to the writer, that all the genera are found in the European Lower Carboniferous, and many of the species are characteristic of that Series. It seems justifiable, therefore, to consider these plant-beds as of Lower Carboniferous age, though they form the upper portion of the Carboniferous Series proper, as developed in Northern New South Wales.

The vertical extent of the Rocky Creek Series is unknown; in the type-locality, a thickness of at least 2,000 feet is exposed.

Such then is the sequence of the older palæozoic sediments. We may now revert to Devonian times, to consider the igneous succession. The spilitic flows and tuffs of the Woolomin and Tamworth Series have already been described. Connected with these, there is a great development of dolerite, often albitised(14). In the preliminary note(15), the writer termed this a diabase, and considered it of later date than the serpentine. The term, however, has been altered, in accordance with modern British nomenclature. The consideration of the age is a different matter. The field-relations in the Nundle region were insufficient to determine, with precision, the position and origin of the rock, and the petrological peculiarity had not been noted. It was thought best to consider it as a later differentiate of the same magma as the serpentine, and, therefore, to be looked for in connection with that rock. At the same time, it did not escape notice, that the dolerite-intrusions ran roughly parallel to the strike, and were confined to the Tamworth (there called Bowling Alley) series of rocks. The later work in the northern district, and the detailed petrology have added much information. Several other distinctive types of dolerite have been found, but that which is analogous to the Nundle dolerite, occurs in rocks of the Tamworth Series only, whether these lie east or west of the serpentine-belt. Where the Tamworth rocks are not developed, the serpentine is quite unaccompanied by dolerites of this character. Moreover, the so-called andesitic lavas in the Tamworth Series, asssociated with the dolerites, prove to be spilites. There are many occurrences cited by Steinmann(16), and Messrs. Dewey and Flett(17), of Ordovician Hercynian, and Alpine eruption-periods, where sediments, usually radiolarian, are associated with tuffs, spilite-flows, and *intrusive sills* of dolerite; and it seems most probable, in view of the later observations, that a like association holds for the rocks under consideration here. In all, these sills are about 2,500 feet thick in the Bowling Alley Point district, but are extremely irregular. The present group of dolerites are then connected with the spilites, not *directly* with the peridotites; and as, in the north, the dolerites have undergone the crushing, in areas east of the serpentine-line, they may fairly be considered to be of earlier date than the serpentine. These dolerite-intrusions were probably almost contemporaneous with the spilite lava-flows, possibly somewhat later.

After the succeeding explosive action that produced the Baldwin Agglomerates, there was a long period of quiet. Then igneous activity broke out again, and the rhyolites, andesites, and tuffs of the Rocky Creek Series were ejected.

The intrusion of the peridolites then followed; they have been shown to occur chiefly in the fault separating the Eastern rocks from the rest of the country, and it is probable that they were intruded into this fault-plane during the crust-movement. They show some signs of shearing in themselves. That the folding period was at the close of the Carboniferous, is indubitable, in view of the strong unconformity between horizontal or slightly disturbed Permo-Carboniferous beds, and highly disturbed Carboniferous rock existing at most points, where the two formations are in contact. The serpentine has intruded the Burindi Carboniferous Series at Crow Mountain, and a pebble of serpentine occurs in the Permo-Carboniferous sandstones in the Newcastle district, as do also other rocks which have come from the north. The Jurassic sandstones lie horizontally and undisturbed, on the vertically dipping serpentine-mass near Warialda. The evidence for these statements will be detailed later. Unfortunately, the Permo-Carboniferous beds and serpentine occurring together *in situ*, are not clearly exposed, so that a direct proof in this manner is impossible

The gabbros and eucrites came slightly later than the serpentines. Their schistose structure suggests solidification during movement, while the dynamic type of metamorphism is indicative of the after-pressure they received by the later stages of the earth-folding.

Intruding the gabbros and serpentines, are a small series of dykes of dolerite, different from the earlier type of dolerite. They are common in the country north and south-east of Barraba, but have not been sought much elsewhere. In some mineralogical and structural variations, there are strong resemblances to certain of the lamprophyres of this region.

A third series of dolerites occur, the age and relationships of which cannot be told at present. They make large and small sills, and laccolites in the Barraba Series of rocks, in the region between Burindi Station, Horton and Cobbadah. Blue Knob laccolite is the larger of these. The manner of alteration suggests a Pre-Tertiary, probably a Pre-Mesozoic age, for these dolerites. Possibly they were intruded during the folding along an east and west axis, which seems to have followed the meridional crumpling. It may be that this movement was connected with that which lowered part of the Carboniferous range, admitting the deposition of Permo-Carboniferous sediments, in the lower series of which, are interstratified, hypersthene, andesite flows, in the Newcastle district. This relationship is, however, pure conjecture, there being little or no evidence on which to base any reasoning.

Following the main intrusions of basic igneous rocks, there occurs a long series of granitic intrusions, ranging probably from the latest Carboniferous to early Mesozoic times. The following grouping of these, based on the work of Andrews(**18**), Cotton(**16**), and others, must be regarded as tentative only.

Upper Carboniferous(?)—1. Felsites of Bingara.

Permian.—2. Granodiorites and Porphyries of Nundle.
3. Sphene-Granites of Moonbi.
4. Tingha Granite.

Early Mesozoic.—5. The "Acid Granite."
6. Tourmaline-granites east of Bingara and Manilla.

These masses of granite form a long series of intrusions lying *behind* the serpentine-intrusion, *i.e.*, in the direction from which the thrust came. In three places, however, the granite-rocks occur in front of the serpentine, namely, in the case of the Bingara felsites, and also in the large area of sphene-granite that has cut through the serpentine at Tamworth, and stretches between Moonbi and Attunga. Again, in the Nundle district, the whole area is seen to rest on a batholith of granite, which appears both east and west of the serpentine-belt.

The great and varied series of lamprophyre-dykes, which occur occur along the serpentine-belt, cannot be referred to any definite eruption-period as yet. Though they seem associated with the serpentine, it is difficult to understand their genetic relationship; it must be noted that the area between the serpentine and the granite, in the background, has not yet been thoroughly searched, and it is probable that evidence will be found there connecting the lamprophyres with the granites. In this connection, it is interesting to note that Mr. E. C. Andrews(17) has found a series of camptonites and other lamprophyres at Hillgrove, which lies on the eastern boundary of the intrusions of the sphene-granite period. He has shown these dyke-rocks to be, there, the latest phase of the igneous activity.

We now return to the consideration of the record of sedimentary rocks. The great earth-folding, which culminated in the intrusion of the peridotite, was a mountain-making period, but, nevertheless, in the closely following Permo-Carboniferous times, before the long series of granite-intrusions was at an end, sedimentation was again in progress. But of this we have very fragmentary evidence in the area under notice. Near Bowling Alley Point, a small block of a few acres only, in extent, has been faulted in among the Devonians, and thus preserved from denudation. The occurrence, in it, of *Glossopteris* leaves(6a) and Permo-Carboniferous marine shells, suggests that here is a portion of the Upper Marine series with some of the Upper Coal-Measures. Again, in the Nandewar Mountains, Dr. Jensen(9) has shown the presence of *Glossopteris* in coal-bearing Upper Coal-Measures, resting unconformably on Carboniferous conglomerates, while Stutchbury, in 1853, noted a coal-seam, and the leaf-bearing sandstone of Derra Gap, west of the Horton River(7). Thirty miles north-east of Warialda, is Ashford, where definite Lower Marine Beds and Lower Coal-Measures have been found(18) on, thence, the Permo-Carboniferous beds, in a highly disturbed condition, stretch east and north to Emmaville, Drake, Texas, and Warwick(19). These contain forms of both the Lower and Upper Marine, and, near Texas, boulders, claimed as belonging to the glacial series.

Following the Permo-Carboniferous period was an era of great crumpling, increasing in intensity in the northern areas. The Newcastle district is slightly folded and faulted; the Nundle district must have been highly faulted; but the area around Ashford, and to the north and east, has been highly folded indeed, so that the rocks have largely become slates. It is for this reason, that the

38

Permo-Carboniferous Beds so long escaped notice. There was so little to distinguish them from the older palæozoic slates associated with them. No doubt, the series of Permian and early Mesozoic intrusions accompanied these foldings.

A long period of erosion followed, and the granite was laid bare. On it was deposited a series of arkoses, conglomerates, and sandstones, which occur in the neighbourhood of Warialda, overlying granite; rocks of the Eastern series, serpentine and Barraba mudstones. These sandstones, etc., are about 100 feet thick, and contain *Alethopteris*, *Phyllopteris*, and *Brachyphyllum*, and have been referred to the Jurassic period(**6**d). They are quite undisturbed or merely gently inclined. In the neighbourhood of Slaughterhouse Creek, they form the upper parts of the range, capped by basalt, and are probably rather thicker than at Warialda.

The Tertiary formations are largely volcanic, and, for the sake of completeness, a very brief résumé of Dr. Jensen's(**9**) work in the Nandewar district, together with other facts, may here be given. In early Tertiary or late Mesozoic times, there occurred crustal movements, throwing down the western part of the Nandewar region. This induced volcanic action, commencing with the intrusion of dolerite-sills into the Permo-Carboniferous strata, followed by:—

(*a*) Sill-like and laccolitic intrusions of syenite, accompanied by flows of phonolite, trachyte, and allied alkaline lavas.

(*b*) Alkaline andesites and more porphyry-sills.

(*c*) Basic porphyrite-dykes and basalt-flows, which lasted into Pliocene times.

In the Barraba region, an ancient, wide-spreading river-basin became greatly alluviated during the early part of these eruptions, and a considerable amount of trachytic tuff is contained in its leaf-bearing clays, which are of considerable thickness, and contain Eucalyptus; the upper layers include a bed of diatomaceous earth about 10 feet thick(**22**). These are covered by the great flows of basalt of the last igneous epoch. Elsewhere there are masses of basalt covering a greater or less thickness of leaf-bearing, Tertiary drift, auriferous or gem-bearing clays, sands, and gravels. Such occur at Bingara, and south of Keera, and are discussed in more detail later.

In the Nundle district also, the Tertiary period was one in which valleys were deeply cut, filled with auriferous drift, and flooded with basalt. Just outside the area of the present survey, it seems probable that this basalt was much intruded by sills of teschenitic dolerite, and basanite(13).

A great period of elevation and block-faulting closed the Tertiary period, and the present topography was thus initiated. This requires careful study, and will be discussed in a later chapter.

LIST OF REFERENCES CITED.

1. ANDERSON, W. A.—Ann. Rept. of Dept. of Mines N. S. Wales, 1888, pp.179-182.
2. CLARKE, W. B.—Reports on the Goldfields of New South Wales, published in the Votes and Proceedinga of the Legislative Council. Papers relative to the Geological Survey of New South Wales, and also in Great Britain, Parliamentary Papers. Further Papers relative to the Discovery of Gold in Australia. Contracted titles of the several reports and references as under.
   (*a*) Report i., Geology of the Country between Marulan and Peel River.
   (*b*) Report ii., Hanging Rock Diggings : Geology.
   (*c*) Report iii., Dispersion of Gold in Australia.
   (*d*) Report v., Hanging Rock and Peel River Field : Conditions and Prospects.
   (*e*) Report viii., Western Slopes of New England : Structure.

N.S.W., Leg. Council.	Great Britain, Parl. Papers.
(*a*) 1852, ii., pp.463-467.	Aug.1853, pp.26-30.
(*b*) 1852, ii., pp.469-475.	Aug.1853, pp.30-35.
(*c*) 1852, ii., pp.477-482.	Aug.1853, pp.35-39.
(*d*) 1852, ii., pp.485-487.	Aug.1853, pp.40-42.
(*e*) 1853, i., pp.565-612.	Feb. 1854, pp.42-55.

3. DAVID, T. W. E., and PITTMANN, E. F.—"On the Palæozoic Radiolarian Rocks of New South Wales. Q.J.G.S., 1899, pp.16-37.
4. JAQUET, J. B.—Ann. Rept. of Dept. of Mines of New South Wales.
5. ODERNHEIMER, F.—"On the Geology of a part of the Peel River District in Australia." Q.J.G.S., 1855, pp.399-402.

6. Stonier, G. A.—(*a*) Ann. Rept. Dept. Mines N. S. Wales, 1891, p.261; (*b*) *ibid.*, 1892, p.137; (*c*)*ibid.*, 1894,pp.131-137; (*d*)*ibid.*, 1895, pp.160, 168, 172.

7. Stutchbury, S.—Trimonthly Reports. Geology of Warrumbungle Mountains and Namoi River Districts (*a*) and Country between Nandewar Ranges and the Condamine River, (*b*)N.S.W., Leg. Council, Votes and Proc., 1853, ii., pp.467-473, 685-695. Great Britain, Parl. Papers. Further Papers relative to Gold in Australia. Feb. 1854, pp.13-17. Dec. 1854, pp.45-54.

8. Ulrich, G. H.—"Notes on the Geology of New South Wales and Queensland, made in 1842-43." Cited by W. B. Clarke, in "Sedimentary Formations of New South Wales." Fourth Edition, Appendix xii.

9. Jensen, H. I.—"The Geology of the Nandewar Mountains." Proc. Linn. Soc. N. S. Wales, 1907, pp.842-914.

10. Etheridge, R., Jun.—"The Corals of the Tamworth District." Rec. Geol. Surv. N. S. Wales, Vol. vi., p.151.

11. Hinde, G. J.—"The Radiolaria in the Devonian Rocks of New South Wales. Q.J.G.S., 1899, pp.39-63.

12. Jaquet, J. B., and Harper, L. F.—"The Iron-Ore Deposits of New South Wales." Memoir No.2, Geol. Survey of N. S. Wales, 1901, Chap.vi., and Map. Also, Ann. Rept. Dept. Mines.

13. Walkom, A. B., and Browne, W. R.—"The Geology of the Eruptive and Associated Rocks of Pokolbin, New South Wales." Journ. Proc. Roy. Soc. N. S. Wales, 1911, pp.379-407.

14. Benson, W. N.—"Spilite Lavas and Radiolarian Rocks in New South Wales." Geol. Mag., 1913, p.21.

15. ————————"A Preliminary Account of the Geology of Nundle District, near Tamworth, N.S.W." Report Aust. Assoc. Adv. Sci., Vol. xii., pp.100-106.

16. Steinmann, G.—"Die Geologische Bedeutung der Tiefseebildungen und der opiolischen Eruptiva." Geol. Beobachtungen in den Alpen, ii., xvi., pp.44-65, 1905.

17. Dewey, H., and Flett, J. S.—"British Pillow Lavas and the Rocks associated with them." Geol. Mag., 1911, pp.202-9 and 241-8.

18. Andrews, E. C.—"The Geology of the New England Plateau, with special reference to the Granites of Northern New England." Rec. Geol. Survey N. S. Wales, Vol. viii., pp.108-129.

19. Cotton, L. A.—"The Tin-Deposits of New South Wales. Part i. The Elsmere-Tingha District." Proc. Linn. Soc. N. S. Wales, 1909,p.733.

20. Andrews, E. C.—Report on the Hillgrove Gold Field. Mineral Resources. Geol. Survey of N. S. Wales, 1900, pp.16, 17, and 24. Also, "The Geology of the New England Plateau. Part iv." Rec. Geol. Survey N. S. Wales, Vol. viii., pp.227-229.

21. DAVID, T. W. E.—"The Geology of the Hunter River Coal-Measures." Memoir No.4. Geol. Surv. N. S. Wales. Also, PITTMANN, E. F., Records Geol. Surv. N. S. Wales, Vol. v., pp.26-30.
22. ANDREWS, E. C.—"Report on the Drake Gold and Copper Field." Mineral Resources, Geol. Surv. N. S. Wales, No.12, 1908, pp.3-11, and the authorities there cited.
23. PITTMANN, E. F.—Ann. Rept. Dept. of Mines N. S. Wales, 1881 (1882), p.142. Also, CARD, G. W., and DUN, W. S., "The Diatomaceous Earth Deposits of New South Wales." Rec. Geol. Surv. N. S. Wales, Vol. v., Pt.3, p.19.
24. BENSON, W. N.—"Preliminary Note on the Nepheline-bearing Rocks of the Liverpool and Mount Royal Ranges." Journ. Proc. Roy. Soc. N. S. Wales, 1911, pp.176-186.

EXPLANATION OF PLATES XX.-XXI.

Plate xx.

Geological Map of the Bingara and Tamworth District.

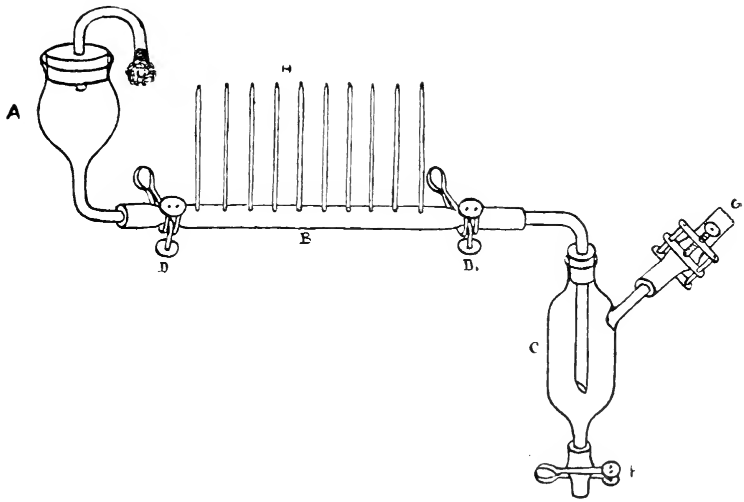
Plate xxi.

Geological Sections across the Bingara, Tamworth, and Nundle District.

NOTES AND EXHIBITS.

Mr. D. G. Stead reported that during a recent visit to the head-waters of the Jenolan River, within five miles of Jenolan, he had found Lyre-birds to be plentiful, and holding their own, in spite of the menace of the fox; and he considered that they may be expected to continue to do so, provided they are protected from being shot. Scrub-wallabies and wombats were also found to be plentiful; and from information received from residents, he had reason to think these interesting animals were on the increase; and it was to be hoped that they would not be unduly interfered with.

Mr. R. Grant showed, and explained the method of using a simple form of apparatus for the rapid filling of capillary tubes with calf-lymph, devised by Mr. A. B. Duffy and himself, and now in use in the Microbiological Laboratory of the Department of Health. With this apparatus, one person can easily fill over 600 capillary tubes in an hour, and all tubes are uniformly filled, —specimen-tubes. It can easily be made by any laboratory assistant, is very readily cleaned, and its cost is merely nominal. All that is required is a thistle-funnel, a piece of rubber pressure-tubing, with a series of holes pierced on the upper surface, three pinchcocks, a screw-clamp, and two or three pieces of glass tubing, one piece of which must be of fairly large calibre, with the ends drawn, and a side-tube blown into it. The method of filling tubes by means of the exhaust is—Fill funnel A with lymph. Open clamp D to allow a small flow of lymph to displace any air that may be caught in the tubing, between the funnel and the first capillary tube. As soon as the lymph is seen to ooze through the opening, close D. Insert the capillary tubes, the upper ends of which are sealed. Then start the exhaust, the screw-clamp controlling it being open. The exhaust is obtained by means of a Bunsen filter-pump attached to the service-pipe. It is very much handier than a hand-pump, and requires less attention. With the Bunsen pump, one merely has to turn on the water, and give an occasional glance at the pressure-gauge. It also enables the operator to devote the whole of his attention to the filling of the capillary tubes. With a properly constructed Bunsen pump, and a good pressure of water, a good exhaust can



Explanation of Figure.

A, Funnel or reservoir for holding the lymph—B, Rubber pressure-tubing, pierced in ten places on the upper surface, for holding the capillary tubes—C, Tube for catching overflow of lymph from tubing B—D, Clamp which controls the flow of lymph to capillary tubes—D_1, Clamp to control the exhaust—E, Rubber cork fitted with a piece of curved glass tubing, plugged with cotton-wool—F, Clamp: through this opening, the overflow lymph is withdrawn—G, Tube to exhaust, controlled by a screw-clamp—H, Capillary tubes.

be obtained in two or three minutes. When the manometer registers about 680 mm., open clamp D_1 for about 10 seconds, and then close it: next open clamp D: the lymph from A will now rush in, and fill all the capillary tubes to within $\frac{1}{8}$ inch of the ends. By keeping clamps D and D_1 both closed, the filled tubes can be removed, and replaced with fresh ones, and the operation repeated. After every filling, a small quantity of lymph remains in the rubber tubing B. This is removed, with every subsequent exhaustion, into tube C. When sufficient lymph has collected there, it can be readily withdrawn, and used over again by screwing down the clamp on tubing G, and opening clamps D_1 and F. Clamping tube G cuts off the exhaust and no capillary tubes must be placed in B. Filling the tubes by gravitation is very much simpler than the exhaustion-method. It is also much slower (the exhaustion is almost instantaneous), also open capillary tubes must be used. Fill up the funnel or reservoir A with lymph. Insert the capillary tubes. Keep clamp D_1 closed. Now open clamp D slowly. Watch the lymph rising in the tubes, close D as soon as it reaches to $\frac{1}{4}$ inch of the top of the tubes. With a portable peep-light, seal the end of each.

Mr. A. A. Hamilton exhibited some examples of Teratology, from the Collection of the National Herbarium, comprising *Rosa* Hort. var., Sydney Botanic Gardens(W. Challis; August, 1913), showing complicated prolification of the flower. The suppressed ovary is represented by an expansion of the flower-stalk, the sepals are leaf-like, the lower petals reflexed, the upper ones unaffected; the axis is prolonged, and bears a circlet of miniature roses, each with a leafy calyx; a few coloured petals, and foliar staminal and carpellary organs are present, the axis finally terminating in a tuft of leaves.—*Plantago lanceolata* Linn., Petersham(T. Steel; June, 1906), showing foliar prolification of the inflorescence, a tuft of leaves occurring on the apex of the flowering-spike, after the maturation of the fruit.—*Dodonæa peduncularis* Lindl., showing foliar prolification of the flower. An example of the male inflorescence of a diœcious plant, in which the calyx is normal, and the stamens replaced by a whorl of leaves.

Miss Hynes showed a specimen of *Coccoloba* (*Muehlenbeckia*) *platyclada* F.v.M., exhibiting xerophytic characters. When grown in a dry situation, the stems, as well as the branches, function as leaves.

Mr. W. W. Froggatt showed a series of specimens recently collected by him in the New Hebrides, comprising—a web-spinner, *Oligotoma* sp. [Fam. *Embiidæ*]; a handsome fruit-fly, *Dacus frenchi* Froggatt, a common orange-pest; and another fruit-fly(*Dacus* sp.) close to, if not identical with, the common melon-fly of India and Ceylon(*D. cucurbitæ* Coqu.), and destructive to melons in the Northern Territory of Australia. Also specimens of four species of Coconut leaf-mining beetles [Fam. *Hispidæ*], *Promecotheca opacicollis* from the New Hebrides, *P. antiqua* from the Solomon Islands, *P. reichei* from Fiji, and an undetermined species from Samoa; these beetles do an enormous amount of damage in the coconut plantations.

Mr. North, by the sanction of the Curator of the Australian Museum, sent for exhibition, the types of *Vini stepheni*, *Ptilopus insularis*, and *Porzana atra*, collected by Mr. A. E. Stephen, in 1907, at Henderson or Elizabeth Island, an outlier of the Paumoto Group or Low Archipelago, in the South Pacific, described by Mr. North in the Records of the Australian Museum, in the following year. Attention has recently been drawn to these species by Mr. W. R. Ogilvie Grant, in a paper in the July number of "The Ibis," in which he beautifully figures Stephen's Lorikeet, *Vini stepheni* (North).

DISCUSSION.

The discussion on "The Study of Zoogeographical Distribution by means of Specific Contours," introduced by Mr. R. J. Tillyard at the Meeting in May, was continued by Dr. J. B. Cleland. Mr. Tillyard reviewed, and replied to, the criticism of his proposals. The following is a summary of the discussion: (for Mr. Tillyard's introductory remarks, see pp.172-173).

Dr. Ferguson exhibited a typical Entogenic Contour, which he had obtained by Mr. Tillyard's method, for a well-defined group of Australian *Amycteridæ* [Coleoptera].

Dr. Cleland claimed that the chief, in fact, almost the only, factor in the determination of zoo-geographical distributions of groups was the tendency of species to mutate; and expressed the opinion that Mr. Tillyard's zoocentres were simply areas in which the greatest mutation had occurred.

Mr. Fletcher pointed out the very great importance of climate as a determining factor; and asked Mr. Tillyard whether he could establish any correlation between his specific contours, and the known facts of rainfall-distribution in Australia.

Mr. Waterhouse said that faunal regions were very indefinite, and merged into another. He had long ago recognised the essential difference between entogenic and ectogenic groups; the idea was not a new one, but only presented in a new manner. He also pointed out how important it was that depressions or lacunæ in the contours should be carefully shown.

Mr. Darnell Smith gave a summary of the distribution of earthworms, and finally announced himself as a supporter of Mr. Tillyard's scheme.

Mr. Mackinnon said that he had succeeded in establishing an entogenic contour for one group of parasitic fungi (*Uromyces*), but had failed to get any definite result with *Puccinia*. He objected to the introduction of new names, which only added to the burden of scientific study. He advocated the use of transparencies over prepared maps.

Mr. Maiden laid stress upon the paucity of data for most groups, also on the indefiniteness of species. These would prove grave difficulties in the use of Mr. Tillyard's method.

Dr. Kesteven claimed that Mr. Tillyard's method did not show all the facts. He objected to the term "archipelagic contour" He instanced, as a case of discontinuity, that a group of rushes occurred in all the waterholes throughout Central Australia; but as these waterholes were many miles apart, the contour for the group would be a number of small ovals, and would be discontinuous, though not archaic. He also said that one closed oval, within another, did not accurately represent the double distribution of two species, whereas two ovals, cutting one another, did do so. He also asked what was to prevent the species within the highest contour-oval being all different from those of the next, and so on, so that with contours 4, 3, 2, 1, no less than ten species would be represented.

Mr. Baker offered some very interesting remarks on the distribution of the various groups of *Eucalypts.* He supported the Specific-Contour method, and believed that it would yield valuable results as to the origin of the Eucalypt-flora.

Mr. Tillyard, in reply, dealt briefly with each of the foregoing criticisms. He pointed out that the question was not one of the origin of species, but of the distribution of species; and, therefore, he did not consider that the question of mutation entered into the discussion at all, even apart from the question of its intrinsic value as a theory, which was not acceptable to everyone. In reply to Mr. Fletcher, he exhibited a large coloured rainfall-map of Australia, and showed how the ectogenic contours corresponded very closely to the monsoonal isohyets, while the entogenic contours came fairly close to the antarctic isohyets. Superabundance of rainfall, as in Western Tasmania, might, however, be a factor *against* distribution. The correlation between rainfall and distribution was of a secondary nature; climate did not determine what groups should inhabit a region, but it did determine the form of the contours of the groups that had reached the region. In reply to Mr. Waterhouse, he showed that he had made ample provision for showing lacunæ, and instanced the case of a subtropical group, which might spread all round a central mountain-range, but fail to ascend to the highest levels. He also showed, in reply to Mr. Mackinnon, how transparencies could be used with the Specific Contour method, the contour being drawn on the transparency, and the underlying map showing the geology, rainfall- or temperature-variation of the region, as the case might require. He agreed with Mr. Maiden's criticism, but claimed that it was time that every collector should realise the value of every single record, even of the commonest species. His method would emphasise this fact. As regards indefiniteness in species, it was one of the merits of the contour-method, that both splitter and lumper would produce almost identically the same contour, since a species A, subdivided into geographical races, A_1, A_2, A_3, ... etc., would count only *one*, except for the rare case in which two races might overlap. Reply-ing to Dr. Kesteven, he said that the method was not intended to show all the facts. It was intended to give a general graphical view of the distribution of a group, and not to try to map every tiny detail. With regard to the rushes, he would draw his contour round the whole region in which they occurred, not round each waterhole. He agreed that the term "archipelagic" was unsuitable, and would substitute "palæogenic." He also claimed that Dr. Kesteven's two cutting ovals were as inaccurate as his own representation, which did not claim to show the details. The possibility of the 4, 3, 2, and 1 contours enclosing ten species was only a theoretical possibility, and could not occur in nature. He agreed with Mr. Baker's remarks.

In conclusion, Mr. Tillyard emphasised the following points with regard to the method: (*a*) It gives a *density-contour,* taking no account of the separate species, as such. (*b*) It is not accurate in small details, but is intended to show, at a glance, the general distribution of a group over a given region, exactly on the lines of a rainfall- or barometric pressure-map. (*c*) The division into ectogenic, entogenic, and palæogenic groups, represented the three main stages in the evolution of any group, and was only a new presentation of a well-known and accepted fact. (*d*) The question of the further subdivision of each of these three types of contour in any given region needed working out, but he felt sure that different subtypes could be shown to exist. (*e*) The zoocentres were simply the areas of greatest density for each group, and it was rmarkable, if Dr. Cleland's mutation-argument were true, that practically all Australian entogenic groups should have similarly located zoocentres! This alone showed the fallacy of the mutation-hypothesis. (*f*) The method is not restricted to regions, but circumtropic and circumpolar groups could be contoured over a map of the whole world; and even winter- and summer-distributions of bird-groups could be exhibited in contrast, by means of it.

ORDINARY MONTHLY MEETING.

SEPTEMBER 24th, 1913.

Mr. W. S. Dun, President, in the Chair.

Miss N. CROUCH, Sydney, was elected an Ordinary Member of the Society.

The Donations and Exchanges received since the previous Monthly Meeting (27th August, 1913), amounting to 13 Vols., 40 Parts or Nos., 21 Bulletins, 3 Pamphlets, and 1 Map, received from 39 Societies etc., were laid upon the table.

NOTES AND EXHIBITS.

Mr. R. J. H. Jenkins showed a flaked, aboriginal stone axe-head, of a rather primitive type, found imbedded in a portion of the root of a Eucalypt, as shown, a little above high water-mark, at Woy Woy, partially overlain by shell-débris.

Mr. D. G. Stead exhibited a photograph of a large Leopard Seal captured, during August, on a shoal at Pelican Island, in Brisbane Water, opposite the township of Woy Woy. It is believed that at least four of these large pelagic Seals were present at that time in Brisbane Water, an exceedingly shallow, lake-like expanse of great extent, connecting, through a very narrow entrance, with Broken Bay. Three examples were recorded as having been seen by the local Inspector of Fisheries, in the main channels on the 6th August, and later on in the day, two were seen at Gosford, which is right at the head of Brisbane Water. During that week, large shoals of apparently terrified fishes were observed on the shallow flats in from 6 to 8 inches of water during every night. It is a most unusual thing for our fishes to school in this manner, especially during the occurrence of westerly winds, as was the case at the time; and it is reasonable to suppose that fear of these savage seals had driven them there. The Seal photographed was tethered to the jetty at Woy Woy for two days, and then liberated—apparently none the worse. Mr. Stead stated that the Leopard Seal appeared to be in numbers on the coast at this time, as he received reports indicating such, from various places, and he considered that those in Brisbane Water were probably enticed in by shoal-fishes near the entrance—then losing their bearings owing to the smallness of the entrance.

Mr. Fred Turner exhibited specimens of three grasses of interest: (1) *Eriachne scleranthoides* F.v.M., found near Mount Poole, N.S.W. The specimen was forwarded by Mr. R. Gowland for identification. Mr. Turner had not hitherto known this Central Australian grass to be indigenous to New South Wales. (2) *Urachne parviflora* Trin., syn. *Piptatherum multiflorum* Beauv., a South European species, collected near Bodalla, N.S.W. Specimens of this grass had previously been received for identification and report, as to its value for stock-feed, from Exeter, in this State, and from Ballarat, Victoria. In Europe it is popularly known as the "Falling Awn Grass," and now appears to be acclimatised in parts of South-eastern Australia. (3) *Bromus macrostachys* Desf., et var. *villosus*. This Mediterranean species and variety were received by Messrs. Anderson and Company, Seedsmen and Plant Merchants, Sydney, from one of their clients near Albury, N.S.W., and they were forwarded by that firm to the exhibitor for identification and report. Two other European species of *Bromus*, viz., *B. mollis* Linn., and *B. sterilis* Linn., have spread very much in New South Wales during recent years, and are common in many of the wheat-fields in different parts of the State.

Mr. R. T. Baker exhibited: (1) A slab of "Red Cedar," *Cedrela Toona* Roxb., taken from a large stack of that valuable timber, which had been entirely ruined by a fungoid growth; the mycelium covered the entire surface in beautiful fern-shaped masses, penetrating the whole fibre of the timber, and rendering it quite valueless as a commercial article. The slabs had been stacked for seasoning, with Oregon laths between each piece, and it was to the presence of the latter that the trouble was attributable, the spores evidently having been imported with the laths. In other stacks where Oregon "strips" were not used, the Cedar was unaffected. (2) A series of specimens, showing various stages of growth of an entomogenous fungus, *Cordyceps*(?) *Gunnii*, collected by Mr. E. H. Wyburd, at Corowa. The specimens were in good preservation, and nearly perfect, except for the absence of the fructification.

Mr. A. A. Hamilton exhibited plants in a teratological condition from the collection of the National Herbarium, comprising *Zinnia elegans* Jacq., (Sydney Botanic Gardens) showing lateral foliar prolification of the inflorescence. A series of leafy branches is noted springing from the axils of the floral bracts. These reduced branches are also produced in the axils of the ordinary leaves. The ligulate florets, as seen in a normal flower, are suppressed.—*Carduus pycnocephalus* Jacq., showing foliar prolification of the flower. The centre of the bud is occupied by the intruded pithy peduncle (the flowers are normally articulate on the peduncle) from which springs a series of whorls of leafy bracts tipped with spines representing the suppressed floral organs.—*Dahlia* Hort.var., showing extra-floral prolification of the inflorescence. A Dahlia with normally white flowers, having a series of branches bearing leaves and supernumerary buds projecting beyond the capitate inflorescence.

Mr. E. Cheel exhibited fresh specimens of *Xerotes* sp., from Hill Top, which appeared to be an undescribed species. Also a fine series of specimens of *Tetratheca* from various localities, namely—*T. thymifolia* Sm., very common at Hill Top, Colo Vale, and Moss Vale; and very distinct from *T. ericifolia* Sm., with which it was united by Baron von Mueller in his Census (1889), and by Moore and Betche, in the Handbook of the Flora of N. S. Wales (1893). Mr. Maiden, in the Agricultural Gazette of New South Wales [vii.,(1896) p.264] mentions it for Hill Top, and the Rev. Dr. Woolls records it for Mount Wilson (These Proceedings, 1887, p.7). It has also been recorded in These Proceedings for 1899, p.354; and 1906, pp.39 and 48, by Mr. A. G. Hamilton, and Mr. R. H. Cambage respectively. In the Flora Australiensis (i., p.130), the range given is from Port Jackson to Blue Mountains, Bathurst, Hastings River, and Twofold Bay. F. M. Bailey and the Rev. Tenison-Woods also record it from Brisbane in These Proceedings, 1879-80, p.141. In the National

Herbarium, there are specimens from Port Jackson (R. Brown, Iter Australiense, 1802-5), Bateman's Bay and Smoky Cape (J. L. Boorman), Port Macquarie (E. Betche), Hunter River (collector ?), West Wallsend (R. H. Cambage), Port Stephens (Backhouse), Currockbilly (J. L. Boorman), Allum Mountain, Bullahdelah (J. H. Maiden), Wallangarra and Awaba (J. L. Boorman), Braidwood (R. H. Cambage), Barber's Creek (J. H. Maiden), Kingsdale near Goulburn, Tumut (W. Mecham), Thornleigh, Hornsby, and Queen's Park, Waverley (E. Cheel). A white-flowering form has also been found at Wahroonga and Botany Bay (J. H. Camfield), Wingello (J. L. Boorman), Badgery's Crossing (W. Forsyth and A. A. Hamilton), Mogo (W. Bäuerlen), Conjola (W. Heron), Port Macquarie (collector ?).—*T. pilosa* Labill., var. *denticulata* Benth., (Fl. Aust. i., 132), of which Bentham says, "about Port Jackson, from several collections." This variety is not mentioned in Mueller's Census, or in Moore and Betche's Handbook. The following is a list of definite localities from which this variety is now represented: Port Jackson (R. Brown, Iter Australiense, 1802-5), Hornsby (J. H. Maiden), Berowra (J. H. Maiden and J. L. Boorman), Manly (J. L. Boorman), Lindfield (R. H. Cambage), French's Forest (D. J. Shiress), Thornleigh (E. Cheel).—*T. juncea* Sm. Bentham (*l.c.*, p.132) gives Port Jackson as the habitat for this species. Other definite localities are, Tempe (A. A. Hamilton), Morrisett, Wallsend, and Bullahdelah (J. L. Boorman), Newcastle (R. H. Cambage), Rookwood, Kahiba near Newcastle, and Waratah (E. Cheel). Specimens of typical *T. ericifolia* were exhibited for comparison.

Mr. Cambage called attention to a laudable legislative effort now being made in England, to check the destruction of bird-life in other countries; and on his motion, seconded by Mr. D. G. Stead, it was resolved—That the Linnean Society of New South Wales considers it to be highly desirable that the Importation of Plumage (Prohibition) Bill, now before the British Parliament, should become law, and desires that a letter be written to the Premier of this State for transmission to the Secretary of State for the Colonies, urging the passing of the Bill.

THE DEVELOPMENT OF THE NATURAL ORDER *MYRTACEÆ.*

By E. C. Andrews, B.A., F.G.S.

Table of Contents.

Introduction.—The present distribution of two Natural Orders of plants was considered with reference to their probable geographical environment in the past, and the environment, thus suggested, was compared with that succession of Cretaceous and Tertiary geographies, which had been deduced years before by the writer from physical data alone. The Orders Myrtaceæ and Leguminosæ were the two chosen in this connection, but the former alone is considered in the present paper.

Such a comparison was suggested by a knowledge of the peculiar assemblage of plants growing on the coarse, acid sandstone of the Sydney and Blue Mountain Districts. Although the sandy soil of this district appeared to be exceedingly sterile, nevertheless it supported a great number of species, as well as numerous genera. Moreover, although the individuals were dwarfed in appearance, yet were they clustered thickly together, and not scattered here and there as on an arid plain. This sandstone area was surrounded by formations of a clayey nature, and the soils from such formations, when protected from the desolating winds of the interior, and also when under the influence of a good rainfall, were observed to support luxuriant growths of plants belonging to types differing in many ways from those which flourished on the sandstones. It was noted, also, that the plant-types which were crowded together on the coarse sandstones were those which had been recognised by botanists as being practically confined to Australia, for example: *Bæckea, Banksia, Leptospermum, Melaleuca, Callistemon, Angophora, Kunzea, Calythrix, Darwinia, Pultenæa, Eutaxia, Bossiæa, Gompholobium, Styphelia, Monotoca, Epacris, Hakea, Grevillea, Xylomelum, Telopea, Persoonia, Boronia, Petrophila, Isopogon, Lambertia,* and others too numerous to mention. This, in itself, was remarkable, but when, in addition, it was noted that the rich, sheltered and well-watered pockets of soil, forming islands in this sandstone-setting, were avoided almost absolutely by the genera practically endemic in Australia, and were largely occupied by genera not peculiar to Australia, such as *Myrtus, Eugenia, Elæocarpus, Ficus, Livistona,* and others, the case became still more interesting, and suggested that the peculiar vegetation, for which Australia is noted, had been developed in an extremely sandy and porous soil. Especially was this idea strengthened by the knowledge that the extremely sandy granites of eastern New South Wales, and the sandstones of the Clarence River Basin supported a flora almost identical with that of the Sydney sandstones and the Blue Mountains. This conclusion received additional support, also, from the fact that this vegetation avoided the rich basaltic soil of the Northern rivers, yielding place there to dense growths belonging to genera not peculiar to Australia, such as *Dysoxylon, Echinocarpus, Panax, Sterculia, Cedrela, Gmelina,* and *Elæocarpus.* Moreover, although the individuals were closely-set together on the sandstone, nevertheless the sunlight had access to all their parts, whereas on the rich soil the genera, not peculiar to Australia, formed dense jungle-growths. This suggested that the vegetation peculiar to the continent had developed either in a rigorous climate or in one essentially sunny; whereas the other was of more recent origin, and depended on moist and sheltered conditions. But whereas the rich basalt-soils, of the sheltered portions of the Coast, supported dense jungle-growths, soils very similar on the plateaus and plains, when exposed to the desolating winds of the Central continent, whether hot in summer or cold in winter, were avoided alike, in great measure, by those types, whether peculiar or not peculiar to Australia. This suggested that:—

1. The basaltic soil plains were of later origin than the evolution of most of the genera peculiar to Australia, and such plants had not yet accommodated themselves to this soil.

2. The genera not peculiar to Australia were unaccustomed to desiccating and desolating influences, and had not yet accommodate themselves to such influences.

3. Or again, it suggested that, possibly, the basaltic soil, under dry and exposed climatic conditions, was peculiarly unfitted to support vegetation in abundance.

Several other interesting points also were suggested at this stage. The leaves of the sandstone-types were characteristically heath-like, or rigid or pungent; nevertheless, others again, such as the majority of the Leptospermums, Melaleucas, and Callistemons were observed to possess much larger leaves, and to frequent the moister situations on the sandstone-areas. The first suggested a general accommodation either to poor sandy soil, to xerophytic, or to cold and harsh conditions; while the second suggested evolution under more genial conditions than had genera, such as *Styphelia*, *Calythrix* and *Epacris*. The wealth of beautiful flowers, on the coarse acid sandstone-areas, also suggested evolution under strong sunlight.

Another point of interest noted was that in proportion to the mildness, the moisture, and the shelter attained in any locality, so, in that proportion, was there a tendency for those genera, which were not endemic in Australia, to oust those which were peculiar to Australia. This, again, suggested that the genera peculiar to Australasia had developed amid rigorous and harsh conditions, and had not yet accommodated themselves to a genial and extremely moist climate.

To most of these rules, however, the genera *Acacia* and *Eucalyptus* formed exceptions. Whether in harsh or genial surroundings, in heat or cold, in soil either good, poor, rich or sandy, these genera rarely failed to establish themselves firmly. Nevertheless, elastic of temperament as they were, *Acacia* and *Eucalyptus* both appeared to be ill-adapted to cope with the advance of those genera not peculiar to Australia, when in an environment of abundant shelter, good soil, and with heavy and continued precipitation. This suggested the failure of even *Acacia* and *Eucalyptus* to compete with the Indian and Antarctic floral elements, when the latter were in their true environment. The range of habitat of these genera, however, is highly instructive. Thus certain Eucalypts* with transverse leaf-venation, with a characteristic essential oil known as pinene, and with peculiar anthers, flourished on the poor sandy soils. Other Eucalypts, again, such as the Boxes, flourished in heavy clay soils, and possessed much cineol or eucalyptol, a characteristic leaf-venation, and, morever, they possessed peculiar anthers opening in pores. Still a third group, embracing such forms as the Peppermint and the Snow-Gums, possessed much phellandrene oil, a parallel venation, and kidney-shaped anthers; and they occupied the moister and cooler portions of the plateau-regions. The Acacias were found in all soils indifferently, but their morphology was found to be peculiar in proportion to their adaptation to certain climatic and soil-surroundings. In the case of the Eucalypt, this suggested an origin in open sandy country, but an ability later, by the production of special devices, to flourish on the heavy soils, and in cold, moist climates.

* R. H. Cambage, Presidential Address. Journ. Proc. Roy. Soc. N. S. Wales, 1913.

In all these observations, the writer inferred that the predominant influence, in the plant-evolution, was geographical environment. Other factors in their evolution appeared to be Time, Heredity, Variation, and Selection. Time is a constantly flowing quantity, and, in the evolution of floras, such an evenly flowing quantity must be large, since the other factors produce only infinitesimal results when acting only during brief periods. The remaining factors are exceedingly variable in their action, and the sluggish or rapid response of the organism, along variable lines, is due mainly, either to the fixity of its climatic and soil-environment, or to a revolution in its geographical surroundings. A geographical revolution would tend to produce either plant-extinction in part or as a whole, or a relatively sudden deployment into new genera or even families, such as one sees among the Dicotyledons in later Mesozoic time.

The principle adopted, in the present note, is the application of the "Law of Probabilities" to the case of the development and distribution of the Myrtaceæ Thus the earlier types of the family have been sought by a consideration of those genera which possess the most points in common, consonant with certain facts known to be connected with the geographical setting of the earlier types. In this way, those types are considered as aberrant which, although excellently adapted to a definite set of local geographical conditions, nevertheless depart in essentials from the deduced primitive forms. Thus, for example, if it should be ascertained that the points common to all genera of the Myrtaceæ were much more characteristic of the genera not endemic to Australia, such as the Myrteæ; furthermore, if such Myrteæ were ascertained to be practically confined to the tropics; that they flourished in good soil and abundant rainfall; that their species far outnumbered those of types endemic to Australia; furthermore, if it were found that Australia had been isolated from the other parts of the tropics during the production of the endemic genera; that the Australian types flourished on porous, sandy soil, and in proportion as they tended to depauperate types, that they exhibited modifications of those organs typically developed in the Myrteæ, then these would be considered as the earlier type of Myrtaceæ, and the capsular-fruited genera would be considered as a type derived from Myrteæ, in harmony with local Australian conditions.

Bentham, in the concluding preface to his Flora Australiensis, made the accompanying statement, with regard to the Australian Flora: "The predominant portion appears to be strictly indigenous. Notwithstanding an evident though very remote ordinal tribual or generic connection with Africa, the great mass of purely Australian species and endemic genera, must have originated or been differentiated in Australia, and never have spread far out of it." The present report appears to bear out Bentham's contention

With the vast amount of information, concerning the Australian Flora, now assembled in the "Flora Australiensis" of George Bentham, "The Flora of Australia and of Tasmania" by Sir Joseph Hooker, "The Census of Australian Plants" and "The Eucalyptographia," by von Mueller, "The Index Kewensis" and its Supplements, "The Critical Revision of the Genus Eucalyptus," and "The Forest Flora of Australia" by J. H. Maiden, as well as the exceedingly numerous unpublished drawings of Eucalyptus anthers by J. H. Maiden, "The Research on the Eucalypts" and "The Research on the Pines of Australia" by Messrs. Baker and Smith, the Botanical Notes (16 papers in these Proceedings, 1900-1913), and other papers* by R. H. Cambage, various papers† on distribution by H. Deane, the papers‡ on Australian Vegetation by Professor R. Tate, the time appears now to be ripe for a statement as to the probable development, in Australia, of Orders such as those of the Myrtaceæ, the Compositæ, the Leguminosæ, the Proteaceæ, the Casuarineæ, or the Coniferæ.

---

* "Climatic and Geological Influence on the Flora of New South Wales." Rept. Aust. Assoc. Adv. Sci. 1907, Adelaide, p.476. Presidential Address, Journ. Proc., R. Soc. N. S. Wales, 1913.

† Presidential Addresses. These Proceedings, 1895 and 1896, also 1900.

‡ "On the Influence of Physiographic Changes in the Distribution of Life in Australia." Rept. Aust. Assoc. Adv. Science, 1889, Vol. i., p.512.

See also, "On the Myrtaceæ of Australia," by the Rev. W. Woolls. These Proceedings, 1884, pp.643-648.

Acknowledgments.—The Writer desires to record here his indebtedness to Messrs. R. H. Cambage, J. H. Maiden, R. T. Baker, H. G. Smith, and C. Hedley, in the preparation of the present paper. During joint excursions made in Eastern Australia, the Writer learned, from Mr. Cambage, the names of the plants, their habitat, and the soils in which they flourished. Throughout the preparation also of the note, Mr. Cambage has given kindly advice and criticism, especially with regard to points pertaining to field-botany.

To Mr. Maiden, very cordial thanks are tendered for access at all times to the storehouse of literature and plants at the National Herbarium, attached to the Sydney Botanical Gardens; also for access to the very numerous unpublished drawings of Eucalypt anthers which he has prepared, and for his great personal kindness in answering any queries as to general botanical information bearing on the point under consideration. To Mr. E. Cheel and Mr. A. A. Hamilton also, the Writer desires to return sincere thanks for their kindness in facilitating research in the National Herbarium.

To Messrs. Baker and Smith, the Writer is deeply indebted for the new light which their "Research on the Eucalypts" has thrown upon the problem of Eucalypt-distribution and classification especially in connection with the relations existing between oil-contents and leaf-venation.

To Mr. Hedley, the Writer is deeply indebted for personal communications concerning the general principles of plant- and animal-distribution in the Southern Hemisphere.

Thesis.—The family Myrtaceæ originated in the fertile tropics, and had a much wider range in the late Mesozoic than at present, owing to the large epicontinental seas, the low-lying lands, and the mild and moist climate of the Cretaceous. With the great increase in size of the continents during Post-Cretaceous time, and the formation of high and broad mountain-borders to the continents, the genial climate of the Cretaceous became differentiated gradually into distinct zones, and the northern and southern range of Myrtaceæ became thereby much contracted. In certain countries, such as Australia and America, which, about that time, became partially or wholly isolated from other tropical regions, the Myrtaceæ underwent divergent transformations, the Eugenias, Myrtles, Campomanesias, Myrcias, Psidiums, Calyptranthes, and other types marking a deployment of genera in the fertile tropics, the capsular-fruited Myrtaceæ marking an adaptation to less genial conditions, while the Chamælaucieæ mark an organic response to severer conditions of climate, and to a greater poverty and porosity of soil, than the majority of the Leptospermeæ.

Geography.—The Cretaceous, in Australia, as in the greater part of the world, appears to have been a period at once of genial and moist climate, of reduction of the continental surface to low-lying plains by stream-action, and a period also of great sea-transgressions over the continent. The continent appears to have been connected with Asia, at least throughout the lower Cretaceous, and to have been separated therefrom at some period during the Upper Cretaceous.

New Zealand appears to have been connected with Australia or New Guinea by way of New Caledonia in the Cretaceous, and the first separation from the main Australo-Asiatic block appears to have been that of New Zealand*, then the Australian province appears to have been separated from Asia and its continuation south and east to Celebes and Borneo. New Caledonia and Fiji appear to have been separated later from the main mass, and Celebes became separated from both Asia and Australia. Timor and other Islands were separated from the continent at a later date.

In the Upper Cretaceous, the Australian Continent was occupied by a central sea. By analogy with a study of Northern American, Asiatic, and European conditions in the Upper Cretaceous, it would be reasonable to infer that the Cretaceous sea completely separated Western from Eastern Australia. There is no direct

* See also C. Hedley, "A Zoögeographic Scheme for the Mid-Pacific."

geological evidence, however, of a complete separation of West from East. This is all the more remarkable, because the period was one of great peneplanation, and a barrier to the junction of the Indian and Southern Oceans, across Australia, by the transgression of the Cretaceous Sea, is difficult to understand.

The characteristic soil of Australia, during the Cretaceous, is evidenced by the sandy and porous nature of the Cretaceous sediments.

A study of Western and Eastern Australian geology suggests that the surface of the continent was mostly sandy in nature, although the various slate- and shale-deposits formed local exceptions.

In the Lower Tertiary, the Cretaceous Sea was drained off the continent in great measure, and the climate of the centre began to change slowly, the old equable and genial conditions giving place to greater extremes of heat and cold, and increasing desiccation. The present stage of dryness over the whole central continent, however, appears to be a recent development.

In the Eocene, the Cretaceous Plain appears to have been warped somewhat on its eastern margins, and in both this and a later period of the Tertiary, deep leads were formed, and great floods of basalt covered many portions of the lowlying eastern continent. During the great "Deep Lead" Period, the warped eastern continent had been partly reduced again to a peneplain.

The Deep Leads contain infrequent traces of Eucalypts, but not of other Myrtaceæ, in fact the numerous plant-remains suggest the occupation of Eastern Australia, during that period, by Indian types,* although plants closely allied to Callitris and Banksia are frequently found in the leads. At the present day, the surface of the areas, in which these remnants of tropical types have been found in such abundance, is occupied mainly by cold-loving types of Australian plants, owing to the formation of plateaus in these areas.

* Baron von Mueller, New Vegetable Fossils. Decades i.-ii., 1874-1882.

During this period, the continent appears to have been co-extensive with New Guinea and Tasmania, and to have extended for a considerable distance southward of Tasmania.

In late Tertiary time, Eastern Australia was affected by a topographical revolution, during which, the low-lying land, near the sea, was disturbed and raised to form the plateaus of New Guinea, Queensland, New South Wales, Tasmania, and South Australia, as also that of Western Australia. The climate thereby became changed.

The central plains of Eastern Australia, which had been initially formed in the earlier and middle Tertiary, were much enlarged by the late Tertiary sedimentation, following upon the uplift.

In the Pleistocene came the general lowering of temperature over the whole world, and with it, the gradual desiccation of Central Australia, as is evidenced by the present process of the choking-up of the old stream-channels with waste. This may be seen well in such districts as that of Cobar.

THE GEOGRAPHICAL DISTRIBUTION OF MYRTACEÆ.

The authorities consulted in this connection were Index Kewensis and the three Supplements thereto. For the Australian distribution of Myrtaceæ, von Mueller's Census for 1889 was used, as also Bentham's Flora Australiensis. With a very few exceptions, the terminology employed is that adopted in the Flora Australiensis (1866).

For the purposes of the accompanying lists of species, *Jambosa* and *Syzygium* are considered as included under *Eugenia,* as suggested by Bentham and Hooker. Lecythideæ is considered as a separate family, the reasons being assigned in a subsequent chapter.

Mr. Cambage has supplied the list of Eucalypts known in Eastern Australia, and Mr. Cheel the distribution in Australia of *Callistemon.*

All the other lists are only approximate.

DISTRIBUTION OF CHAMÆLAUCIEÆ.

	Eastern Australia.	Western Australia.	
Actinodium	......	......	......
**Darwinia* ... **Homoranthus* ... **Chamælaucium*	6 (approx.)	32 (approx.)	......
Verticordia	1	40	......
Pileanthus	......	3	......
**Calythrix*	12 (approx.)	29 (approx.)	*C. tetragona* found in all the States.
Llotzkya	1	10	*L. genetylloides* common in S. Australia and Victoria.
**Thryptomene*	......	33 species in Australia, mainly in W. Australia.	......
**Micromyrtus*	......	9 species in Australia, mainly in W. Australia.	......
Wehlia	......	3	......

* Lists not complete.

DISTRIBUTION OF CAPSULAR-FRUITED MYRTACEÆ.

Genus.	Eastern Australia.	Western Australia.	New Guinea.	New Caledonia.	New Zealand.	New Britain.	Timor.	Phil-ippines.	Borneo.	China.	India.	Java.	Sumatra.	Burmah.
Scholtzia	......	12	...	...	...	...	...	...	...	...	...	...	...	...
*†*Bæckea*	17(approx.)	48(approx.)	...	5	...	...	...	...	...	1	...	...	1	...
Astartea	......	3	...	...	...	...	...	...	...	...	...	...	...	...
Hypocalymma	......	12(approx.)	...	...	...	...	...	...	...	...	...	...	...	...
Balaustion	......	1	...	...	...	...	...	...	...	...	...	...	...	...
Agonis	1	12	...	...	...	...	...	...	...	...	...	...	...	...
§*Leptospermum*	16	7	...	...	3	...	...	1	1	...	...	1	...	1
**Kunzea*	10	10	...	...	...	...	...	...	...	...	...	...	...	...
Callistemon	16	2	...	2	...	...	...	...	...	...	...	...	...	...
***Melaleuca*	36	84‡	...	2	1	...	...	...	...	...	...	...	...	...
Conothamnus	......	2	...	...	...	...	...	...	...	...	...	...	...	...
Beaufortia	......	18	...	...	...	...	...	...	...	...	...	...	...	...
Regelia	......	3	...	...	...	...	...	...	...	...	...	...	...	...
Phymatocarpus	......	2	...	...	...	...	...	...	...	...	...	...	...	...
Calothamnus	......	23	...	...	...	...	...	...	...	...	...	...	...	...
Lamarchea	......	1	...	...	...	...	...	...	...	...	...	...	...	...
Eremæa	......	6	...	...	...	...	...	...	...		...	...	...	...
Angophora	5	......	...	...	...	...	...	...	...	...	...	...	...	...
Eucalyptus	200	70-100 (approx.)	4(?)	...	...	1‡‡	4‖	1‡‡	...	...	...	...	...	...

* Lists not complete. † *B. virgata* in New Caledonia and Australia; *B. frutescens* common in Eastern Archipelago and South China. § *L. flavescens* in Eastern Australia, Indian Archipelago, Malacca, etc.; *L. scoparium* in E. Australia and New Zealand. ** *M. leucadendron* abundant in E. Australia, Indian Archipelago, and Malayan Peninsula.
‡ 6 common to east and west. ‖ 3 species also in Moluccas. ‡‡ *E. Naudiniana*.

DISTRIBUTION OF METROSIDEREÆ.

Genus.	Eastern Australia.	Western Australia.	New Guinea.	New Caledonia.	New Zealand.	New Britain.	Timor.	Phil-ippines.	Borneo.	China.	India.	Java.	Sumatra.	Burmah.	Malaya.	Banca Is.
Tristania	14	...	1	7	...	...	...	1	...	...	...	...	...	3	3	1
**Metrosideros*	14	...	1	7	16	...	...	...	...	...	...	1	...	...	...	...
†*Syncarpia*	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Xanthostemon	2	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...
Lysicarpus	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nania	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Cloezia	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...
Spermolepis	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Piliocalyx	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...
Backhousia	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
‡*Osbornia*	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...

* *Metrosideros* also possesses one species in South Africa, two in the Moluccas, one in Madagascar, two in the Saudwich Islands, one in Lord Howe Island, one in Chili, and one in Tahiti. The African, American, Tahitian, and Hawaiian species appear to be anomalous and doubtful.

† *Syncarpia* possesses one species in the Amboin Is.

‡ The species in Australia and the Philippines is the same.

DISTRIBUTION OF MYRTEÆ.

Genus.	Tropical America (rarely extra-trop.).	Tropical Asia.	South Europe.	Pacific Islands.	Africa (mostly Trop.)	New Caledonia.	New Zealand.	Australia.	Islands between Asia & Australia.
	Species.	Species.	Species.	Species.	Species.	Species.	Species.	Species.	Species.
Eugenia	850 (approx.) ...	200(approx.)	......	55(approx.)	76(approx.)	20	......	40	96 (approx.)
Myrtus	135 (approx.), a few in extra-tropical America	8	1(*M. communis*; also in W. Asia)	......	2	8	4	16	6 (also in Japan)
**Myrcia*	320 (approx.) ..	.....	......	.. ...	... ..	......	......	......	......
**Campomanesia* ..	70	1 (doubtful)	......	......	...	.. ...	......	......	......
**Calyptranthes* ...	100	......	......	3 (Fiji)	1 (1 also in Mauritius)	......	.. ...	.. ...	1 (Java)
**Calycolpus*	10 (approx.) ...	......	......	......	. ...	......	......	.. ...	......
**Psidium*	130 (approx.) ...	7	......	A few	1 (2 also in Mauritius)	......	......	......	......
**Feijoa*	2	......	... ..	......	......	......	......	......	......
**Marlieria*	30	......	......	......	... ..	......	......	......	......
**Calycorectes*	10	... ..	......	......	.. ...	... ..	......	......	......
**Decaspermum* ...	... ...	2	...	1	......	......	......	1	2
Rhodomyrtus ...	... ...	1	.. ...	......	......	......	.. ...	4	.. ...
Rhodamnia	... .	1	......	.. ..	......	......	......	4	2
Nelitris	.. ..	3	......	2	1	1	... .	2 or 3	9
Fenzlia	...	......	......	......	......	......	.. ...	2	......
Pimenta	4	1	......	.. ...	......	......	......	......	......
Myrrhinum ...	4	......	......	......	......	. ...	......	......	......
Pleurocalyptus ..	... ...	......	......	......	..	1	......	.. ...	......

Aulacocarpus, *Psidiopsis*, *Paivœa* and *Tepualia* 3, 1, 1 and 1 species, respectively, in South America.

* Lists not complete.

Combining these approximate results we have:—

Eugenia with about 1,325 species.
Myrcia with about 320 species.
Eucalyptus with about 300 species.
Myrtus with about 180 species.
Psidium with about 140 species.
Melaleuca with about 135 species.
Calyptranthes with about 100 species.
Bæckea with about 80 species.
Campomanesia with about 70 species.

The other genera are much smaller as regards numbers of species.

In Myrtaceæ, there are approximately 3,100 species (Pflanzenfamilien, 1898, records about 2,750 species in Myrtaceæ) of which America (almost wholly tropical or subtropical) contains about 1,670, Australia about 800, Tropical Asia about 235, South Europe 1, Africa (mainly tropical) about 85, and the Pacific Islands, together with the Indian Archipelago, about 310 species. Of these 3,100 species, Tropical and Subtropical America contain about 54 per cent., while Australia and the surrounding Islands contain about 26 and 10 per cent. respectively. The fact that Europe contains only one species (common also in Western Asia) is most significant, as is also the fact that North America probably contains not more than 10 species. One genus alone, namely *Eugenia*, contains about 43 per cent. of the total species, but less than 3 per cent. of these occur in Australia.

The fleshy-fruited genera are widely spread over the tropics, the capsular genera are almost wholly Australian, while the Chamælaucieæ are almost wholly West Australian.

The Earlier Types of Myrtaceæ.

Several factors need consideration in this connection. Principal among these appear to be:—

(*a*) The present distribution of the family.

(*b*) The environment of present-day Myrtaceæ.

(*c*) The geography of the Cretaceous as compared with that of the Tertiary and the present.

(*d*) The practical isolation of Australia from the rest of the temperate and tropical world during the latest Cretaceous and a great portion of the Tertiary.

(*e*) The morphological characters common to the majority of the Myrtaceæ.

The present distribution of the family has already been considered, and may be stated very briefly in this connection.

The greatest number of species by far occur in tropical and subtropical America, while Australia is the area of greatest density after America. The family is practically absent in the cold temperate regions of both hemispheres. The fleshy-fruited genera are uncommon in Australia, but are extremely common in the tropics of both hemispheres. The capsular-fruited genera rarely get beyond the Australasian Region or the Indian Archipelago. The Chamælaucieæ are confined to Australia, especially to the Western half of the Continent.

The present environment of the Myrtaceæ is peculiar, one group, namely, the fleshy-fruited genera, characterised by abundant shelter, moisture and warmth; another group, namely, the Metrosidereæ, selecting situations of shelter, moisture and warmth, but not being so absolutely dependent on these factors acting in conjunction, as the Myrteæ; another group, namely, the Leptospermeæ, exclusive of Metrosidereæ, shows an ability to flourish in an excessively sandy and porous soil, and under moist or dry, hot or moderately cold conditions, while the Chamælaucieæ, and certain genera of the Leptospermeæ, such as the Bæckeæeæ, appear to flourish both in poor sandy soil and in dry situations.

The geography of the Cretaceous appears to have been one of lowlying plains, mild, genial and moist climate of almost cosmopolitan range. The soil of Australia, at that period, appears to have been very sandy and porous, taken as a whole.

High mountains, great deserts, glaciated polar regions and large continents characterise modern geographies, whereas, in the closing Mesozoic, the inland seas were large, the land-relief slight, and the climate genial and moist.

Australia appears to have been connected with Asia during the Jurassic and the Lower Cretaceous, but during some part of the Upper Cretaceous, it seems to have been cut off from Asia, and it is doubtful whether there has been any direct communication between the two continents since that date.

Morphological Characters common to the Myrtaceæ.

Upon an examination of the family, it will be at once apparent that certain morphological characters run throughout the various genera. In proportion to the xerophytic nature, or harsh environment, of the genus or species, so are the characters common to the family obscured in that genus or species, and the morphological clue is not readily seen, but, on the other hand, in proportion as the fertile tropics are approached, especially those of America, so, in the Myrtaceæ of these regions, is the morphological clue most easily retained. In those genera which are partly depauperate in type, such as Bæckea, it may be noted that the species which are not depauperate, have more points in common with the family, as a whole, than those species of the genus, which live amid harsher conditions. *Eucalyptus* possesses a cap to its young flower, and, with this protection to its reproductive organs in their earlier stages, it has accommodated itself to various climates and soils, and it departs markedly from the generality of the family in many particulars. The extremes are probably exhibited by Chamælaucieæ and Myrteæ respectively, the one being confined practically to the fertile tropics, the other, in great measure, to the relatively sterile tracts of Western Australia. The capsular genera occupy a middle position, and exhibit, on the one hand, a great resemblance to Myrteæ, and, on the other hand, to the Chamælaucieæ.

The question then arises, what were the characters of the earlier types? Are we to conclude that some form, such as *Eucalyptus,* was the early type, that it had a cosmopolitan range, and that, later, it became extinct in the world generally, nevertheless flourishing in Australia, and giving rise, in the meantime, to the fleshy-fruited genera, all of which show a marvellous likeness to each other, but very little resemblance to the Eucalyptus? Or are we to consider that the more or less xerophytic types, such as *Eucalyp-*

tus, originated in Australia, and then, in some way, crossed the oceans to Asia, Africa, and America, giving rise there to types very similar to each other; nevertheless differing widely from the capsular types? Or are we to consider that the localised form is the more or less depauperate descendant of a type belonging to the moist and fertile tropics?

An application of the Law of Probabilities suggests that either the localised and isolated xerophytic, or the more or less depauperate forms, which all exhibit great morphological differences among themselves, are the descendants of types, possessing at once a range world-wide as regards the fertile tropics, a close similarity of morphological characters, and a great wealth of species. This idea is strengthened by the fact, that the Cretaceous Period was one of genial and moist climate, and that Australia has been isolated from the tropical world since the close of the Cretaceous.

A consideration of these points suggests an appearance as outlined hereunder for the earlier forms of the family:—A tree or shrub, generally large. Leaves simple, entire, opposite, penniveined, dotted and possessing intramarginal veins. Calyx-lobes and petals imbricate. Petals 4 or 5 (probably five). Flowers regular, solitary or in cymes. Stamens indefinite, numerous, free, often crimson or brightly coloured, and generally exceeding the petals Anthers two-celled, versatile, the cells parallel and opening in longitudinal slits. Ovary inferior with two or more cells. Style simple. Ovules two or more to each placenta. Fruit inferior and crowned by the persistent limb, indehiscent, succulent or fleshy, rarely dry. Albumen none. Cotyledons thick and fleshy, with a short radicle.

This plant appears to have possessed a graceful and umbrageous habit, with dense, glossy and beautiful foliage. Wherever possible, exposed situations were avoided, as also sandy porous soils.

Home of the Earlier Types.

This difficult question is best approached from three view-points, namely, the areas of greatest density, as regards species, at the present time; the location of modern types most closely allied to the deduced original Myrtacean type; and the typical geographical conditions of the Cretaceous Period.

The areas of greatest density, to-day, are Tropical America, and warm, temperate Australia.

The families most closely related in morphological characters to the Myrtaceæ, are the Combretaceæ, the Melastomaceæ, the Rhizophoreæ, and the tribe known as Lecythideæ, included by Bentham and Hooker under Myrtaceæ. Combretaceæ is a tropical family, Rhizophoreæ is also mainly a tropical family, while Melastomaceæ forms a large family, and is found mostly in the tropics, chiefly American.

Upon a careful comparison of various members of the Lecythideæ, and a knowledge of their distribution, the Writer has considered it advisable to treat it as a family distinct from Myrtaceæ. For, if one considers its confinement to the fertile tropics, and its development in freedom from those harsh conditions which have left their traces so indelibly upon the majority of Australian Myrtaceæ, one would expect it to exhibit morphological characters more in harmony with those of the Myrtaceæ of the fertile tropics, and to retain the morphological clue, which is so easily traced in *Eugenia, Myrtus*, and allied genera in Myrteæ. Nevertheless, the clue is not at all easily retained in Lecythideæ. The characteristic opposite and dotted leaves are missing, the general appearance of the leaves otherwise is not like those of Myrteæ, the flower-spikes are unfamiliar in connection with Myrtaceæ, and the fruit-forms are not at all suggestive of Myrtaceæ. Nevertheless, Lecythideæ must be considered as a closely allied family.

The consideration of the home of the family, from this double point of view alone, strongly suggests that the Myrtaceæ originated in the tropics, but the questions then arise:—

(*a*) Did the Myrtaceæ originate in the Old World tropics, then extend to America and Australia, and become strongly differentiated in these localities, while evolution lagged in the intermediate area, owing to severe competition? or:—

(*b*) Did Myrtaceæ originate in Tropical America, and spread thence to Asia and Australia?

The answer to these, is practically insoluble without a knowledge of the geographical factor. The study of the geological record undoubtedly suggests that the earth has passed through various periods of genial and almost cosmopolitan climates, and that these have alternated with periods of marked differential climate. The cosmopolitan and genial climates have tended to produce cosmopolitan, or at least widely-spread, floras whenever sea-barriers have not been opposed to distribution. On the other hand, the variation of climates has tended to floral differentiations.

The Cretaceous was a period of such marked tendency to genial climate, and the fertile tropical flora appears to have possessed a wide range in that time. On the other hand, xerophytic and depauperate types are almost wholly wanting in the collections obtained from the Cretaceous and earlier Tertiary deposits.

The Pliocene and later periods have presented marked differentiations of climate, culminating in the Pleistocene glaciation. This would tend to produce marked local variations in the floras (and faunas), and thus an erstwhile, widely-spread type would, upon a gradual differentiation of climate, tend to contract its range altogether as regards the primitive type, and to bring it nearer the equator; while local floras would arise as the result of adaptation to new environments under conditions of isolation.

One would, therefore, expect the primitive types of Myrtaceæ to have had a great tropical range in the Cretaceous, probably extending into the regions now temperate in both Hemispheres, and later, upon the great Post-Cretaceous changes of climate, to have been confined to the tropics, and to have become locally differentiated in such places as America and Australia, where they were not opposed by such severe competition as in the Northern Hemisphere.

Differentiation of Myrtaceæ.

The Eugenias and and the Myrtles appear to be the genera nearest in morphological characters to the earlier types of the family. In the wide belt of the fertile tropics during Cretaceous time, where large deserts and high land-barriers were very rare, there was a tendency for the Myrtaceæ to become cosmopolitan in range, and for that family to preserve, therein, the purity of the types already firmly established..

A slight difficulty arises in attempting to establish the order of the appearance of the Eugenias and the Myrtles. Both contain single flowers in certain species; the Eugenias are plants typically with embryos possessing large cotyledons and small radicles, with flowers of four petals, and with inflorescences racemose or clustered; while the Myrtles are plants in which there is a typical development of large radicles and small cotyledons, of flowers with five petals, and of rather simple inflorescences.

The evidence suggests that *Eugenia* was more nearly related to the earlier type, by reason of its embryo, and the extratropical range of Myrtus. On the other hand, the 4-petalled-flower of *Eugenia* is a departure from type, and it would appear that there were still earlier types, from which both these important genera deployed. Moreover, in *Rhodamnia* and *Rhodomyrtus* among the Myrteæ, and in *Leptospermum*, *Melaleuca* and *Callistemon* among the Leptospermeæ, the leaves are generally strongly nerved, and this interesting survival likewise suggests that nerved leaves existed among some of the earlier, but now extinct, forms of the family.

Apparently a land-bridge existed in the Cretaceous between some portions of tropical America and tropical Africa. The land-bridge between Asia and Australia appears to have been destroyed in the Upper Cretaceous.

This led to two important modifications of the Myrtaceæ. In Asia, fertile tropical conditions still continued, but there arose a severe floral competition during later and Post-Cretaceous times in Asia, owing to the deployment there of other vigorous and aggressive families. In America, fertile tropical conditions continued; while, in Australia, the vigorous outside competition was not experienced, but the soil there was neither so fertile, nor was the climate so genial, as in the other regions. These conditions were most noticeable in the south-west of Australia, where great sandy expanses of land existed*; while the northern portion of Australia probably was very similar to the other portions of the tropics.

* See also A. R. Wallace, "Island Life,"(1892), pp.487-508.

The true Eugenias appear to have been developed in Central and tropical South America, and these underwent parallel transformations with the Myrtles, into the Myrcias, Psidiums, Campomanesias, Calyptranthes, Myrrhinums, Blephærocalices, Myrierias and other types. In all these forms, one may note the similarity of the types evolved, a similarity suggestive of the continuity of fertile and tropical conditions. In Asia, *Jambosa* and *Syzygium* are the representatives of *Eugenia*, but in their geographical distribution, in their inflorescence of trichotomous cymes or panicles, and in their petals more or less cohering in calyptra, it would appear advisable to include *Jambosa* and *Syzygium* under genera separate from *Eugenia.*

In studying the various types of *Eugenia, Jambosa,* and *Syzygium,* one notes, at times, the peculiar sessile, opposite and somewhat cordate leaves, which suggest the peculiar juvenile leaves of certain seedling Eucalypts. *Syzygium propinquum,* in addition, has a venation suggestive of the corymbose Eucalypts. In one species, at least, of Eugenia, again, the buds are strikingly suggestive of certain Eucalyptus-types, while strong intramarginal veins are not uncommon in some Eugenias. The absence of *Myrtus* and *Eugenia* in Europe and extra-tropical Asia, with the exception of *Myrtus communis* in Southern Europe and Western Asia, and the almost complete absence of these genera in Patagonia, Southern Chili, the Argentine, and the United States of America, as also their absence in Southern Australia, except for *Eugenia* (*Syzygium*) *Smithii* in Victoria, indicates unmistakably that the Myrteæ have not been enabled to adapt themselves to cool, temperate conditions, especially in a direction northwards, in the face of the aggressiveness of the Scandinavian flora. It is a rather remarkable fact that *Eugenia* (*Syzygium*) *Smithii* is the one species, at least in the Eastern Hemisphere, which possesses kidney-shaped anthers.

The presence of 40 species of the genera *Jambosa* and *Syzygium* in Australia, suggests that these genera entered Australia, or at least the southern portion of what is now the Malay Archipelago, in Cretaceous time, and that they are ill-adapted to compete with the endemic flora under existing geographical conditions.

The interesting problem of the development of Myrteæ in extra-Australian areas, is one which can be settled at all definitely only by long and continued study of the habit of each tree, the soil in which it grows, and the climatic aspect which it favours, in tropical America, Asia and Africa.

The origin of the capsular-fruited Myrtaceæ may now be considered.

In Upper Cretaceous time, Australia doubtless extended much farther northward and southward than it does at present, and a long and wide inland sea practically separated the continent into two portions, with a possible connection to the south between east and western points, but such possible connection could not have affected the distribution of the Myrtaceæ for a long period of time. The south-western portion of the continent was very large, and doubtless had a considerable extension beyond its present limits.*

Tasmania and Antarctica appear to have been joined to Australia, and the Eastern portion of the continent probably had a moderate extension seawards.†

New Zealand also probably had a connection indirectly with Australia by way of New Caledonia, the North-eastern corner of the continent, on the one hand, and by way of Antarctica, on the other hand.

In this northern portion of Australia, before separation from Asia, the fleshy-fruited Myrtaceæ found themselves in an area of warm and moist climate, but of relatively poor soil. The land to the south awaited occupation by hardy types, and the Leptospermeæ, with the exception of the Eucalypteæ and the Metrosidereæ, appear to have been developed in response to the existence of this poor soil. There appear to have been two divergent developments from the earlier forms of the capsular types. The one was represented by the broader-leaved forms of the Euleptosper-

* See also A. R. Wallace, "Island Life," p.487-508.

† See also C. Hedley, "Zoögeographic Scheme for the Mid-Pacific." These Proceedings, 1899; and Benham, Rept. Austr. Assoc. Adv. Sci., 1902, pp.319-343.

meæ, and the other by the Metrosidereæ. For the Metrosidereæ, the transition from the Myrteæ is suggested by *Backhousia* and *Osbornia,* which have capsular but indehiscent fruits. The transition to Euleptospermeæ is not at all well defined, and the earlier forms appear to be extinct. The Leptospermeæ are possessed of long and often richly-coloured stamens, but some of the genera possess well-marked nerves, whereas the Metrosidereæ contain no nerved leaves. The Euleptospermeæ, moreover, are not often possessed of opposite leaves.

After the evolution of *Bœckea, Leptospermum, Melaleuca, Callistemon, Metrosideros, Tristania, Syncarpia, Xanthostemon,* and others, there was a tendency to disperse from the Australian centre. The Leptospermeæ, with the exception of Metrosidereæ, suggest an adaptation to the poor soil, and more temperate and dry climate of the main continent; while the Metrosidereæ are closely allied to the Myrteæ, and were unable to push their way southwards. In the same way, the Leptospermeæ, with the exception of the Metrosidereæ, were not well adapted to compete with the Asiatic vegetation in the fertile tropics. The Metrosidereæ thus had a better chance of being distributed throughout the long, narrow, fertile land-connections with Fiji, New Caledonia, New Zealand and Asia. On the other hand, the only chance which presented itself for the distribution of the remainder of the Leptospermeæ in these directions, was the infrequent existence of poorer soils existing to the north and east.

From these considerations, it is evident that the chances of distribution for the Metrosidereæ throughout what is now the Malay Archipelago, New Caledonia, and New Zealand, were much greater than for the remainder of the Leptospermeæ; and when one finds *Bœckea* in the Malay Islands, Southern China, Sumatra, Malaya and New Caledonia (5 species); *Leptospermum* in the Malay Islands, Burmah, Malaya, and New Zealand (3 species); *Melaleuca* in New Caledonia, the Malay Islands, New Zealand, and Tahiti; *Callistemon* in New Caledonia; while *Metrosideros* occurs in New Zealand, New Caledonia, the Moluccas, South Africa (?), Java, Tahiti (?), Chili (?), Lord Howe Island, Madagascar (?), and the

Sandwich Islands (?); *Tristania* in Burmah, New Caledonia, Malaya, Borneo, Banca Islands, and the Philippines; *Syncarpia* in the Amboyne Islands; *Cloezia* in New Caledonia; *Spermolepis* in New Caledonia; and *Piliocalyx* in New Caledonia, one is rather at a loss to which subtribe to ascribe the greater age From the distribution alone it would seem, at first glance, that the Metrosidereæ had the greater age, but when the Australian range of the Euleptospermeæ and of Bæckeæ, is also taken into consideration, it seems advisable to assign a Cretaceous age for each, the one working towards the tropics, the other acclimatising itself to more southern and exposed conditions.

Bæckea appears to be somewhat younger than *Leptospermum* and *Melaleuca,* partly because of its more restricted range, and partly by reason of its specialised structures. The distribution also indicates the separation of New Zealand from Australia long before that of New Caledonia, and the separation of Asia from Australia at a later date than that of New Zealand.

The separation of New Caledonia, from Australia, appears to have taken place at a considerably later date, and New Caledonia itself appears to be a mere residual of a much larger land-mass, from a consideration of the number of genera endemic to it, such as *Cloezia, Piliocalyx, Spermolepis,* and *Xania.*

A consideration of Bæckeæ and Euleptospermeæ strongly suggests that the earlier types developed in a very poor soil, but in a moist and mild climate, and that the more xerophytic types are of decidedly younger age. In other words, the distribution suggests that the subarid types are much later modifications of the younger and less pauperate types. Nevertheless, the Euleptospermeæ are, on the whole, decidedly depauperate types as compared with Metrosidereæ.

Eucalypteæ.—This subtribe, which comprises the Eucalypts and the Angophoras, appears to have descended through the earlier types of the Metrosidereæ, at a date later than the separation of Australia from Asia, and of New Caledonia from Australia. No undoubted Eucalypt has been recorded from New Zealand, Fiji, New Caledonia, Borneo, Sumatra, or Asia. Several important points impress the student, at the very outset, in the study of Eucalyptus.

(1) It did not spring from a depauperate type.

(2) It is intimately related to *Angophora, Tristania, Metrosideros* and *Syncarpia.*

(3) Its earliest leaves were opposite, cordate, sessile and peculiarly veined.

(4) Its stamens are frequently very brightly coloured in some Northern and Western Australian species.

(5) It is separated into several groups, quite distinct from each other, and with little or no trace of connecting links.

(6) It is a type adapted either to resist hot, subarid, or cold, moist conditions, in the main, by reason of its operculum, its oil-contents, its wax-like bloom, its twisted leafstalks, its thick leaves, its enlarged root-stocks, as well as other adaptations.

(7) It has little or no striking morphological resemblance to the Euleptospermeæ and the Beaufortieæ, except for the long and brightly coloured stamens.

It would appear that both the Eucalypteæ and the Euleptospermeæ were, in the first instance, an organic response to a poor soil, and only secondly, after a long lapse of time, to a drying climate.

With regard to the question of its evident adaptation, in the first place, to a poor soil, and next to a subarid climate, it seems impossible for such a type to have existed in America, Europe, and Asia during the Cretaceous, when the types of plants found, are such as do not at all suggest arid or subarid conditions. Deane has advanced cogent reasons* in support of the growing belief that the older determinations of *Eucalyptus* in the Cretaceous and Tertiary of the Northern Hemisphere, by Ettingshausen, cannot be accepted. Hooker (quoted by A. R. Wallace, in "Island Life," p. 486) also appears to have considered the determinations of fossil Eucalypt-remains, in the Tertiary and Cretaceous of the Northern Hemisphere, as valueless. Bentham also appears to have disbelieved

* See "Observations on the Tertiary Flora of Australia." These Proceedings, xxv., 1900. See also R. H. Cambage, "Development and Distribution of the Genus Eucalyptus," Presidential Address. Journ. Proc. Roy. Soc. N. S. Wales, 1913.

Heer's and Unger's determinations of genera upon the evidence of leaves alone.*

Another strong reason for not accepting the statement that *Eucalyptus* flourished in the Northern Hemisphere during the Cretaceous and Tertiary, is to be found by observations of the juvenile leaves of the genus. The obstinate persistence of juvenile opposite, cordate, sessile, and horizontal leaves in the genus, indicates that such leaf-types had been thoroughly well established for a very long period, in the family, before the evolution of the genus *Eucalyptus;* and that the later, typical Eucalyptus-leaf, with twisted stalk, is a more unstable adaptation to a harsher climate, and one which would tend to become extinct, in favour of the old persistent type, under certain favourable climatic conditions. But it is exactly the later, more or less xerophytic and unstable form, which has been always reported as existing in the Cretaceous and Tertiary beds of the Northern Hemisphere, beds strongly suggestive of moist genial climates; and, moreover, even so, as Deane† has pointed out, such leaves recorded as Eucalypts, might equally be made to fit the plants of other families. Furthermore, such recorded leaves would not be regarded, by a student of Australian Eucalypts, as being suggestive of even the adult Eucalyptus-leaf of later xerophytic origin.

The existence of several distinct groups of Eucalypts, in regions partly overlapping, is very instructive in any discussion as to the origin of the Eucalypts. Indeed, a careful examination of this genus would serve well as a guide to the methods employed by the Myrtaceæ in the development of the endemic types of Australasia. The group which presents the most striking morphological similarities to the generalised type of the Myrtaceæ, includes

---

* Island Life. p.486.

† "Observations on Tertiary Flora of Australia." These Proceedings, 1900, pp.463-475. Deane, however, suggests that the capsular-fruited Myrtaceæ originated in Northern or North-eastern Australia, then attained their maximum development in Western Australia, and gave rise to the fleshy-fruited Myrtaceæ, which later spread to Asia and Europe, as differentiations of the primitive capsular type (*ibid.*, p.474).

the Bloodwoods. The members of the group possess widely divergent, almost transverse, secondary venation; the leaves are of luxuriant type; the principal oil is probably pinene; the anthers possess parallel cells opening in longitudinal slits; the flowers are corymbose; the fruits are urceolate, the valves deeply enclosed; and the soil in which they grow, is of the poorest sandy nature. Another point in which they conform to the generalised type of Myrtaceæ is, that they are confined to the warmer and peripheral portions of the continent, avoiding the deserts and the colder portions of Australia. Of these forms, two only, *E. calophylla* and *E. ficifolia*, grow in South-Western Australia. [*E. sepulchralis* is an aberrant member of the group, in which the anthers and the leaf-venation have been much modified.] Fifteen belong to the northern portion of Australia, namely, *E. Abergiana*, *E. clavigera*, *E. corymbosa*, *E. dichromophloia*, *E. ferruginea*, *E. Foelscheana*, *E. miniata*, *E. peltata*, *E. perfoliata*, *E. phœnicea*, *E. pyrophora*, *E. ptychocarpa*, *E. setosa*, *E. terminalis*, and *E. Watsoniana;* while six belong to the eastern side of Australia, namely, *E. corymbosa*, *E. eximia*, *E. intermedia* (R. T. Baker), *E. terminalis*, *E. trachyphloia*, and *E. Watsoniana*. Of these, *E. pyrophora* and *E. intermedia* are very close to *E. corymbosa*. *E. maculata*, *E. botryoides*, *E. resinifera*, *E. robusta*, *E. saligna*, and *E. tesselaris* are generally considered as belonging to the Bloodwoods, but they are all aberrant types in which either the bark and fruits, or the soils in which they grow, differ from the generalised type, and the soil in which the Bloodwood-type flourishes.

These points, as also the fact that *E. setosa*, *E. peltata*, *E. perfoliata*, and *E. ferruginea*, in the North, possess the peculiar leaves similar to the generalised type of the Order, strongly suggest that the cradle of the Eucalypts was in the north of Australia. This group, moreover, frequently possesses brightly coloured stamens, and exhibits strong affinities with the Angophoras.

A smaller section, namely, the Eudesmieæ, with opposite leaves, peculiar fruits, stamens, and notched calyces, is found in Northern and Western Australia. These also appear to preserve traces of the early Eucalypt-leaves. So peculiar is this group, that Robert

Brown proposed to raise it to generic rank, under the name of *Eudesmia*.

A third group comprises the Ironbarks and the Boxes, characterised by the possession of small anthers opening in pores, of peculiar barks and timbers, and a predominance of cineol.* The members of the group are numerous. They are confined to the Eastern half of the continent, and they grow, as a rule, in the heavier clay-soils, in contradistinction to the barren, sandy soils chosen by the Bloodwoods.

It is instructive, in this connection, to remember that the alluvial plains of Australia were formed during a period subsequent to the origin of the early Eucalypts. The Box-Ironbark group represents a main, but double, limb springing from the generalised type, at a period later than the secretion of cineol and phellandrene. The extreme twigs of this great, double limb, represent types such as *E. melliodora*, *E. sideroxylon*, *E. Cayleyi*, *E. leucoxylon*, *E. gracilis*, and *E. uncinata*, and are the farthest removed from the direct line of succession, in the genealogical tree of the Eucalypts, besides being far removed, also, from the generalised type of the Myrtaceæ.

A fourth group comprises the Stringybarks, the Peppermints and allied types, which possess kidney-shaped anthers of two types, each opening in divergent and confluent slits; peculiar leaves, fruits, and bark; as also a preponderance, in the main, of phellandrene oil and piperitone.† These grow in moist, and cool to cold climates, and are confined to the Southeastern portion of the continent, particularly in the plateau and mountainous regions of recent origin. *E. acmenioides*, *E. Naudiniana*, and *E. microcorys*‡ are aberrant types of the group.

---

* For analyses of these oils, see "Research on the Eucalypts." Baker and Smith (1902).

† This subject of the oils is dealt with by Messrs. Baker and Smith, in their "Research on the Eucalypts" (1902), forming a very valuable contribution to the hypothesis of the origin of the Eucalypts.

‡ Mr. J. H. Maiden appears to have been the first to consider *E. microcorys* and *E. Naudiniana* as anomalous forms, from a consideration of their anthers. [Critical Revision of the Genus Eucalyptus].

This group forms another great, bifurcating limb springing from a point higher up the stem of the genealogical tree of the Eucalypts, than that which gave rise to the Boxes and the Ironbarks; and their extreme types, such as *E. microcorys, E. stellulata, E. coriacea, E. coccifera*, and *E. hæmastoma* are as far removed from the general succession as are the extreme types of the Boxes and Ironbarks.

In the more arid portions of the continent, lying between these various groups, the desert-types were developed in the fulness of time. Types, *E. oleosa, E. dumosa, E. incrassata, E. uncinata, E gracilis, and E. pachyphylla.*

In brief, the history of *Eucalyptus* appears to have been as follows: A prototype of the Metrosidereæ, in the late Cretaceous, secreted a pinene oil, in Northern Australia or the neighbouring regions, and succeeded in forming an operculum by the coherence of its petals, for the protection of its reproductive organs. The earlier types appear to have possessed parallel anthers opening in longitudinal slits, stamens often brightly coloured, large glossy leaves, with transverse venation, a thick bark, pinene oil; and they appear to have grown in a porous sandy soil, and in a warm to hot climate. Moreover, the earlier leaves were opposite, sessile, and cordate, with horizontal surfaces. Protected by the operculum and the essential oil, the new plant began to push its way into the cooler country to the south. In proportion to such progress, and to its adaptation to a porous soil, it lost its juvenile opposite leaves.

With the retreat of the Cretaceous Sea, the Eastern side of Australia underwent a geological and geographical transformation, and, in their attempts to respond to their peculiar environment, the Eucalypts secreted a non-volatile wax-bloom, and two fresh oils, cineol and phellandrene. The function of the oils appears to be, in the main, to form a thin spray to withstand desiccation, but also, in the case of phellandrene and certain other constituents, their function appears to have been in part, at least, to resist cold, because the Metrosidereæ, with the Myrteæ, are unable to resist cold equally with aridity. The twisting of the leaf-stalk, and the development of the wax-bloom on the tender parts of the plant, appear also to be provisions against aridity.*

A group of the new genus appears to have detached itself gradually from the Corymbosæ members, and to have pressed its way far to the south. This was made possible by the protection of the tender reproductive organs, partly by the operculum during the earlier stages, and partly by reason of the thick capsule generally, for the typical Myrteæ have never been enabled to move far from the tropics, owing to the tender nature of their structures. This southward-moving group acclimatised itself to temperate, moist, and sheltered conditions, and there, it tended to revive the old, opposite, cordate, sessile, and horizontal leaves of the tribe, whereas the early, or corymbose, Eucalypts had practically discarded such leaf-types. The thinness and delicacy of the juvenile leaves belonging to some of these southern forms, suggest a development in the absence of strong light. The abundant development of cineol, among these types, also suggests protection from severe climatic conditions. Survivals of these types include *E. globulus, E. goniocalyx,* and *E. Maideni.* More modified types are *E. Cambagei* and *E. rubida.* In this group, the generalised type of anther for the Order is unaltered.

Another section with opposite juvenile leaves, is represented by types such as *E. viminalis, E. amygdalina,* and *E. radiata.* These opposite, sessile leaves, however, in order to adapt themselves to varied conditions, have adopted a thicker leaf-type, the breadth of the leaf is much reduced, and the leaf is held almost vertically.

At a much later period, namely, after the formation of the great plateaus of Eastern Australia, these Eucalypts gradually worked their way northwards as far as Queensland, and, to-day, along the plateaus, one may see the effect of this wonderful reinvasion by southern Eucalypt-types.

But prior to this stage, the eastern side of Australia became flooded with basalts; and heavy, rich clay-soils were formed in the area which had been vacated by the Cretaceous Sea. The Boxes

* Robert Brown, quoted by Schimper, in Plant-Geography.

and Ironbarks established themselves, in part, upon this, and became so modified in the process, that the links connecting this group and the earlier Bloodwoods, have practically vanished.

Similarly, as the eastern periphery of Australia became roughened, two other, but allied, groups of Eucalypts gradually developed in the more southern portions, and as the climate became colder, they slowly extended their way northwards. These groups include the Stringybarks, Peppermints, Mountain-Ashes, Messmates and the majority of the Mountain-Gums. They possess peculiar, kidney-shaped anthers, which again fall naturally into two types; they also possess a peculiar leaf-venation, and their oils are likewise characteristic.*

With the formation of the great plateaus of Eastern Australia during the Kosciusko-Period, the Eastern Eucalypts became differentiated into fresh species and varieties, while the Boxes, Ironbarks, and Bloodwoods remained but slightly modified.

Thus, at present, along the highlands of Victoria, New South Wales, and Southern Queensland, may be seen the effect of reinvasion by forms of Eucalypts, which had been developed in regions further to the south.

---

* In attempting to work out a scheme for the evolution of the Eucalypts, special attention should be directed to anthers, leaves, oils, soil, and climate. With regard to anthers, the work of Bentham, von Mueller, and Maiden is invaluable. So important a factor did the anthers appear to the great Bentham, that he actually established a sound classification of the Eucalypts upon such basis, its imperfections being due merely to his lack of knowledge of the growing plants and their environment. This difficult task, commenced by Bentham, is being carried on by Mr. J. H. Maiden, whose views have been, and are being, expressed in the "Critical Revision of the Eucalypts" and "The Forest Flora." The work also of Baker and Smith is highly important in Eucalypt-studies. The great resemblance between *Angophora* and the Corymbosæ Eucalypts is clearly pointed out by them. Especially clearly have they shown the intimate relations existing between the development of the leaves and the oils of the genus, as also the relations existing between the Peppermint and Stringybark groups. Recently, the influence of the soils, and the climate has been perceived by Mr. Cambage; and he has accomplished the difficult and highly important task of co-ordinating the different lines of evidence yielded by a study of soil and climate.

An examination of the several distinct groups of Eucalypts living in different soils, in different climates, and possessing leaves, barks, inflorescences, and anthers strikingly dissimilar in character, suggests that here, probably, several genera have been grouped together, groups apparently quite as distinct from each other as *Beaufortia*, *Regelia*, *Melaleuca* and *Callistemon*, or as *Leptospermum* and *Kunzea*, or as *Kunzea* and *Bæckea*. Thus *E. tetrodonta*, *E. erythrocorys*, *E. eudesmioides*, *E. tetragona*, and *E. odontocarpa*, with their 4-toothed calyces, their stamens more or less united into four clusters, their 3-flowered peduncles, their leaves opposite, and their very limited geographical range, might well be restored to generic rank as *Eudesmia*. In the writer's opinion, this appears to be but just to Robert Brown.

The work of Bentham, followed up by that of von Mueller and Maiden, the edaphic studies of Cambage, and the oil-studies by Baker and Smith have shown conclusively that the Section Corymbosæ is the oldest, and the Peppermint-section* the youngest, nevertheless the intermediate forms have vanished, and it may be shown, on morphological and geographical grounds, that the types which, at first sight, apparently show connection between the groups, are really only aberrant or specialised forms of *much later* origin.

The name Eucalyptus was proposed by l'Heritier for a genus, of which the present *E. obliqua* is the type. This type is included by Bentham in his Section Renantheræ under Eucalyptus. The group appears to be easily divisible into the Stringybarks, Peppermints, Mountain-Ashes, and their specialised forms, the Sallies, the Tallow-wood, etc. Of these, the Stringybarks, in part at least, appear to be the older members. The name Eucalyptus might be reserved for these plants. As already mentioned, they possess reniform anthers, a tendency to arrange the secondary leaf-veins parallel to the midrib, they possess varying quantities of phellandrene and piperitone oils, and they are confined to South-eastern Australia, a region of rugged and well watered topography. The types include forms such as *E. Delegetensis*, *E.*

* Certain desert-types also appear to be fairly youthful.

obliqua, *E. dives*, *E. amygdalina*, *E. piperita*, *E. Risdoni*, *E. pilularis*, *E. capitellata*, *E. lævopinea*, *E. eugenioides*, *E. macrorhyncha*, *E. Muelleriana*, etc.

Specialised or aberrant forms include *E. coriacea*, *E. stellulata*, *E. coccifera*, *E. vitrea*, *E. Smithii*, *E. acmenioides*, and *E. microcorys*, the last two varying in the opposite direction to that taken by the first-named four types. A careful examination of *E. buprestium*, *E. marginata*, and *E. santalifolia* from W. Australia indicates that they are specialised forms only of Bentham's Normales, and are only analogous forms to what are here called the true Eucalypts (Renantheræ of Bentham). Moreover, the study of the geographical conditions shows that the Eucalypts, of which *E. obliqua* is the type, have originated in the mountainous topography of South-eastern Australia, at a time during which the climate and topography of the region separating Western from South-eastern Australia, have been such as to forbid the migration of the *E. obliqua*-type to the west. In Western Australia, one finds only the Normales-type, with its peculiar aberrant or specialised forms. Even the great Section of the Porantheræ is there unrepresented. Moreover, *E. buprestium*, *E. marginata*, and *E. santalifolia* have neither phellandrene nor piperitone contents. Thus they may be removed from the true Eucalypts.

Types, such as *E. corymbosa*, *E. setosa*, *E. miniata*, *E. ficifolia*, *E. calophylla*, *E. terminalis*, *E. trachyphloia*, *E. eximia*, *E. peltata*, *E. perfoliata*, *E. Abergiana* and *E. ferruginea*, might be called Corymbosa. In this, as in some other groups, the bark is not to be relied upon always for purposes of natural classification. In the earlier types of the genus, it appears to have been thick, and more or less charged with kinos and other material for the purpose of resisting the excessive transpiration to which the ancestral form of the primitive type had been a stranger; but with types such as *E. maculata* and *E. tesselaris*, this property could be dispensed with, owing to the ability of such later forms to reach a water-supply easily. Nevertheless, vestigial traces of the primitive, thick bark remain still on these types. *E. coriacea*, *E. stellulata*, *E. hæmastoma*, *E. vitrea*, and *E. coccifera* are still more striking instances of this feature (namely, rejection of the primitive thick, and more or less corky bark) in the case of the true Eucalypts.

Another Eastern Australian group may be raised to generic rank, under the name of Poranthera. This includes the Boxes and Ironbarks, whose special features have been considered elsewhere. These, among others, include *E. albens*, *E. hemiphloia*, *E. odorata*, *E. Woollsiana*, *E. microtheca*, *E. polyanthemos*, *E. populifolia*, *E. conica*, *E. crebra*, *E. Cayleyi*, and *E. siderophloia*. Aberrant or specialised forms (widely separated from the primitive Corymbosa, on the one hand, and the younger Eucalypt, on the other hand) include *E. melliodora*, *E. Bosistoana*, *E. paniculata*, *E. leucoxylon*, *E. Behriana*, *E. uncinata*, and *E. gracilis*. This genus is divisible, again, into Boxes, Ironbarks, and certain Mallees. The bark here becomes a powerful aid in classification. Connecting links with the earlier forms possibly are to be found in *E. pruinosa* and *E. melanoxylon*.

The remaining types fall into groups to which the name Parallelanthera may be applied. Members of this Section are to be found in all parts of Australia; representatives are to be found in the deserts, others in the moisture-laden coastal ravines, others in the hot north, others on the exposed subalpine plateaus.

They represent, with the exception of Eudesmia, Eucalyptus, Poranthera, and Corymbosa, all the forms possessing caps to the unexpanded flower. With the knowledge of this wide geographical range, the variety of climates, the oft-changing topography, and the long time-factor involved, to which the earlier forms of this Section were subjected, it is not strange that members of the same should have proved a veritable puzzle to systematists. It is as if representatives of the earlier types had penetrated into remote corners of the continent, and then being cut off later from intercommunication, they had become more and more specialised, yet not so markedly as to have given rise to new genera. A few examples will suffice to establish this point. *E. globulus*, *E. goniocalyx*, *E. Cambagei*, *E. Maideni*, *E. Nova-Anglica*, *E. viminalis*, *E. cinerea*, *E. pulvigera*, *E. cordata* and similar types, have developed in abundance of moisture and shade, with moderate shelter, in the recently formed plateau-province of South-eastern Australia. *E. Perriniana*, *E. urnigera*, *E. alpina*, *E. Gunnii*, and *E. vernicosa* have evolved on the wind-swept and snow-laden plateaus to the south; while *E. viridis*, *E. Morrisii*, *E. platyphylla*, *E. oleosa*, and *E. dumosa* are a response to the hot and subarid to arid portions of the continent. *E. rostrata* has spread across Australia by creeping along watercourses, and thus defying the surrounding desert-conditions; while *E. cornuta*, *E. gomphocephala*, *E. cosmophylla*, *E. macrocarpa*, *E. pyriformis*, *E. cæsia*, *E. megacarpa*, *E. fœcunda*, *E. loxophleba*, *E. diversicolor*, *E. redunca* and others, occur in Western Australia, and are found neither in Northern nor Eastern Australia. In most cases, the peculiarities of these various assemblages are suggestive of a response to xerophytic conditions. This is, however, not applicable to the famous *globulus*-group, whose youthful stages indicate an immediate ancestor which flourished in cool, temperate, moist, shady and moderately sheltered situations. In a word, so effectively has the general development progressed, and so universally have the intermediate or connecting forms been stamped out, that no systematist can state from which group either the Eucalypts or the Porantheras have sprung. Neither can the origin of the *globulus*-group be traced back more than one step. All that is known is, that the *globulus*-group is relatively young, so also the Eucalypts, while the Corymbosæ are old.

Angophora presents a peculiar problem to the student of distribution. Indistinguishable from the Corymbosæ Eucalypts, except for the coherence of the petals to form an operculum to the unopened flower, it occurs only in the milder extratropical portions of Eastern Australia; its anthers are parallel, and they open in longitudinal slits; its stamens are not brightly coloured; its bark, with one exception, is rough; its leaves are mostly opposite and sessile; with one exception, the soils it seeks, are extremely sandy, porous, and lacking in fertility; and the distribution of the species is exceedingly limited, being confined, with one exception, to small patches of barren sandstone. Such are *A. cordifolia*, a stunted type, confined to the

Sydney sandstone ; *A. lanceolata*, confined to sandstone patches along the coastal regions as far north as Rockhampton ; *A. melanoxylon*, limited to small patches of gravel and sand in north-western New South Wales; while *A. intermedia* has a considerable range in the warmer portions of extratropical Eastern Australia; but this type has succeeded in establishing itself upon the light clay-soils, and is, apparently, a much more recent type than *A. cordifolia* and *A. melanoxylon.*

Angophora, indeed, appears to be a type which deployed, with *Eucalyptus*, from the ancestors of the Metrosidereæ, but which did not succeed in developing protective characters to such an extent as *Eucalyptus* did. It failed, therefore, to populate Australia, and as *Eucalyptus* extended its borders, with the development of each new protective character, so, to that extent, the less elastic type, namely, *Angophora,* was crowded out until, at the present day, it appears to be a genus rapidly undergoing extinction, and existing only in outposts, as regards its former distribution. *A. cordifolia* and *A. melanoxylon* are splendid examples of this contraction of habitat, while *A. intermedia* is a striking example of the success of a species which has become modified with respect to the type.* It is highly probable that, in Tertiary time, *Angophora* had both many species, and a wide distribution in warmer Eastern Australia. The failure to supersede the obstinately persistent, opposite and sessile leaves, except in rare instances, appears to have been one reason for its extremely limited development.

Chamælaucieæ, etc.—In dealing with Chamælaucieæ, Beaufortieæ, and certain other groups of Myrtaceæ, it may be advisable to consider them from a general point of view.

It will be found that, in proportion as the climatic and soil-conditions, in which a Myrtacean genus occurs, vary from those of the fertile tropics, so do the morphological characters of such genera undergo a distinct change. This suggests a corresponding youthfulness for the genera considered.

---

* Mr. Maiden has drawn attention to the great similarity between *A. intermedia* and *A. subvelutina.*

In this connection, it may be advisable to consider leaves, stamens, anthers, and the habits of individuals.

The leaves of Myrtaceæ are typically opposite, glossy, broad, penniveined, and dotted. In many Bæckeas, Darwinias, Kunzeas, Verticordias, Chamælauciums, Melaleucas, Thryptomenes, Micromyrtus, and other types, the leaves are rigid, terete, and generally depauperate in form. Such suggest development under harsh climatic, or impoverished soil-conditions; and such species are mainly the younger forms of the genera which have accommodated themselves to the Post-Cretaceous and later Tertiary, or even Post-Tertiary, conditions.

The stamens of Myrtaceæ are characteristically numerous, free, long, and often brightly coloured. In Chamælaucieæ and some Leptospermeæ, the stamens are frequently much reduced in size and number, and such condition is accompanied, as a rule, by severe climatic and soil-environment. Those species of the genera, thus affected, are apparently of more recent development than the typical types of the genera.

The typical anthers of the family are versatile, the cells parallel and opening longitudinally. Thus the Angophoras and Corymbosas have the typical anthers of Myrtaceæ, but the Boxes and Ironbarks possess peculiar porose or truncate anthers, and the Stringybarks, Peppermints, Messmates, Mountain-Ashes, and some Mountain-Gums, possess kidney-shaped anthers. The Melaleucas, Callistemons, Leptospermums, and Kunzeas possess typical anthers, but *Beaufortia, Regelia, Pileanthus,* and *Verticordia* possess peculiar varieties of porose and grooved anthers, and such peculiar types, moreover, are endemic in Western Australia. Again, the Bæckeas of Eastern Australia are mostly possessed of typical anthers, whereas the majority of the species, endemic in Western Australia, possess anthers very divergent from the type.

These interesting facts, coupled with a knowledge of the geographical environments, indicate that those Eucalypts, Bæckeas, Chamælauciums, and Beaufortieæ, with peculiar leaves and anthers, are recent in proportion as they depart, in morphological characters, from the generalised type of the fertile tropics, and that they have been evolved in response to some particular, physical revolution, such as a change to a sandy, a clay, a dry, or a cold environment.

Similarly, the fruits of the earlier types of Myrtaceæ were fleshy, and the capsular-types, in this instance, appear to be a response to less fertile and less sheltered habitats. The depauperate fruit of the Chamælaucieæ here suggests a much more recent response again to conditions more generally severe.

The habit of the individual is again instructive. The typical Myrteæ either may be the largest of forest-trees or they may be elegant shrubs, with full habit and glossy foliage. The typical Chamælaucieæ, and many of the Leptospermeæ, are very depauperate in form, and not at all suggestive of the stately and handsome Myrteæ and Metrosidereæ. Such depauperate forms, moreover, abound in the subarid and barren, sandy areas of Australia. From this consideration, also, such forms appear to be much more recent developments. Furthermore, almost without exception, such depauperate and apparently aberrant types have a limited range, being endemic to Australia, frequently Western Australia. This restricted geographical range, moreover, suggests a much more recent origin than that of the widely-spread Myrteæ.

The distinctive characters, however, of the majority of Western Australian from Eastern Australian species of Myrtaceæ, in view of the fact that the areas considered are mainly sandy in nature, and the centre of Australia arid, strongly suggest that the Central Australian desert was a hindrance rather than an impetus to Myrtaceous differentiation; and that the peculiar sandy soil of Eastern and Western Australia, formed one of the most potent influences in the production of new species, and that, whereas, probably in earlier Tertiary time, the Eastern and Western species commingled, they have more recently developed along divergent lines, since the interposition of an arid barrier of less sandy soil, in Central Australia.

From these considerations, it would appear that the Myrteæ are much the oldest branch of the family, that Euleptospermeæ and

Metrosidereæ are of great age, the Angophoras and Eucalypts being much younger than these, while the Chamælaucieæ and Beaufortieæ are still more recent modifications of types, probably such as *Leptospermum*, *Kunzea* and *Bæckea*, on the one hand, and of *Melaleuca*, on the other.

[Printed off December 15th, 1913.]

THE GEOLOGY AND PETROLOGY OF THE GREAT SERPENTINE BELT OF NEW SOUTH WALES.

Part ii. The Geology of the Nundle District.

By W. N. Benson, B.A., B.Sc.

(Plates xxii.-xxiv.)

The Nundle District lies near the head of the Peel River, the chief township being 37 miles from Tamworth. Gold was discovered here in 1852, and mining has been carried on fitfully ever since. The district is divided diagonally by the Peel River, to the east of which lie the high outposts of the New England Plateau, with the lesser heights of the Peel River Buttress to the west. Nundle lies in the hollow produced by down-faulting. The smaller township of Bowling Alley Point is in the narrow valley of the river, by which it leaves this sunken area, while the rapidly growing, agricultural township of Woolomin lies on the wide-spreading, alluvial flats at the junction of the Peel River and Duncan's Creek.

The amount of detailed work done here, previously, is very small, the reports of Clarke(**3**), Odernheimer(**5**), Wilkinson(**25**), and Jaquet(**4**) being the only important writings, and the two latter are concerned chiefly with the Tertiary drifts. No systematic survey has yet been attempted. The map given (Plate xxii.) may, therefore, claim to be original in every detail. A preliminary account of this area was read two years ago(**15**), but subsequent work has called for some modification in the conclusions then reached, and a much more detailed map is here presented.

The Palæozoic foundation rocks fall into three series, the Woolomin Series, the Bowling Alley Series, and the Nundle Series. The first occupies the eastern side of the area, and is separated by the line of peridotite-intrusions from the Bowling Alley Series. The latter passes directly upwards into the Nundle Series without any unconformity. It has been shown (see Part i.) that these three Series exist throughout the whole belt as far as Warialda, that the Bowling Alley belts are the local equivalent of the Tamworth Series, that the Nundle Series corresponds to the Barraba Series, and that reasons may be offered for the absence of the Baldwin Agglomerates. The higher Burindi Series does not appear till one reaches Goonoo Goonoo, 20 miles to the west.

We now proceed to a detailed description of the several formations, as developed in this area.

(1). Woolomin Series.

The eastern portion of the area is made up of rocks of the Woolomin Series. Their western boundary is the line of fault, which is marked throughout by the serpentine-intrusions. The series is made up of jaspers, phyllites, spilite-lavas, and tuffs, with occasionally conglomerates. The jaspers are the most striking rocks, and are developed in long bands not quite parallel to the serpentine-line. Commencing in the rugged cliffs of Wallaby Mountain, west of Woolomin, they may be followed across the Peel River; they form the Peak by Warden's Farm, and the high rocks overlooking Sheep Station Creek; and then continue along the line of watershed between Munro's and Duncan's Creeks, and finally are cut out by the granodiorite. A line of section from Warden's Farm, on the Peel River, across to Duncan's Creek, shows nine bands of jasper, varying in width up to 100 feet, and invariably giving marked relief. They are not banded but homogeneous, pale pink to deep red in colour, and with traces of radiolaria, which are rarely visible distinctly in microscopic section. They are often intensely silicified, riddled with twisting quartz-veins, small or reaching some yards in width, and, in one instance, the jasper-band is entirely replaced by a huge white quartz-reef, over 100 yards long, and 8 or 10 yards wide, that stands out, like a wall, from the eastward-facing cliffs beyond the head of Munro's Creek, and is protecting the upper waters of that creek from capture by the Duncan's Creek System. On the other hand, the ferruginous content of the jasper may increase till the rock becomes merely a siliceous hæmatite. This, however, is unusual. Very ferruginous phyllite is more common, and passages from this into a jasperoid rock are frequently observable.

Between the jaspers, are normal micaceous phyllites and varying types of green and purple schistose tuff that have not as yet been much investigated. Spilites are common in varying stages of alteration. In the field, before microscopic investigation had shown their nature, they were a great puzzle, and were considered to be a dark-coloured hornfels. They are all fine-grained, often slightly vesicular, and break with difficulty, giving an irregular fracture. They are much sheared and jointed, and, in some forms of alteration, strongly resemble altered mudstone. They have been found in various localities, and are particularly abundant on the slopes east of Munro's Creek, where they are invaded by the porphyries. Here they are probably the predominant rock, and are, no doubt, far more abundant elsewhere than is at present known.

Between the head of Munro's Creek and Swamp Creek, there is a wedge-shaped area of Woolomin rocks differing from those described above, but resembling what may be found near Mundowey, on the Namoi River. This area has not been much investigated, and is doubly difficult of study owing to its poverty in good outcrops, and the thickness of the vegetation. A peculiar slatey conglomerate forms the northern portion, and stretches from north of Folly Creek down to Nuggety Creek, along its western tributary; while hence, to the south and east, a tough, grey, non-schistose hornstone is present, suggesting an altered microcrystalline rock porphyritic in quartz, but which, on microscopic examination, is clearly clastic. A similar rock occurs at Mundowey. A little inlier of this rock is to be found among the basalts near the head of Swamp Creek (here called Burrows' Creek). It is quite impossible, so far, to make any statement of the stratigraphy of this much disturbed area. Many of the dips recorded are probably only cleavage-plane slopes, but wherever the true dip is seen, like the cleavage-plane, it has a general strike of N.20°W., and a dip varying from the vertical to 70° to the east, or occasionally to the west. In the Swamp Oak district, some fifteen miles to the north-east, Stonier(**26**) has shown that the rocks (presumably of the Woolomin Series) are in normal folds quite independently of the cleavage, which is parallel to that at Nundle. At present, however, there is no means of checking this assumed identity; the Swamp Oak rocks may be even a Permo-Carboniferous mass nipped in like those at Emmaville(**27**).

The thickness of the Woolomin Series is quite indefinite, and without doubt there is much repetition by faulting and folding. The presence of so many parallel jasper bands is evidence of this, but it would need a careful study, yard by yard, with much microscopical work, of the section from Warden's to Duncan's Creeks, to determine the horizons, and how often they are repeated. Even then the thickness will be unknown. There is no base, and the series is terminated by the fault of the serpentine-line.

(2). Bowling Alley Series.

This occupies the central portion of the map, and may be directly correlated with the Tamworth Series. It may be divided into five portions, the horizon of the limestone being taken as the line of reference, though it is true, that the limestone is not confined to one narrow zone.

The line of section at Bowling Alley Point, westward from Chrome Hill, is the most typical, and, on this, the subdivisions have been erected. Further north, the succession is less well known; further south, it is more disturbed, but, throughout, the limestone serves as a good horizon of reference for mapping.

(*a*).*Lower, Banded, Radiolarian Claystones.*—These occur next to the serpentine on Chrome Hill, one mile east of Nundle, may be traced thence up the west side of Munro's Creek, where they are much disturbed, and occur again south of Hanging Rock, in the small triangle of Bowling Alley rocks that lie east of the serpentine. In all three localities, the rocks are rather cherty.

Between Munro's Creek and Hanging Rock, the rocks west of the serpentine are more slatey, are more or less altered by the magmatic waters associated with serpentine-intrusion, and are greatly disturbed. Some cherty bands and spilites are present here. North of Bowling Alley Point, the same cherty claystones are developed, notably in the knoll that rises from among the Permo-Carboniferous rocks on the Peel River, but are less well marked north of the stream. Small lenses of limestone occur, but rarely. They have been seen on Munro's Creek, but have not yet been found to contain radiolaria. They are only a few inches in width. The maximum thickness of this series is about six hundred feet.

(*b*). The Lower Bowling Alley Tuffs and Breccias extend from Chrome Hill across the river to the limestones. Making due allowance for the numerous intrusions of dolerite (but none for possible strike-faulting), they seem to be about 4,000 feet thick. The rock is chiefly a grey-green, felspathic tuff, in which the constituent fragments are scarcely more than one-quarter of an inch in diameter, but occasionally it is more coarsely grained, becoming a regular breccia, with angular fragments of chert several inches in length. It consists chiefly of fragments of radiolarian chert, and finely divided igneous material, chiefly chips of spilite, and crystals of plagioclase, augite, and iron-ores; quartz is less frequent. The rocks are often extremely indurated, and, on weathering, the constituent fragments, or sometimes the cement, are brought out in high relief by natural etching.

Here and there, throughout the series, are subordinate layers of banded, cherty claystone. Flows of spilite are present, and, in particular, may be noticed the mass that forms the prominent crag, White Rock, that overlooks Munro's Creek (Plate xxiii.). Nevertheless the rock does not appear so abundant as in the upper series.

A hard, black, basalt-like band near the 'Possum Mine, Bowling Alley Point, has proved to be a peculiarly even-grained, basic tuff.

(*c*). The limestones form a series of long or short lenses, extending the whole length of the area (twelve miles). While probably not all exactly on the same horizon, they are mostly confined to a narrow zone, while those apparently out of the zone, may, in some cases, be displaced by faulting, though this explanation will not hold for all. A brief description of several occurrences, commencing from the north, must now be given.

North of Black Jack, a red and white crystalline limestone occurs, and passing below the basalt cap, continues to the south. It forms two bands about 80 yards apart. On crossing Cope's Creek, it is thrown westwards by a small fault, but thence continues southwards, reaching a maximum thickness of over 50 yards, pinching out after about a mile. It is remarkable for its brecciated character, being composed of angular fragments of red, pink, and cream-coloured limestone, cemented with white calcite. It takes a high polish, and makes a handsome stone. Numerous crinoid-stems are present, but recognisable fossils are few.

At the east of the southern end of this, is a band, about 50 yards wide, of grey limestone much mixed with tuffaceous material and sediment. The patch is about half a mile long, and contains numerous, determinable fossils. About a mile to the south of this, is a pair of lenses of limestone, one of which forms a small bluff by the creek. It is of a brecciated character, and no determinable fossils were found. South again, and west of the general horizon, are two small lenses of grey, non fossiliferous rock, one on a hilltop north of Hyde's Creek, the other north of Cann's Plains Creek. It is hardly likely that they are faulted repetitions of the main horizon. One mile to the east of the last, are two fossiliferous lenses occurring in the saddle by the old Phœnix Mine. Half a mile east of these, is a small lens near the river, opposite Warden's Farm, with traces of fossils, which is probably on the same horizon as the fossiliferous rock by Tongue's house, on the river to the south. This is a coarse, tuffaceous breccia, with large fragments of limestone, one of which contains *Phillipsastræa.*

South of Cann's Plains Creek, and again on the general horizon, are situated the limestone quarries by Bowling Alley Point. It is a fairly pure, grey stone with a few fossils, about

30 feet thick, and enclosed between two layers of banded chert. On the hill, one-quarter of a mile east of this, is a second, more richly fossiliferous band, which, however, is rather silicified, and contains a good deal of tuffaceous material. This is inter-stratified with the tuffaceous breccias of the Lower Series. *Diphyphyllum*, *Heliolites*, *Heliophyllum*, and *Favosites* occur here. A little patch of white, saccharoidal limestone occurs in the bend of the river, opposite Pyrke's Store, to the east, again, of these.

Continuing southwards, there is a long series of small masses either of clear pure lens, or patches of tuffaceous breccia with large fragments of limestone; or, as these frequently are dissolved out, the limestone-horizon is represented by merely tuffaceous breccia, with large irregular cavities. The abundance of travertine, in the creeks draining from here, indicates the fate of the original limestone-content of these cavities. A small band of dark tuff, with limestone fragments, appears by the roadside south of Bowling Alley Point, the first limestone east of the river; and two other small patches lie about one mile to the south, on the hillside. In this case, the breccia is largely spilite. Near by, is a small lens of pure, grey limestone only a few feet wide. South, again, the limestone is present as fragments containing crinoid and coral remains, imbedded in a dark, compact spilite-lava, the microscopic examination of which gives every indication of rapid cooling. Skeleton-crystals of augite, of magnetite, and felspar are imbedded in a glassy matrix. There can be little doubt that here the organisms were killed out by a flow of spilite-lava, which caught up and included the individuals. The cavernous breccia and that containing limestone-fragments were doubtless produced by a rain of volcanic material falling on to calcareous organisms. Both indicate the very shallow water origin of the rocks concerned, as was pointed out in a previous note(**14**).

This cavernous and limestone-tuff breccia occurs again just north of Moonlight Hill, north of Swamp Creek. It is about 10 yards wide, and is bounded on either side by banded, cherty claystones. It occurs in the same manner on the sharp point north of the junction of Folly and Swamp Creeks. South of

Folly Creek, it is 100 feet thick. The lower portion is of the cavernous tuff-type, but the upper is a white crystalline limestone, with thin bands of quartz and tuffaceous material. It is followed by a narrow zone of fine breccia, covered by a great thickness of cherty claystones. About half a mile east of this, is a very narrow bar of pure, crystalline limestone.

Tracing further to the southwards, we find a small bar crossing the spur by the Swamp Creek Falls, and again a small patch, with *Diphyphyllum*, in the angle above the Falls Both these approximate to the cavernous type. Nothing further is seen for two miles, then a tiny lens of cavernous rock is found on Ruzicka's Hill ("Risky's Hill") near Hanging Rock. This is east of the proper horizon. On the true horizon, a little limestone is to be seen at the head of Spring Gully, in Stringer's Tunnel (Deegan's lease), and, near here, some traces of brachiopods were found, in the slate, too obscured for determination (*fide* Mr. W. S. Dun). A few hundred yards further down hill, there is a small group of lenses by the Devil's Elbow, on the Hanging Rock Road, with obscure shells (one like *Atrypa*) and corals, including *Heliolites porosa*. One of these lenses is intruded by dolerite. A small lens occurs in Oakenville Creek, and ascends the hill opposite the cliffs of Hanging Rock. This is the southernmost occurrence noted. A complete list of the forms observed is given in the preceding Part. In the author's opinion, the limestone is not only analogous to the Tamworth limestone, but is on the same horizon.

(*d*). The Upper, Banded, Radiolarian claystones lie on these limestones. They form a well marked band about 1,000 feet thick. They may be traced from north of Cann's Plains Creek, across the Peel River, where they are well developed in Daylight and Mahoney's Creeks, and form the great cliffs that overhang the junction of Swamp Creek and Folly Creek. Here they are often very cherty. Further to the south, they cross Oakenville Creek, and are well developed near Mount Ephraim. They contain abundant radiolarian casts.

Interstratified with these, is a large amount of the tuff-breccia identical in character with that below the limestone.

The chief point of interest, in these rocks, is the abundance of the spilites. Their chief occurrences are shown on the map, but it should be noted that, as the nature of this rock and its peculiar interest were unknown to the author when the field-work was in progress (1909-10), less attention was paid to it than would otherwise have been the case. With this must be considered the very complex relation between the dolerites and the spilites, which adds further uncertainty to some of the observations. The occurrences mapped, however, have all been proved, by microscopic work, to be true spilite. North of Bowling Alley Point, the spilites are rare, but south of the township, a flow commences, which may be traced, with interruptions, right to the limit of the map. Commencing near the Peel River, it passes across the face of the hillside and forms the high point known as Tom Tiger, overlooking the mouth of Swamp Creek. Beyond, it runs across the face of Frenchman's Spur, where it is very fresh, and, after a break, widens out into the mass which forms the hill west of the Devil's Elbow, on the Hanging Rock Road. From here, it splits into two or more bands, one of which continues southwards to the head of Oakenville Creek, where it passes below the basalts, forming a ridge protruding into their lower portion. The splitting into several bands is probably the result of strike-faulting.

North of Tom Tiger, the mass is much disturbed with dolerite-intrusions, and veins of axinite with epidote-quartz and calcite, producing a rock closely resembling that described by Lacroix from Pic d'Arbizon, in the Pyrenees(**28**). This latter, he considers produced by the last stages of activity of an intrusive granite. It is difficult to see how this applies here. Unfortunately the occurrence was not thoroughly investigated in the field or laboratory. The axinite has been described, mineralogically, by Dr. Anderson(**29**).

A second and lower flow of spilite is that which forms the high, shutter-like wall in front of the Swamp Creek Falls, which have just broken through (Plate xxiv.). This flow, also, may be traced for some distance north and south. A third, possibly the uppermost horizon, occurs on the western slopes of Tom Tiger, and may be traced northwards on to the roadway. This is of considerable width, the spilite being split into several layers, and intercalated with banded chert.

No evidence of pillow-structure has yet been seen among these rocks, but certainly it was not looked for specially.

(*e*). *Upper Bowling Alley Tuffs and Breccias.*—The Upper Tuffs and Breccias complete the Bowling Alley Series, and occur throughout, from north to south. They are about 3,300 feet in thickness, and are fairly free from intrusions of dolerite and flows of spilite. Interbedded with them, are minor bands of radiolarian clayshales; and probably the western limestone-lenses north of Cann's Plains and Hyde's Creek, belong also to this formation. All along its lower limit, occur those peculiar associations of tuff and clay-shales described by Professor David and Mr. Pittman from Tamworth(**3**), in which the tuff seems intrusive into the chert. The origin of this structure is not clear. The explanation of a somewhat similar feature at Lyndhurst, given by Mr. Pittman(**30**), does not seem to apply here. In a large measure, they may be due to crushing, for elsewhere brecciated cherts are found, that seem to have been almost telescoped, and the situation of the "tuff-intrusions," *i.e.*, at the boundary of tuff and chert, formations probably of very different powers of mechanical resistance to pressure, would be very favourable to such a crushing. But the same formation also occurs above the radiolarian chert, in the Baldwin Series exposed in Cobbadah Creek Gorge, where such crushing is out of the question. Moreover, the association seems to occur where tuffs lie on the claystones or chert, and has not been noticed in the reverse case.

It might be suggested, therefore, that were white-hot tuffaceous material to fall on wet mud forming in a shallow or partially dried lagoon, its heat might cause the mud to flake off and crack away, and the commotion produced by the escape of steam, from beneath, would give the stirring action necessary for mixing up the flakes of mudstone and the tuffaceous material. In support of this, it may be urged, that the flakes of mudstone are rarely more than a few inches long, and are often bent like dried cakes of mud;

that there is often a distinct alteration, a bleaching and induration of the mudstone at its contact with the tuff, and that it does not involve the action of a kind of steam-blast all along the line of contact of the claystone and tuff subsequent to their deposition, a process of which it is extremely difficult to conceive, or of which there is no evidence beyond the facts already mentioned. The absence of steam-cavities may be accounted for, on either hypothesis, by the crushing into the vacancy of the plastic tuff and shale, and the complete escape of the steam favours the new suggestion.

It should be noted that, if this explanation is true, either the mud must have been deposited in a very shallow sea, or the tuff must have fallen in such great quantity as to protect the lowest layers from immediate quenching by the seawater. There is little sign, apparently, of the tremendous disturbance that the latter alternative would necessarily have involved.

Above this, the breccias are seen to be interbedded with a considerable amount of banded claystone. The lower portion of this mass is best observed in the valley of Swamp Creek, the upper in the tributaries of Happy Valley, draining the Frenchman's Spur. Oakenville Creek also is in this series, for the most part. The breccias incline to be coarse, more so in the upper portions, and contain large fragments of banded chert. Occasionally they are so coarse-grained as to resemble the finer portions of the Baldwin Agglomerate, and possibly the narrow band of this rock, at the top of the Upper Tuff-breccias, may be considered the representative of the Baldwin Agglomerate in this neighbourhood. This does not, however, seem necessary.

In the upper portions of the series also, are bands of claystone containing *Lepidodendron australe,* radiolaria being found also in the fossil specimens. These occur on the main road, about one mile south of the Swamp Creek Bridge(G.L.,342).

Stratigraphy.—The five divisions of the Bowling Alley Series seem well substantiated; nevertheless, the great similarity of the Series below the limestones, to those above the limestones, is so suggestive of a wholesale repetition by strike-faulting (as is known to occur further north), as to make it advisable to call attention to their differences. These are not very great. The spilites are present in much greater abundance, as far as is known, in the upper breccias than in the lower, a discordance in character that is significant only because the discussion is on the relationship of two adjacent series. High spilite-content is not a general characteristic of the Upper Series, for this lava is much less common in the series at Tamworth, which is considered identical with the Upper Bowling Alley Tuff-breccias and chert. Secondly, the peculiar coarse breccias, and large chert-fragments characteristic of the upper part of the Upper Breccias, are not at all common in the upper part of the Lower Breccias, nor has *Lepidodendron* been found yet among these.

It is very probable, however, that the whole belt of Bowling Alley rocks is traversed by a series of parallel, overthrust faults, so that what appears to be a single portion of the series, *e.g.*, the Lower Breccias, may be thickened by many repetitions. This would account for the very frequent interbedding of breccia and claystone throughout. Also the multiplication of spilite-flows might be explained thus.

The strike of these beds is generally parallel to that of the serpentine-line, and swings to the north and south direction sympathetically with the serpentine on Oakenville Creek, where a dip W.5N. at 70° has been observed. Generally speaking, the lower breccias and claystones have a very steep easterly dip (70°-90°), the limestones very little to one side or the other of the vertical, while the upper claystones and breccias have a slowly decreasing angle of dip to the west. Minor contortions occur here and there.

The chief difference throughout, between this series and the Tamworth beds with which they are correlated, lies in the apparent absence of the small lenses of radiolarian limestone. These are not very obvious in a rapid survey of the Tamworth region itself, and it is quite possible that they may occur in the Nundle region, but have been overlooked. Spilitic rocks are much more frequent, however, than at Tamworth.

3. The Nundle Series is quite analogous to the Barraba mudstones, with which they are correlated. It lies on the Bowling Alley Series, and in absolute conformity with it. It is very difficult indeed to draw any precise line of division, the formations shading one into the other. The lithological change lies in the replacement of the cherty claystone by a finely laminated, green-brown mudstone, with thin layers of yellowish felspathic material, which becomes the dominant rock of the formation. The igneous activity diminished, and is expressed by thick layers of a fine, even-grained tuff of the same mineral composition as the ground-mass of the coarse breccia, but is almost free from cherty fragments. Large and small lenses of blue, argillaceous, non-fossiliferous limestone are frequent. Here and there, conglomerate bands are present, and one well-marked zone can be traced from west of Yellow Rock Hill, across Nundle Sugarloaf (in front of Square Top), and north-west to Rodney Mountain, west of Bowling Point, beyond the limits of the map. The finer mudstones, in this series, contain radiolaria, and *Lepidodendron australe* is also present.

These beds dip to the south of west at angles gradually decreasing as one goes westward, though increasing again after some distance. Their thickness, measured along Jimmie's Creek to the summit of Square Top, is apparently 13,000 feet, but probably there is much repetition. The fault shown near Nundle, displacing the base of this formation, cannot be taken as proved, but is merely offered as a suggestion to account for the facts observed there.

4. The Dolerite.—This rock is present in very great amount, and its distribution calls for comment. It is chiefly in the Lower Radiolarian Claystones and Breccia, and the Upper Claystones, but is present, to only a very small extent, in the Upper Breccias. As far as the mapping goes, it appears to form large, irregular, sill-like intrusions, and has been traced throughout the series, from Hanging Rock to Black Jack. Time has not permitted their being mapped north of Hyde's Creek, though they are less common than to the south. They have been much disturbed; mining operations at the foot of Hanging Rock, and elsewhere, have shown that the country is full of "slides." Occasionally, as at Bowling Alley

Point, they contain very coarse pegmatitic veins of a composition similar to their own. Their relation to the spilite-lavas, in the field is often very perplexing; at times, they certainly intrude into the spilite, elsewhere the spilites appear to intrude into them. Sometimes, in hand-specimens, it is difficult to say which is which, the dolerite assuming a vesicular character. This was all the more confusing, as at the time of surveying, it was believed that the dolerite was subsequent to the peridotite(**15**), on account of the apparent intrusion of dolerite into peridotite, especially on the north slope of Chrome Hill. Work in the northern regions, and subsequent microscopic studies have shown this is not the case. The dolerite is related to the spilites, and is older than the ultra-basic rock. The mass of dolerite, in the peridotite alluded to, must have been torn off the adjacent dolerite-mass invaded by the peridotite. Petrological investigation shows that the rock has the structural characters of ordinary dolerite, except that the plagioclase varies from andesine, the usual type, to oligoclase albite in the Hanging Rock. Occasionally, specimens show a slightly gneissic flow-structure, notably some near Red Rock, which overlooks Munro's Creek (Plate xxiii.). This series of intrusions probably took place during, or shortly after, the deposition of the Bowling Alley Tuff-breccias, claystones, and spilite-flows. The abundance of dolerite, and absence of agglomerate, in this region, together with the abundance of agglomerate and rarity of dolerite in other regions, suggests that the same igneous activity might have had subterranean expression in the one case, superficial in the other.

5. Following the dolerite-intrusion, and deposition of the Nundle Series, there was a great earth-movement, a thrust from the E.N.E., which developed the persistent fault-plane separating the Woolomin and Bowling Alley Rocks. The peridotite was intruded into this plane during the movement. (The evidence for this statement will be discussed later.) Microscopic examination of the rocks proved them to be derived chiefly from hartzbergite, with a minor amount of herzolite and dunite. Generally the rock had a fairly even grain-size of about 2 mm., in diameter, but here and there, particularly on Chrome Hill by Bowling Alley Point, the

enstatite formed large plates several inches long, with poikilitically included olivine.

Associated with these peridotites, was a small amount of gabbro, which occurs chiefly on the top, and on the southern slope of Chrome Hill, on the western side of the peridotite. On the hilltop, it is very coarsely pegmatitic with large, grey-brown diallage, "saussuritised" felspar, and sometimes a little chromite. Large masses of chromite occur here with pseudophite, and coarse-grained rocks composed of chromite and smaragdite also occur, as well as rocks composed entirely of coarse bastite-crystals. The last two are rare. Down the slope, the rock is sometimes almost undecomposed, and the great basicity of the original felspar can be determined. A few instances of the prehnitic alteration of the felspars are also to be found.

One of the very few instances of serpentine occurring west of the great serpentine-line, is found on the Peel River, near Warden's homestead (Portion 9, Parish Dungowan). Only a few square yards are exposed in the river-bank, and alluvium covers the remainder, so that its relations are unknown. Probably it occupies a fault-plane, but, so far, the fault has not been sought on the hill across the river to the south, where it should occur if present.

The original peridotite has now been more or less completely altered, and it is the variety and sequence of these changes that gives this locality its unique interest. The subject will be fully discussed from a petrographical standpoint later; at present, merely the field-facts will be stated.

(*a*) *Mechanical Alteration.*—This consists in converting the rock into the well-known schistose material. It may be either complete or partial, in which case large or small nodules of massive serpentine remain imbedded in the sheared mass. This process has naturally taken place, to the greatest extent, on either side of the intrusion, but particularly on the eastern. Thick schistose bands have a massive central core.

(*b*) *Chemical Alteration.*—This may be considered as: (1) hydration (serpentinisation); (2) carbonation; (3) silicification; (4) leaching. The last three are more or less related together.

(1) Hydration has taken place, to a greater or less extent, throughout the whole mass; very little olivine remains unattacked. We, therefore, get normal, massive, bastite-serpentines, schistose serpentine, and antigorite-serpentine, the latter being best developed on the Razorback Ridge, half-way up Munro's Creek, where some of its features resemble Weinschenk's stubachite(**31**).

(2) Carbonation is developed best between Folly Creek and Quackanacka Creek, and is well exposed in the workings of the Trevena gold-mine. The rock is more or less completely converted into carbonates of magnesia and iron, with a little talc, quartz, chalcedony, etc. With this is associated more or less pyrites. Both the schistose and massive types of serpentine have been thus altered, and their original structures are well preserved. The rock does not make a strong outcrop, but, on the surface, is weathered to a cavernous, red hæmatite, with a little talc, by which the formation may be traced. In the western side of the serpentine, the Bowling Alley rocks have been acted upon by the same agents as transformed the serpentine. Clayshales, spilites, and tuffs occur highly oxidised and carbonated, and impregnated with pyrites. This entire formation is more or less auriferous, but differs entirely from any other gold-bearing formation in the district.

(3) Silicification takes the form of replacement of the serpentine by chalcedony, quartz, and opal. The change occurs in various ways, and frequently is associated with leaching. In Sheep Station Creek, the serpentine contains little cavities lined with chalcedony, and the main mass of the rock is partly replaced by silica, as chalcedony and white opal. On Cope's Creek, and to the east of Chrome Hill, is a narrow band of serpentine, changed chiefly to very finely divided chalcedony, with the preservation of the schistose structure of the original rock. Between Munro's Creek and Folly Creek, the serpentine is replaced by a bottle-green opal with black cloudy masses (pyrolusite). This opal forms kernels surrounded by a husk of hæmatite, veined with white opal, and speckled with dusty talc or hydromagnesite. By Hanging Rock, at the head of Oakenville Creek, on the east side of the serpentine, is a large mass of silicified rock, from which excellent specimens of

chalcedony may be obtained, together with botryoidal masses of magnesite. Here, too, the rocks may be thoroughly leached, and left as a siliceous sinter, more or less filled with hæmatite. This was described by Wilkinson, in 1885, as due to geyser-action(**25**). While this is by no means probable in the strict sense, it is certainly the effect of ascending, hot, siliceous solutions.

The date at which the great silicification of the Woolomin Series took place, is as yet uncertain. Probably it was during the orogenic period. Huge quartz-veins were formed through the Woolomin rocks, and to a much less extent in the Bowling Alley Series, while they are absent from the Nundle beds. While these veins are found in the dolerite (with epidote), the granites and porphyries are quite subsequent to them.

6. Granodiorites, Granites, and Porphyries.—There is no direct evidence as to the relative age of these rocks and the Permo-Carboniferous, but owing to the want of metamorphism in the latter, and the slight resemblance between the granites, etc., and the oldest types described by Mr. Andrews as Carboniferous, the Nundle rocks are tentatively classed as of that age. As will be seen, the granite probably underlies the greater portion of the area at no very great depth. The largest exposure is on Duncan's Creek, and is eight or ten square miles in area. Its composition has not been thoroughly investigated. Some variation was noted in the field; the specimen collected proved to be granodiorite, orthoclase being subordinate to plagioclase. It was noted that the upper surface of the mass had only a slight inclination, as along the stream-scared, western slopes, the boundary of the granite swung back and forth in sympathy with the contour-lines. All around the boundary is an immense number of intrusions of porphyry of several types, a dark blue fine-grained rock with white felspar and black hornblende-crystals, being most abundant. About fifty of these have been mapped, but there are many more, particularly just above the granite-boundary on the steep slope above-mentioned. The long, northern point of the massif passes into this rock, and intrusions of the porphyry, into the granodiorite itself, have been noted further to the south, below Yerro-

winn. The intrusions are noteworthy in that they are roughly oval in shape rather than in definite dykes, indeed, few, narrow, lengthy dykes have been observed. Naturally the intrusions are less abundant at a distance from the granodiorite. A remarkable increase in the number of intrusions, on Frenchman's Spur, may be taken as evidence of approach of the underlying batholith towards the surface in that neighbourhood. An intrusion of porphyry into dolerite, near Moonlight Hill, is perhaps worthy of mention.

Granite occurs again at Mount Ephraim, and may be traced thence towards Yellow Rock Hill. The complicated geology of this portion has not yet been mapped. In these rocks, orthoclase is present in greater amount, and the rock is strictly a granite.

Lastly, there is a mass of porphyry intruding the Nundle mudstones, near the head of Jimmie's Creek, and a few small dykes have been noted between this and the river. These are all very decomposed, so much so that one sill-like intrusion of porphyry, on the main road, is locally termed sandstone.

There are also rarely dykes of odinite and vosgesite, which occur on Frenchman's Spur, and in Daylight Creek Gully. It is very possible that these are differentiates of the granodiorite magma.

Mention may here be made of a neck of light grey andesite about 30 yards in diameter, by Oakenville Creek, on the south side of Hanging Rock. Its appearance suggests that it is of some considerable age, and the acidity of the plagioclase is perhaps sufficient to place it in the keratophyres, in which case it may be comagmatic with the Devonian spilites.

(7). Permo-Carboniferous.—In 1891, Stonier(**69**) recorded the occurrence of *Glossopteris* in shales met with in a shaft sunk on Anderson's Flat, which is the area by the river, stretching from Sheep Station Creek northwards. Recently, Mr. Tooth, the local schoolmaster, drew the writer's attention to the occurrence of fossils resembling those of the Permo-Carboniferous, revealed in digging some fence-post holes at Reichel's homestead, on Portions 11 and 144, at the northern end of Anderson's Flat. All the material available was searched, and Mr. Tooth's discovery was fully confirmed. The rock is an impure sandstone, and contained *Deltopec-*

ten, Martiniopsis, and obscure casts resembling *Astartila, Edmondia, Mourlonia* and *Ptycomphalina.* It is impossible to fix the horizon of these, but they are more probably of Upper than Lower Marine Age, with portion of the upper freshwater measures.

The rocks do not make any good outcrop, and accordingly the boundaries drawn, rest entirely upon the change of surface-slope. At Reichel's, the fossils were found in the low saddle between two hills of Bowling Alley rocks, but the wide opening of the river-valley at this point, both on the eastern and the western side, is a marked and unique feature, which may be due to the differential erosion of the soft shales and sandstone from among the harder Devonian rocks. In that case, it is probable that Permo-Carboniferous rocks lie beneath most of the widespread alluvial covering of the valley-floor.

The rocks are doubtless portions of a great overspreading sheet of Permo-Carboniferous rocks, and were preserved by down-faulting probably during the early Mesozoic period of tectonic movement. As they lie more than 40 miles from the nearest known masses of Permo-Carboniferous rock, it will be seen how great an extension of the area of Permo-Carboniferous sedimentation is indicated by them.

(8) Tertiary Gravels and Clays.—These lie beneath the basalt-masses, and are most easily described with a locality-grouping.

The Yerrowinn Gravels are exposed on the south side of Duncan's Creek, where they are about 120 feet thick. They are here composed of coarse gravel. On Folly Creek, to the west, they are much thinner, about 20 feet in all, and may be traced thence on to the watershed between Munro's and Folly Creeks. Here they are also gravels, but finer sandy bands have been found with leaf-impressions. Some beautifully preserved, coniferous wood occurs in these gravels, similar to that found near Barraba. The slope is to the west, with a fall of 210 feet in $2\frac{1}{2}$ miles. The boulders consist of reef quartz-jasper, with granite and phyllite.

In the basalt, about 200 feet above the top of this gravel, there is a small, narrow band of gravel at the eastern face, and a third horizon is suspected still higher up. Near the head of Duncan's

Creek is a gravelly deposit in the creek-bed, which contains large zircons, colourless or brown, and sapphires, sometimes of good quality, "as large as your finger-nail and blue like a castor-oil bottle." These are probably derived from another interbasaltic layer of gravels.

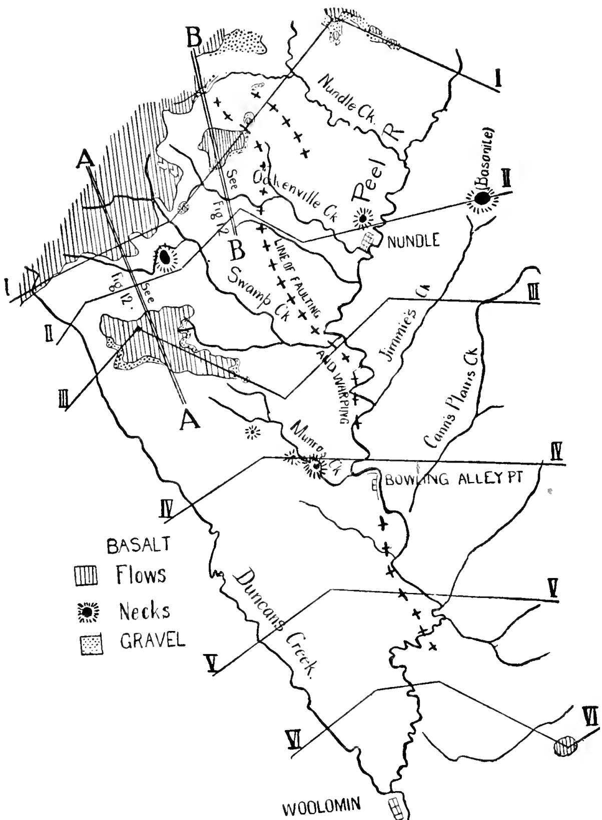


Fig. 3.—Plan of the Nundle District, showing position of basalt necks and the various lines of section in Figs. 4 and 6.

On the divide, between Nuggety and Quackanacka Creeks, a peculiar, fine, pink clay lies beneath the basalt. It has not been proved to contain fossils. Possibly these are the clays which Wilkinson describes as being under "the Sugarloaf," but as that name is applied to every hill in the vicinity, one cannot be certain.

The Mount Sheba Series is, perhaps, the most continuous and important, as being the most largely worked for gold. They occur under a thin capping of basalt, at the head of Oakenville Creek, where they are largely mixed with clay and sand. Just below the basalt in Dangar's Gully, a southern tributary of Oakenville Creek, a tunnel has been driven in soft, carbonaceous shales partially baked by the basalt. These are full of plant-impressions. Across the valley, a small face of gravel is exposed in the Mount Pleasant workings (more usually known as Mount Misery, the name having been altered since the abandonment of the mine in winter time). Here the gravel is about 80 feet thick, and not very coarse, with

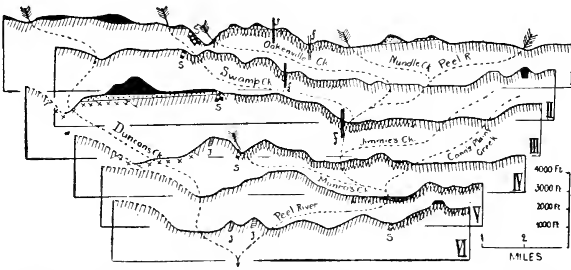


Fig.4.—Cross-section through Nundle District to illustrate relation of physiography to geological structure.

clay and sand, and leaf-impressions in limonite. The gravels continue below the basalt, were opened up at Deep Lead Creek, half a mile to the west, and a huge face has been sluiced away at the head of Butcher's Gully, the Red Hill Workings. Here, the gravels, fine, coarse and sandy, are about 100 feet in thickness. A fault of 200 feet throw (approximately) separates Mount Sheba from this. It lies to the west again, and has a similar, huge, sluiced face. A smaller sluicing occurs on the southern side of the same patch of gravel.

The occurrence at Mount Ephraim, south of the Sheba Sugarloaf, is peculiar, and needs further investigation before a description can be given. Perhaps it has been disturbed by the fault that separated Red Hill from Mount Sheba. Moreover, the gravels lie on granite. As might be expected, there is a very large amount of decomposition always taking place in the rocks on which the gravels lie, and the non-removal of such decomposed material leads to peculiar appearances. Granite is peculiarly unstable ("la maladie du granite"), and the result here is very remarkable.

Between here and Nundle Creek is a run of granite and shale, overlain here and there with basalt; but the country was so confused, and the trees so thick, that about a mile of it has been left unmapped. A very wide area of hard gravel occurs east of Nundle Creek, while a few yards of gravel and a little basalt occur about half a mile to the north of that.

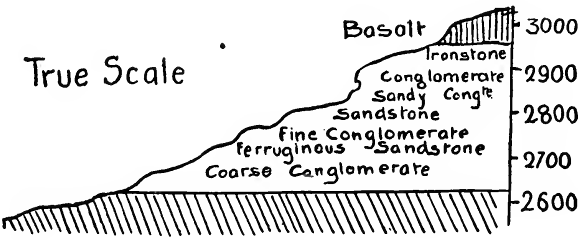


Fig. 5.

Yellow Rock Hill is the thickest mass of gravel in the district, being 340 feet thick at the northern end. Fig. 5 is a true scale section of this face. It thins out to about 40 feet only, and though the west base of the gravel is 140 feet higher than the eastern; the western base of the overlying basalt is lower than the east. The gravel contains reef-quartz, red jasper, and Bowling Alley breccia together with silicified wood. Soft, current-bedded bands of argillaceous sandstone are intercalated, but rarely.

Indications of continuances of this lead to the south, up Nundle Creek, and to the south-west across the Peel River, have been noted, but not investigated. The latter was probably the main-stream line. Wilkinson says it may be traced west in the direction of Quirindi(25).

All the material collected was submitted to Mr. Henry Deane, F.L.S. He recognised fragments suggesting the *Cinnamomum*-type, *Sterculia, Flindersia, Clerodendron tomentosum,* and *Ficus scabra.* There are no leaves which can be referred to *Eucalyptus.* He adds: "I do not think these fossil leaves can lead to any deductions as to age. They are quite of the same character as the Brush-vegetation of our coast, a type which has existed in Eastern Australia from the Miocene, if not from an earlier period. Of course, the climate must have been a much moister one, owing partly to the absence of a parched interior, enabling a luxuriant vegetation, now restricted to patches of the coast, to spread over the tableland and down the western slopes."

Comparing the above facts of the mode of occurrence of the gravels, their displacement by faulting, the abundance of leaves, and the presence of seeds, as noted by Wilkinson, with the criteria given by Andrews(**32**), it is evident that the Nundle leads must be classed with the newer Series, and are consequently of Pliocene age.

(9). Tertiary Volcanic Rocks.

(*a*) *The basaltic series.*—As stated above, these occur capping the gravels that had been deposited in immature valleys. They overflowed the brims of these valleys and flooded the low, rolling country between them, which, however, was not completely planated, so that the resistant rocks still formed elevations that rose some distance into the basalt, or remained as islands above the lava-flood. We may note the irregularities produced by the resistant spilite behind Mount Sheba, the serpentine-ridges by Hanging Rock, and the inlier of Woolomin rocks at the head of Swamp Creek. Apart from the irregularities, the general, slight discordance between the boundary of the basalt and the contour-line on the plateau, shows the mature character of the prebasaltic surface, trenched, as it was, by immature valleys. This is evidence towards the substantiation of the process of peneplanation, uplift, and partial dissection claimed by Andrews to have taken place before the eruption of the older basalts, and which was repeated on a grander scale, before the Newer Basaltic Period. (Fig.6).

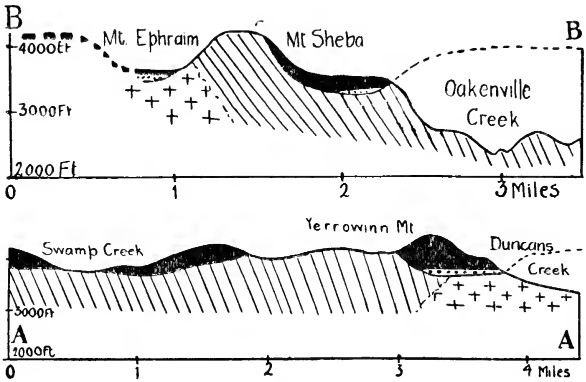


Fig.6.

The manner of eruption of the basalt is unexpected, while, in general, the mode of occurrence is that of plateau-basalts derived from fissure-eruptions, as stated by Mr. Harker(**33**). No fissures (dykes) can be found, except a small one in a fault-plane crossing Jimmie's Creek, and one, 10 yards wide, intruding the dolerite north of Ruzicka's Hill. On the other hand, at least six basalt-necks have been found as follows(Fig. 3) :—

(1) Donald's Mount at Nundle, a hill chiefly of basalt intruding into the slates (about 120 × 170 yards in area).

(2) Nuggety Sugarloaf, south of Nuggety Creek, a steep hill 500 feet high, the southern side of which is basalt, about 500 × 400 yards in area.

(3) A circular patch of basalt, about 30 yards in diameter, on the ridge east of Munro's Creek.

(4), (5), and (6). The patches of basalt in the valley of Munro's Creek, near the Razorback, respectively 160 × 120, 50 × 50, and 20 × 20 yards in approximate area. The last is strongly prismatic, and makes a small hillock overlooking the tributary creek at this point.

Whether the basalt on Black Jack (about 100 acres in area) is part of a flow from a distant vent, or surrounds a local pipe, cannot yet be stated.

Three types of basalt are developed. There is a smooth, aphanitic type, which has a grey surface on weathering, streaked with etched-out flow-lines; and there is also a darker, not so very finely grained type, with a rough hackly surface, and a habit of breaking into small pellets when rather decomposed. An intermediate variety is the commonest rock, and is frequently prismatic, but the extreme types sometimes occur interbanded in the same mass, either in the necks or in the basalt-flows.

A third type is thoroughly scoriaceous and largely decomposed. This occurs in a flow extending north and south of the Dams on Burnt Hut Creek, by Hanging Rock. No basalt-tuffs or breccias have yet been found in the necks or between the lava-flows.

(*b*) Nepheline-basanite occurs, forming the upper 300 feet of Square Top Hill, two miles west of Nundle. This has been shown (**24**) to be a member of a varied series of rocks of a basic alkaline character, that occur intruding into the Tertiary basalts. The series includes coarsely granular theralites and teschenites, nepheline-basanites, and coarse dolerites with large purple augites, with or without analcite. The mode of occurrence of the Square Top rock is as yet uncertain.

A small amount of vesicular olivine-basalt has been found around the base of the basanite, and it has been noted that the lower portion of the latter is coarser-grained, and richer in augite-phenocrysts than the upper portion. No gravel was found below the basalt, but only the eastern face has been studied as yet. Probably, as elsewhere, this was a sill-like intrusion through a basalt-flow, possibly it was a mass of the mamelon-type.

Rocks of this alkaline group occur in great amount, as boulders in the Peel River, evidently derived from the Liverpool Range. They appear to occur *in situ* on Wombramurra Creek, and it is probable that the very striking cone, Wombramurra Peak, is of this character, to be correlated with Mount Warrawalong, near

Newcastle(24), and Delungra Peak, near Warialda(27), which it strongly resembles in appearance.

Some peculiar chloritised dolerites, with large purple augites, occurring in the basalt-range east of Mount Ephraim, are probably sills related to these alkaline rocks. They have not yet been investigated.

(10). Pleistocene and Recent Alluvial Deposits.

Two series of alluvial deposits occur along the Peel River and Duncan's Creek. The higher deposits are frequently auriferous, and have been worked on the Peel River, south of Bowling Alley Point, and at Bowling Alley Point itself. A well marked terrace, about 50 feet high, occurs on the east bank of the Peel River, one mile north of Nundle.

Recent alluvial deposits occur all along the river and its larger tributaries, and form an area of over a square mile in extent at the township of Woolomin. They are often auriferous, but rarely very deep. The streams entering the Peel River, on the western side, usually break up into distributaries, and soak through wide marshy tracts into the main river. Hyde's Creek and Cope's Creek are conspicuous examples of this.

Economic Notes.

Gold was first found in this district in 1852, and, since then, about £900,000 worth has been obtained.* It occurs in many ways:—

(*a*) In quartz-veins near the boundaries of the dolerite, which have generally suffered much faulting.

(*b*) In quartz-veins in the slate, away from the dolerite.

(*c*) As impregnations in pyritous, carbonated serpentine.

(*d*) As pyritous impregnations in claystone, spilite, etc., in wide, low-grade channels with rich quartz-stringers. These are the

---

* A very remarkable theory of the origin of this gold, was put forward by the Rev. W. B. Clarke in 1853(2), in a lengthy report on the subject. It was considered to be deposited under a shallow sea in the vicinity of volcanic eruptions.

deposits that occur beside the carbonated serpentine, and are the result of the same agencies of change. The gold is chiefly partly free, but largely in the pyrites. ("Battery test" on separated pyrites, 20oz., 15dwt. per ton, according to local report).

(*e*) In Tertiary drift mined by hydraulic sluicing, from the Sheba and Mount Ephraim gravels.

(*f*) In high-level river-gravels (sluiced).

(*g*) In the present river-gravels, won by dredging.

Scheelite occurs in small quantities in most of the above modes of occurrence, but of these, only the first two have yielded payable amounts. It forms lenticular bunches in claystones, associated with a little quartz. Stibnite occurs near Nundle, in a brecciated fissure-vein in clayshales. Chromite forms large segregations in the serpentine, particularly on Chrome Hill, behind Bowling Alley Point.

The white marble does not form large enough masses, and is too difficult of access for economical working; the red marble is in greater quantity, takes a good polish, and is easy of access. Zircons and sapphires have been found in interbasaltic gravels, but are rarely of good quality.

BIBLIOGRAPHY,

Additional to the References cited in Part i.

25. Wilkinson, C. S.—Ann. Rept. Dept. Mines N.S.W., 1885, pp.132-136.

26. Stonier, G. A.—*Ibid.*, 1892, p.127.

27. Carne, J. E.—"The Tin-Mining Industry of New South Wales." Second Edition. Geol Surv. of N.S.W.: Mineral Resources, No.

28. Lacroix, A.—"Le Granite de Pyrénées et ses Phénomènes du Contact." 2me. Memoir, Bull. Carte Géol. de France, No. 71, p.60.

29. Anderson, C.—Records of the Australian Museum. Vol.v., p.133.

30. Pittman, E. F.—"Mineral Resources of New South Wales." 1901, p.56.

81. Weinschenk, E.—" Beiträge zur Petrographie der östlichen Central Alpen, speciell des Gross Venedigerstockes." Abhandlung der Kgl. Bayr. Akad. der Wiss., 1893, p.660.

32. Andrews, E. C.—" The Geographical Unity of Eastern Australia." Journ. Proc. Roy. Soc. N. S. Wales, 1910, pp.469-471.

33. Harker, A.—" The Natural History of Igneous Rocks," p.53.

EXPLANATION OF PLATES XXII.-XXIV.

Plate xxii.

Geological Map of the Nundle District.

Plate xxiii.

View looking up Munro's Creek, showing the serpentine-belt to the left, the cliffs of spilite, " White Rock," in the centre, and the dolerite cliffs, " Red Rock," to the right.

Plate xxiv.

Swamp Creek Falls, dropping behind a shutter-like mass of spilite.

DESCRIPTIONS OF THREE NEW SPECIES OF *MYRTACEÆ.*

By R. T. Baker, F.L.S.

(Plates xxv.-xxvi.)

Introduction.—The two species of *Melaleuca* described in this paper, have, in the past, been regarded as *M. Leucadendron* Linn. or at least forms of it.

The proposal, now, to raise them to specific rank, has come about by a research, undertaken during the last four years, at the Technological Museum, on the "Melaleucas and their Essential Oils," the results having been read before the Royal Society of New South Wales. When, however, an investigation of the species passing as *M. Leucadendron* Linn., was undertaken, it was found that at least six distinct species had, in the past, been synonymised under it, by various authors working on the genus.

In the Flora Australiensis (Vol. iii., pp.142-143), Bentham places the following as synonyms:—*M. Leucadendron* Linn., *M. minor* Sm., *M. viridiflora* Gæertn., *M. saligna* Blume, *M. lancifolia* Turcz., *M. Cumingiana* Turcz., *M. Cunninghamii* Schau., *M. saligna* Schau., *M. mimosoides* Schau., *M. lanceolata* R.Br. Bailey, in his Flora of Queensland, gives as varieties:—*M. Leucadendron* Linn., var. *lancifolia*, var. *saligna*, and var. *Cunninghamii.*

In the paper read before the Royal Society, this year (1913), it has been shown that no such synonyms obtain in connection with this species, and that the above are all worthy of specific consideration. Further, it is doubtful now whether *M. Leucadendron* Linn., really occurs in Australia, comparison of Australian material having been made with the original specimens of Linnæus, in the Herbarium of the Linnean Society of London.

The two, here described, are distinct from any of the above, and so are given specific rank under the name of *Melaleuca Maideni* and *M. Smithii*, respectively.

MELALEUCA MAIDENI, sp.nov. (Plate xxv.).

"Broad-leaved Tea-Tree."

A tree often growing to a large size, with pale-coloured, laminated papery bark, with red streaks when cut on the quarter; branchlets angular, pubescent. Leaves erect, glabrous, ovate sometimes oblique, obtuse, subcoriaceous; petioles short; silky pubescent, mostly 5- to 7- or more nerved, rarely 3-nerved, with anastomosing veins, 4-5 inches long and ½ inch wide. Flower-spikes terminal in all the specimens examined, or in the axils of the last two or three leaves, larger and longer than in *M. Smithii*. Rhachis and calyx pubescent. Calyx-tube short, cylindrical, about 1 inch long and 1 inch in diameter, pubescent, lobes obtuse, less than one-half the length of the petals. Petals concave, obtuse, under 2 lines long. Stamens not ringed as in *M. Smithii*. Top of the ovary silky-hairy. Fruit comparatively large, squat, cup-shaped, 3 lines in diameter at base, mostly distant at the base of the outgrowing branchlet.

Arbor mediocris vel magna. Cortex papyraceo-lamellosus. Ramuli graciles, pubescentes. Folia circiter 4-5″ longa, ½″ lata, alterna, oblongo-ovata, rigida, sæpe obliqua, nervi 3-7 vel plures, petioli pubescentes, breves. Spicæ circiter 2-3″ longæ et terminales; flores subdistantes, punicei. Rhachides pubescentes. Calyces vix 1‴ longi, pubescentes. Antheræ 6-8‴ longæ. Fructus 3‴ longi, in orificium sensim contracti.

Hab.—Casino, Port Macquarie, and North along the coast as far as Brisbane.

Timber.—A pale, delicately tinted wood. It is hard, yet light in weight, planes easily, has a nice close grain, and even texture; polishes well, and is an excellent cabinet-timber, and one of the best all-round timbers of the Continent. It can be obtained in fair-sized logs, so could be used for bridge-decking, beams, piles, etc., as it is very durable in the ground and in water. It is really one of the finest timbers in the Museum here. It is especially recommended, and, apart from its other qualities, it has no pronounced sapwood, being free from borers, and, therefore, cuts up with little waste.

Oil.—See paper by Baker and Smith (Journ. Proc. Roy. Soc. N. S. Wales, 1913) "On *Melaleuca Leucadendron*, its alleged synonyms, and their Essential Oils."

Remarks.—This tree is one of those which has been regarded as *M. Leucadendron*, and, like the others of this group, is known as "Broad-leaved Tea-Tree." As usually obtains with this Section of the Myrtaceæ, it is found growing on swampy ground or on land subject to floods.

The Melaleucas form a group of trees little prized for their timber, but yet they produce excellent woods, and deserve to rank higher in value in the timber-trade.

This species differs from *M. Smithii* in having a superior timber, probably the best of the genus.

Morphologically, the species differs from *M. Leucadendron* in the shape, length, and texture of the leaves, in the inflorescence, and in the chemical constituents, and in like manner from the other species listed in the Introduction; from *M. Smithii*, also in the nature of its timber, chemical constituents, leaves, and inflorescence.

It is named after Mr. J. H. Maiden, F.L.S., Director, Sydney Botanic Garden, whose work in the field of Australian Botany is too well known to be particularised here.

Melaleuca Smithii, sp.nov. (Plate xxvi.).

"Broad-leaved Tea-Tree."

A tree often attaining large dimensions, with a thick bark composed of thin papery layers. Leaves very numerous, glabrous, alternate, or verticillate at the ends of the branchlets, ovate or elliptical-ovate, rigid, straight, obtuse, subcoriaceous, on short petioles, mostly about 2″ long and ½″ wide, 3- to 5-nerved, but in general with three, with anastomosing veins. The Gosford and Terrigal leaves are smaller, thinner, and narrower than the Sydney ones. Young terminal leaves silky-hairy. Flower-spikes cylindrical, short, 1½″ long, mostly not interrupted, axillary, or 2 or 3 terminal, rhachis glabrous or with a few rusty-coloured minute hairs. Calyx-tube stumpy, cylindrical, about 1 line in diameter, or 1 line long, lobes short, hemispherical, one-half the length of the petals. Petals obtuse, 2 lines long; stamens almost white, of irregular length, connate at the base forming a ring, as shown in Plate xxvi. Fruit sessile, cylindrical, about 2 lines in diameter and 1½ deep, rim counter-sunk before opening, but thin when mature.

Arbor mediocris vel magna. Cortex papyraceo-lamellosus. Ramuli robusti, glabri. Folia circiter 2″ longa, 1″ lata, alterna, elliptica, ovata, erecta, rigida, 3-5 nervis. Spicæ circiter 1½″ longæ, axillares vel terminales, densæ, cylindraceæ, spicæ glabræ; flores albi. Calyces vix 1½‴ longi, glabri, lobis obtusis. Antheræ pallidæ, didymo-rotundæ. Fructus 1½‴ longi, cylindracei, truncati.

Hab.—Rose Bay, Bondi, Gosford, and Terrigal.

Timber.—A hard, close-grained, medium-weight wood, having a light pinky colour, inclined to become red, with a large wavy figure, planes and dresses well and takes a good polish. Could be used for general building purposes, but especially for posts, being, like its congeners, very durable in the ground. It would be very suitable for boat-building, and should rank as a cabinet timber of some merit, as the colour and texture are very suitable for this branch of industry. It can be distinguished from *M. Maideni* by its pronounced sapwood, which is readily attacked by borers.

Remarks.—Of the species ranked as *M. Leucadendron* in the past, this probably has the smallest leaves, except that of *M. lanceolata* R.Br., Herb. There is a specimen of this species in the National Herbarium, Melbourne, labelled by Robert Brown as *M. viridiflora*, but that cannot stand in view of Solander's figure (1788) and description, in the "Illustrations of the Botany of Captain Cook's Voyage, &c., 1768-71" (1900) edited by J. Britten, F.L.S., and published by the Trustees of the British Museum.

It is a swamp-loving species in the area of its distribution, and so gregarious, and, like its congener here described, is commonly known as the "Broad-leaved Tea-Tree."

It differs from *M. Leucadendron* in the shape, length and texture of its leaves, flowering spikes, and perhaps smaller fruits. Chemically, it is quite distinct, and differs in similar characters from *M. Maideni* described in this paper.

M. minor Sm., has thinner and narrower leaves, and longer spikes, and produces "Cajeput" oil of commerce. *M. viridiflora* Gærtn., (*M. Cunninghamii* Schau.) and *M. saligna* have very much longer and broader leaves, and white woolly tomentum on the inflorescence.

M. lanceolata has leaves under 1″ long, a white woolly inflorescence, and a constant trinerved venation.

It is dedicated to my colleague, Mr. H. G. Smith, F.C.S.. Assistant Curator of the Technological Museum, who has now done so much organic research work on the Australian flora.

Angophora ochrophylla, sp.nov.

A large, spreading tree, with a very rough, "woolly" thick bark, glabrous in all its parts, with willowy, filiform branchlets. Inflorescence in large, terminal, loose, delicate corymbs. Leaves opposite, on short, slender petioles, lanceolate, slightly falcate, occasionally oblique, texture thin, almost membranous, pale yellowish or ochreous in colour, 3 to 5 inches long. Flowers rather small, on exceedingly slender or almost filiform peduncles. Calyx 1 line long, teeth acuminate, ribs of equal prominence. Fruits on filiform pedicels up to 6‴ long, 3-4‴ wide, 2-3‴ in diameter.

Arbor altitudinem 60-100′ attinens. Cortex trunci squalido-vel fusco-canus, rugosus, rimosus, persistens. Folia circiter 3-5″ longa, breve petiolata, lanceolata, obliqua, et evidenter tenuiora quam in *A. intermedia.* Flores in corymbis. Fructus 2-3-4‴ longi, truncato-ovati.

Hab.—Myall Creek, Bingara (C. F. Laseron), Woodburn (W. Bäuerlen).

Remarks.—On a cortical classification, this *Angophora* falls into the rough barks, but yet it has a bark quite unlike any other described species of the genus. In field-facies, it much resembles *Eucalyptus Bridgesiana*, the bark especially so; in fact, the barks of the two trees are identical in character.

The leaves differ from its congeners in having a bright yellow or pale colour, due to the presence of a dye, probably Myrticolorin. The terminal branchlets are very slender, and the fruits are supported on filiform peduncles. All these characteristics, as well as the timber and oil, differentiate it from other Angophoras. Another feature, which might be noted, is that the leaves are often attacked by an insect, which entirely alters their normal conformity.

At Bingara, it is found as a medium-sized tree, 60 feet high, and 4 feet in diameter, growing in the vicinity of creeks and rivers, and has a woolly, somewhat "Box-like" appearance (C. Laseron); whilst, at Woodburn, it is a large, spreading tree, with very rough bark(W. Bäuerlen).

Timber.—Hard, open-grained, yet interlocked timber, of a light grey, pale chocolate, or fawn colour.

No local use appears to be made of the wood, so that data are not available as to its adaptability or otherwise in Technology.

Oil.—My colleague, Mr. Henry G. Smith, F.C.S., states concerning this oil:—The oil of this Angophora does not differ, in general constituents, from that of the other oil-yielding species of Angophora. The yield of oil, from leaves and terminal branchlets, was 0·13 per cent., and this consisted principally of dextrorotatory pinene with a high rotation, two esters of geraniol (geranyl-acetate and geranyl-valerianate), free geraniol, a small amount of volatile aldehyde, together with a low-boiling ester, which had the odour of amyl-acetate, and a small amount of sesquiterpene. Neither cineol nor phellandrene was present, nor do these constituents occur in the oils of the Angophoras.

EXPLANATION OF PLATES XXV.-XXVI.

Plate xxv.—*M. Maideni.*

Fig.1.—A flowering branchlet with leaves, etc.
Fig.2.—Individual flower (enlarged).
Fig.3.—Spike of fruits.

Plate xxvi.—*M. Smithii.*

Fig.1.—Flowering branchlet, showing leaves, and unexpanded fruits.
Fig.2.—Individual flower (enlarged).
Fig.3.—Stamens, showing attachment at base in bundles.
Fig.4.—Fruits in cluster on branchlet.

ORDINARY MONTHLY MEETING.

OCTOBER 29th, 1913.

Mr. W. S. Dun, President, in the Chair.

The President announced that the Council was prepared to receive applications for four Linnean Macleay Fellowships, tenable for one year from April 1st, 1914, from qualified Candidates. Applications should be lodged with the Secretary, who would afford all necessary information to intending Candidates, not later than 29th November, 1913.

The Donations and Exchanges received since the previous Monthly Meeting (24th September, 1913), amounting to 12 Vols., 102 Parts or Nos., 15 Bulletins, 1 Report, and 15 Pamphlets, received from 59 Societies, etc., and 1 Author, were laid upon the table.

NOTES AND EXHIBITS.

Mr. D. G. Stead exhibited two Californian Rainbow Trout, *Salmo irideus* Gibbons, hatched from eggs stripped from parent-fish already acclimatised in this State. The Rainbow Trout exhibited were reared at the Government Trout Farm at Prospect, near Sydney; and though differing so greatly in point of size, were both yearlings, and had been grown under the same environmental conditions. The smaller measured 120 mm., and weighed $1\frac{1}{16}$ oz., while the larger was 362 mm., and of a weight of no less than 1 lb. $2\frac{1}{2}$ oz.! Mr. Stead stated that the growth of many of the yearling Trout during the past year had been quite phenomenal (notwithstanding the comparatively unsuitable natural conditions prevailing at Prospect), and nothing like it had previously been attained at this hatchery. Those exhibited were respectively (approximately) the smallest and the largest of about 350 yearlings at present retained in the hatchery ponds. About 50 had attained, approximately, the size of the largest shown, and might easily have been mistaken for 3-year old Trout, judging by past local experience of growth.

Mr. Fred Turner exhibited a specimen of *Eragrostis tenella* Beauv., "Love-grass," collected on the plains near Yetman, a new record for this rare species in New South Wales, the only other locality in the north-west where the exhibitor had previously seen it, being on plain-country near Warialda. This very interesting and pretty Australian grass was first recorded by Mr. Turner in the Official Catalogue of New South Wales Exhibits, Colonial and Indian Exhibition, London, 1886, p.439. This species has been described by different botanists under various names, in Brown's Prod., p.181, as *Poa tenella* Linn.; in Bentham's Fl. Honkg., p.431, and Fl. Austr., vii., p.643, as *Eragrostis tenella* Beauv.; and in Hooker's Fl. Brit. Ind., vii., p.316, as *Eragrostis interrupta* Beauv., var. *tenuissima* Stapf. This grass and *Eragrostis pilosa* Beauv., "Weeping Love-grass," are the most widely distributed annual species of the genus indigenous in Australia, but neither of them is endemic. When Mr. Turner was Superintendent, Botanic Gardens, Brisbane, he cultivated both these grasses in adjoining plots over a series of years, and the yield of herbage under cultivation was much greater, especially in the case of *E. pilosa*, than that usually seen in the pastures. Dairy stock and horses ate those grasses with avidity, both in a green state and when turned into hay. Mr. F. M. Bailey, C.M.G, F.L.S., Government Botanist, Queensland, has published a figure and description of *E. tenella*, and in Turner's "Australian Grasses," Vol. i., p.26, appear a figure and description of *E. pilosa*. Before the white man settled in Australia the latter species was of some importance to the aborigines, for the grain, usually produced in abundance, provided them with food. A comparison of the grain of *E. pilosa*, with that of the allied species *E. abyssinica* Link, one of the food-grains ("Teff") of Abyssinia, showed that they were not quite as large.

Mr. Tillyard offered some observations on the colouration of the larvæ of the dragonfly, *Æschna brevistyla* Rambur. The larva lives in water-weed, and is usually of a greenish colour, harmonising well with its surroundings. A few weeks ago, some specimens were taken from the roots of some detached reed-clumps. These roots had turned a bright red colour, and the larvæ clinging to them were found to have the ventral surface of the labium, thorax, legs, and abdomen bright red, exactly the same colour as the roots to which they were clinging. Other specimens taken close by, on living water-weed, were of the usual greenish colour. It was suggested that these larvæ possess pigment-cells which, after an ecdysis, reproduce the exact colour of the surrounding surfaces; and it is further suggested, that much of the so-called protective resemblance in insects may have arisen by a similar process.

Mr. W. R. B. Oliver showed some large Trochus and other shells from the Kermadec Islands, and he reviewed the probable evolution of this insular group. They are oceanic islands possibly built up on a continental base. Granite is found in small pieces, but has not been seen *in situ*. The lowest beds are of submarine volcanic origin, and these are overlain also by volcanic rocks. The ancestors of the terrestrial fauna and flora probably came overseas, as former, hypothetical land-connections with continental areas were not required to explain the present-day natural history.

Mr. A. A. Hamilton exhibited, from the Collection in the National Herbarium, specimens of *Sonchus oleraceus* Linn.,(Yanco; H. Wenholtz, February, 1913), showing both foliar and floral prolification of the inflorescence. In some of the flower-heads the ligulate florets had one or more leaves situated on the apex of the achene, the ligula of the floret was suppressed, and the pappus reduced. In other flower-heads abortive buds, with an attenuated involucre, were produced on short branches.—*Cosmos* Hort. var., (Sydney Botanic Gardens; W. Challis, March, 1904) showing terminal prolification of the inflorescence. The involucral bracts of the capitate inflorescence were produced into long acuminate points. The sterile ray florets retained their position, but exhibited gradual virescence. The inner tubular florets were raised upon elongated peduncles, and the bracts separating them were produced into acuminate points.—*Clematis glycinoides* DC.,(Lady Robinson's Beach; A. A. Hamilton; August, 1913), showing leaf-variation, the normal trifoliate leaf being gradually reduced to a simple one. The leaves were all taken from the same plant.

Mr. E. Cheel exhibited specimens of *Cephalaria transsylvanica* Schrær., (Family *Dipsaceæ*) collected at Burrowa, N.S.W. (T. Paterson; November, 1911). There are also specimens in the National Herbarium from Bathurst (R. W. Peacock).—Also a weed commonly known as "Giant-Mustard" or "Turnip-Weed" (*Rapistrum rugosum* All.) from Penshurst (November, 1910). This weed is fairly common in wheat-fields in South Australia, according to J. M. Black.—Specimens of *Acacia glaucescens* Willd., were also shown, which were collected from the summit of Mount Jellore, an unusual situation for this species, which is usually found skirting river-embankments.—*Eragrostis asper* Nees,(Wagga; E. Breakwell, April, 1912). This grass was first forwarded to the National Herbarium in January, 1902, and appears to have become established in the district. It has hitherto been confused with *E. pilosa*, and closely allied species. It is a native of Southern India, and extends through tropical Africa and the Mascarene Islands It has probably been introduced here with other seeds.—Also *Dischidia* sp.,(Asclepiadeæ), from the Solomon Islands, having small pitchers (ascidia).

Mr. A. G. Hamilton exhibited a remarkable teratological example of the common Arum Lily (*Calla æthiopica*) showing abnormal form and disassociation of the spadix and spathe.

Dr. H. G. Chapman cited a case, which had recently come under his notice, of a green tree-frog (*Hyla cœrulea*) resting on a red leaf of a Canna, which had the lower parts also markedly red; and he discussed the possible mode of production of the red tinge.

On the invitation of the President, Dr. E. Mjöberg, who had recently returned from a lengthy collecting visit to North Queensland, showed a number of interesting specimens, including skins of *Dactylopsila trivirgata* and other marsupials, blind or partially blind insects and other organisms inhabiting dark caves, Peripatus, and termites; and he gave a very interesting account of his experiences with these animals under natural conditions.

Mr. North sent for exhibition an instance each of "climatic" and "individual" variation in New South Wales birds. The former was a skin of an adult female Yellow-breasted Robin (*Eopsaltria australis*) obtained by Mr. Thos. P. Austin, of Cobborah Station, Cobbora, in the lightly-timbered, stony scrub-lands found in a portion of that neighbourhood, and nearly two hundred miles in a direct line from the coast. The type of *Eopsaltria australis* was procured near Sydney, from which the present specimen may be distinguished by its being everywhere paler, and by its clear yellow upper tail-coverts. "Individual" variation was exhibited in the skin of an adult female Superb Warbler (*Malurus australis*). This specimen, which is remarkably pale, was obtained by Mr. Harry Burrell at Manilla, the only one observed among a number of typically plumaged birds. An example of a normally plumaged skin of each species, was also sent for comparison.

Mr. W. S. Dun exhibited a specimen of *Syringopora*, sp.nov., from the Silurian of Derrengullen Creek, Yass. This species was collected by Mr. A. T. Shearsby, and is remarkable for the extremely small diameter of the corallites, $\frac{1}{40}$-$\frac{1}{30}$ inch.

NEW FOSSORIAL *HYMENOPTERA* FROM AUSTRALIA AND TASMANIA.

By Rowland E. Turner, F.Z.S., F.E.S.

Family THYNNIDÆ.

Subfamily Rhagigasterinæ.

Rhagigaster jubilans, sp.n.

♂. Niger; scapo, pronoto, tegulis, abdomine pedibusque rufo-testaceis; alis pallide flavo-hyalinis, venis basi testaceis, apice fuscis. Long. 11 mm.

♂. Clypeus with a carina from the base to the apex. Head rugosely punctured on the front, more finely on the vertex, the interantennal prominence broadly rounded at the apex, a strong transverse carina below the anterior ocellus extending to the eyes. Pronotum very shallowly emarginate anteriorly, the anterior angles slightly prominent. Thorax shining, sparsely punctured, the mesopleuræ more coarsely and closely punctured. Median segment more finely punctured than the thorax, shorter than the scutellum, twice as broad as long, very steeply sloped posteriorly. Abdomen slender, very sparsely punctured, the segments constricted at the base; seventh dorsal segment trilobed at the apex, the median lobe the longest and subtuberculate; the hypopygium consisting of a single recurved aculeus. Third abscissa of the radius about half as long again as the second; first recurrent nervure received at three-fifths from the base of the second cubital cell, second at about one-eighth from the base of the third cubital cell.

Hab.—Borroloola, Northern Territory.

Type in Victorian National Museum.

The colour is very distinct from any other species of the genus; the form of the seventh dorsal segment is also distinct.

Rhagigaster lævigatus Sm., occurs in the same locality.

EIRONE CELSISSIMA, sp.n.

♂. Niger; mandibulis, clypeo, antennis articulis 4 apicalibus, pronoto macula magna utrinque, scutello macula magna mediana antice trilobata, femoribusque macula apicali flavis; pedibus pallide ferrugineis flavo intaminatis: segmentis abdominalibus secundo, tertio, quartoque totis, primo apice, quinto basi, septimoque apice rufo-ferrugineis; alis hyalinis, venis nigris. Long. 15 mm.

Var. abdomine nigro, segmento septimo apice solo rufo-ferrugineo.

♀. Rufo-castanea; abdomine bruneo, gracillimo, subcylindrico. Long. 9 mm.

♂. Clypeus convex, depressed and truncate at the apex; mandibles stout, strongly bidentate at the apex. Head not produced behind the eyes; third joint of the flagellum a little longer than the first and second combined. Head very minutely and closely punctured; the posterior ocelli twice as far from the eyes as from each other. Pronotum strongly rounded at the anterior angles, the anterior margin raised. Mesonotum closely, scutellum less closely punctured with a transverse, coarsely punctured groove at the base, truncate at the apex; postscutellum shining and almost smooth. Median segment rounded, almost smooth, finely rugulose on the sides. Abdomen fusiform, shining, very sparsely punctured; hypopygium subtruncate, with an apical fringe of fulvous hairs. Second and third abscissæ of the radius about equal in length; second recurrent nervure received at the middle of the third cubital cell: the subdivision of the first cubital cell only indicated by a scar.

♀. Head rectangular, a little broader than long, smooth and shining, with a short longitudinal sulcus between the antennæ. Thorax and median segment smooth and shining: the pronotum much narrower than the head, about one-third longer than broad, a little narrowed anteriorly; scutellum small, narrower than the pronotum, very little larger than the dorsal surface of the mesopleuræ; median segment slightly longer than the pronotum and scutellum combined, narrow at the base, nearly twice as wide at the apex. Abdomen shining, with a few small scattered punctures, very slender, narrowed at the extremities; sixth dorsal segment pointed.

Legs short, the posterior femora serrate, intermediate coxæ scarcely separated.

Hab.—Mt. Wellington, Tasmania, 2,200 ft.; January, 1♂; March, ♂♀ in cop.

The male is the type.

The male specimen, taken in March, has the abdomen almost entirely black. There is another specimen of the typical form of the male with red on the abdomen in the Tasmanian Museum, taken at a lower elevation. The species is easily distinguished by the yellow apical joints of the antennæ in the male. It belongs to the group of *E. ichneumoniformis*, Sm., but is larger and more robust than any of the related species. Two species of *Ichneumonidæ*, taken freely in the same locality, also have the apical portion of the antennæ yellow and the abdomen red, and though rather smaller, closely resemble this *Eirone*.

Subfamily THYNNINÆ.

ARIPHRON BICOLOR Erichs.

Ariphron bicolor Erichs., Arch. f. Naturg. viii., p.264, 1842,♀.

Ariphron rigidulus Turn., Proc.Linn. Soc. N. S. Wales, xxxii., p.274, 1907,♂.

Taken in cop., by Mr. Lea, at Ulverston, Tasmania. I do not believe the Victorian record for the male is correct. I took several males at Eaglehawk Neck in Tasmania, flying round and settling on a fallen Eucalyptus log, which contained a nest of Myrmecia ants. I searched the ants' nest as far as possible, hoping to find the female, but was not successful.

ARIPHRON PETIOLATUS Sm.

Thynnus petiolatus Sm., Cat. Hym. B.M. vii., p.36, 1859,♂.

♀. Nigra, punctata; pygidio integro; antennis tuberculisque antennalibus fusco-testaceis; mandibulis fusco-ferrugineis. Long. 8 mm.

♀. Mandibles falcate, not bidentate; head shining, closely microscopically punctured, with larger scattered punctures, a little broader anteriorly than long, but a little longer than the posterior breadth, an obscure, short, frontal sulcus, the antennal tubercles moderately developed. Thorax rather closely punctured; the pronotum broader than long, deeply excavated on the sides anteriorly; median segment a little shorter than the pronotum. Abdomen broader than the thorax; the basal segment punctured rugose, second segment with a basal transverse carina, the basal half transversely rugulose, the apical half and the remaining segments closely and rather finely punctured. Pygidium simple, not truncate or compressed, clothed with fulvous hairs on the sides and in the middle. Fifth ventral segment with a small tubercle on each side near the apical angles.

Hab.—Brisbane (Hacker), October. In the Australian and Queensland Museums.

TACHYNOMYIA AURIFRONS Sm.

Aelurus aurifrons Sm., Cat. Hym. B.M. vii. p.55, 1859, ♂.

♀. Nigra, crasse punctata, cinereo-pilosa; antennis pedibusque fusco-ferrugineis. Long. 18 mm.

♀. Head fully half as broad again as long, moderately convex and strongly rounded at the posterior angles: the front very coarsely punctured, the punctures more or less confluent longitudinally, the vertex smooth and shining. Thorax shining, sparsely but strongly punctured; the pronotum nearly twice as broad anteriorly as long, narrowed posteriorly; median segment about as long as the pronotum, rather more sparsely punctured and strongly broadened posteriorly. First and second dorsal segments of the abdomen closely punctured, the punctures confluent longitudinally and forming shallow, irregular striæ. Segments 3-5 shining, sparsely and shallowly punctured, sixth dorsal segment finely longitudinally striated; ventral segments shining, minutely punctured.

Hab.—Albany, W.A. (Masters), ♂♀ in cop.

The female has not been previously described.

PHYMATOTHYNNUS PYGIDIALIS, sp.n.

♂. Niger, cinereo-pilosus, punctatus; abdomine nitido; clypeo late emarginato; hypopygio apice obtuse rotundato, haud dentato; alis hyalinis, leviter infuscatis, venis fuscis. Long. 13 mm.

♀. Fusco-nigra; flagello mandibulisque fusco-testaceis, pedibus testaceis; segmento dorsali secundo fusco-ferrugineo, transverse ruguloso. Long. 10 mm.

♂. Mandibles broad, bidentate at the apex, the inner tooth very broad and blunt; clypeus widely emarginate, with a carina from the base to the apex, closely punctured. Antennæ no longer than the thorax and median segment combined, the apical joints strongly arcuate beneath. Head and thorax closely and not very finely punctured, more finely on the vertex and median segment than elsewhere; the thorax as broad as the head, the anterior margin of the pronotum slightly raised. Abdomen shining, somewhat flattened, very sparsely and indistinctly punctured, fusiform; hypopygium not very small, short, and broadly rounded at the apex, without an apical spine; seventh dorsal segment rugose. Second abscissa of the radius longer than the third, second recurrent nervure received by the third cubital cell at a distance from the base equal to half the length of the second transverse cubital nervure.

♀. Head large, slightly convex, nearly half as broad again anteriorly as long, broadly rounded at the anterior angles, very minutely punctured, with larger scattered punctures and an obscure frontal sulcus. Thorax finely and sparsely punctured, the pronotum nearly half as broad again as long, almost rectangular; scutellum much narrowed posteriorly. Median segment opaque, as long as the greatest breadth, longer than the pronotum, very narrow at the base, strongly broadened towards the apex, the posterior slope oblique. Abdomen shining, sparsely punctured, second dorsal segment coarsely transversely rugulose; with two strong transverse carinæ at the apex, separated by a deep groove. Pygidium simple; the sixth dorsal segment finely rugose, with a strong longitudinal carina, narrowly rounded at the apex, shorter than the ventral plate, which is narrowly truncate at the apex. Ventral segments coarsely but shallowly punctured. There is a very small tubercle at the base of each antenna.

Hab.—Near Melbourne.

This species is nearest to *P. nitidus* Sm., in the unarmed hypopygium of the male, but in *P. nitidus* the hypopygium is much smaller. The female differs much from *P. nitidus* in the shape of the head and thorax. It is not improbable that the present species is *Lophocheilus distinctus* Guér., but the description of that species is too poor for recognition.

The male is the type.

Type and type of female in the Victorian National Museum.

PSAMMOTHYNNUS KERSHAWI, sp.n.

♂. Niger; clypeo, mandibulis, orbitis oculorum, margine anteriore pronoti angustissime, tegulisque basi flavis; segmentis abdominalibus secundo, tertio quartoque, primo dimidio apicali quintoque lateribus, femoribus, tibiis tarsisque rufo-testaceis; mesopleuris macula magna flava antice; alis hyalinis, venis fuscis. *Var.* Pronoto omnino nigro. Long. 12 mm.

♂. Clypeus large, convex, broadly truncate at the apex; the interantennal prominence well defined, and narrowly rounded at the apex. Antennæ shorter than the thorax and median segment combined, the apical joints feebly arcuate beneath. Front rugosely punctured, vertex and thorax finely and rather closely punctured. Median segment rounded, shallowly punctured. Abdomen flattened, long and slender, much narrowed to the base; the segments slightly constricted at the base, shining and very sparsely punctured, clothed with whitish pubescence on the sides. Hypopygium deeply emarginate at the apex, the apical angles produced into spines, a tuft of long hairs at the apex. Second recurrent nervure received at about one-third from the base of the third cubital cell; third abscissa of the radius a little longer than the first and second combined.

Hab.—King Island, Bass' Straits (J. A. Kershaw), December.

This is not quite a typical *Psammothynnus*, the antennal joints being less strongly arcuate beneath, and the second recurrent nervure being received further from the base of the third cubital cell than in *P. depressus* Westw. One specimen has the coloured portion of the abdomen fusco-ferruginous instead of rufo-testaceous.

Type in the Victorian National Museum.

Aberration *nigricans.*

♂. Several specimens in the same collection, captured at the same time, have the abdomen entirely black.

Aberration *atripes.*

♂. A male in the Victorian National Museum, from Bacchus Marsh, Victoria, has the legs black.

NEOZELEBORIA LACTEIMACULATA, sp.n.

♀. Fusca; segmentis abdominalibus margine apicali pallido-testaceis; segmento dorsali secundo transverse quadricarinato, macula sub oculis pallide flava. Long. 8 mm.

♂. Niger; mandibulis, clypeo, macula utrinque supra basin antennarum, marginibus oculorum apice anguste interruptis, pronoto marginibus, mesonoto macula, scutello macula mediali, postscutello, segmentoque mediano linea angusta longitudinali flavis; segmentis dorsalibus 1-5 macula laterali utrinque albo-lactea; pedibus fusco-ferrugineis; alis subhyalinis, venis fuscis, costa testacea. Vertice macula utrinque fusco-ferruginea. Long. 13 mm.

♀. Mandibles falcate, with a very small tooth on the inner margin about two-thirds from the base. Head more than half as broad again anteriorly as long, flattened and thin, narrowed and very broadly rounded posteriorly; subopaque and very finely shagreened; eyes small and oval, not touching the base of the mandibles; a very short frontal sulcus from between the antennæ. Thorax and median segment finely shagreened; the pronotum a little longer than broad, raised and subtuberculate in the middle of the anterior margin, with a very short longitudinal sulcus on the raised portion; scutellum and median segment combined no longer than the pronotum. Abdomen shining, very sparsely punctured; first dorsal segment very narrowly transversely depressed at the apex; second with four transverse carinæ, including the raised apical margin; fifth ventral segment sparsely punctured. Pygidium lanceolate, very slightly widened at the apex, with a tuft of long, pale, fulvous hairs on each side. Legs and antennæ fusco-ferruginous.

♂. Clypeus slightly produced, the apical margin distinctly but shallowly emarginate. Antennæ no longer than the thorax and median segment combined, the apical joints distinctly arcuate beneath. Front closely and rather strongly punctured, vertex and thorax more finely and closely punctured, sparsely clothed with cinereous hairs. Median segment rounded. Abdomen shining, very shallowly punctured, the dorsal segments somewhat flattened and not constricted at the base. Hypopygium short, rounded, as broad as long, with a minute spine at the apex. Second abscissa of the radius nearly as long as the third; first recurrent nervure received at two-thirds from the base of the second cubital cell, second at about one-seventh from the base of the third cubital cell.

Hab.—Kuranda, N. Queensland; July, ♂♀ in cop.

This species approaches more nearly to *Agriomyia* than most of the genus, the structure of the pygidium in the female being very similar. But the male clypeus and antennæ are those of *Neozeleboria*, also the first dorsal and fifth ventral segments of the female.

DORATITHYNNUS SPRYI, sp.n.

♂. Flavus; fascia lata transversa infra ocellis, antennis, vertice, mesonoto basi fasciaque longitudinali utrinque, segmento mediano fascia longitudinali utrinque, segmentis abdominalibus basi in medio latissime, segmento septimo, tibiis intermediis et posticis subtus, tarsisque posticis et intermediis nigris; alis hyalinis, venis nigris, stigmate testaceo. Long. 13 mm.

♂. Clypeus convex, long, truncate at the apex, the labrum projecting and emarginate. Head small and thin, the antennæ shorter than the thorax and median segment combined, the joints not arcuate. Head and thorax finely and closely punctured, scutellum, median segment and abdomen much more sparsely punctured. Pronotum longer than the scutellum, narrowed anteriorly, the anterior margin raised and widely and shallowly emarginate; scutellum broadly truncate at the apex; the median segment rounded. Abdomen slender, somewhat flattened, the segments moderately constricted near the base, third and fourth ventral segments tuberculate at the apical angles, fifth ventral segment armed with a long and stout spine at the apical angles; hypopygium short, armed with three short, stout apical spines, the middle spine the longest, the sides parallel. Seventh dorsal segment broadly truncate at the apex. Second abscissa of the radius longer than the third; second recurrent nervure received at about one-eighth from the base of the third cubital cell.

Hab. —South Australia, 24 miles west of Kychering Soak, on the railway from Port Augusta to Coolgardie; 2 males.

Type in the Victorian National Museum.

Allied to *D. orientalis* Turn., but has the clypeus much longer, and the hypopygium much broader with the spines more strongly developed, the pronotum is longer, and the yellow colouring much more extensive. The lengthening of the clypeus seems to be characteristic of many of the desert *Thynnidæ*, and is associated with a longer and more or less exposed labrum.

GUERINIUS CONFUSUS Sm.

Thynnus confusus Sm., Cat. Hym. B.M. vii. p.13, 1859,♂.

Thynnus sulcifrons Sm., Cat. Hym. B.M. vii. p.43, 1859,♀.

Tachynothynnus confusus Turn., Wystman, Gen. Insect., cv. p.50, 1910,♂.

Tachynothynnus sulcifrons Turn., Wystman, Gen. Insect., cv. p.50, 1910,♀.

A pair in the Australian Museum, taken in copulâ, by Mr. Masters, at Albany.

The name *Guérinius* Ashm., must stand for this genus, as pointed out by Rohwer.

ZASPILOTHYNNUS CAMPANULARIS Sm.

Thynnus campanularis Sm., Trans. Ent. Soc. London, 1868, p.232,♂.

Thynnus leachiellus Olliff, Mem. Austral. Mus. ii. p.98, 1889 (nec Westwood).

Olliff identified this wrongly; the species taken on Lord Howe Island being *T. campanularis* Sm.

ZASPILOTHYNNUS RHYNCHIOIDES, sp.n.

♂. Niger; capite, fascia transversa inter oculos excepta, pronoto, mesopleuris antice, pedibus anticis, segmentisque abdominalibus tribus apicalibus aurantiacis; alis flavis basi et apice infuscatis, venis ferrugineis; antennis fusco-ferrugineis, apice nigris. Long. 21 mm.

♂. Clypeus pointed at the base, deflexed and broadly truncate at the apex, finely longitudinally striated. Interantennal prominence broad, the antennæ of even thickness throughout and inserted nearer to the eyes than to each other. Head and mesopleuræ finely and closely punctured, subopaque; thorax finely and sparsely punctured, shining, scutellum with a strong median carina, postscutellum very broadly rounded and projecting slightly beyond the base of the posterior truncation of the median segment, the surface of which is distinctly concave, shining and not very finely punctured. Abdomen finely and rather sparsely punctured, more closely at the base than at the apex; first segment the broadest, vertically truncate anteriorly; sixth ventral segment with a spine on each side at the apical angles; hypopygium with a blunt lobe on each side at the base, thence broadly triangular with a stout apical spine. Seventh dorsal segment with a flattened lamina. First recurrent nervure received at three-fifths from the base of the second cubital cell, second at about one-tenth from the base of the third cubital cell. Third abscissa of the radius a little longer than the first and second combined. The pronotum is widely emarginate anteriorly, the anterior margin raised with a deep transverse groove behind it.

Hab.—Borroloola, Northern Territory; January.

Type in Victorian National Museum.

The colouring recalls *Rhynchium superbum*. The species belongs to the typical *interruptus*-group of *Zaspilothynnus*, and is perhaps closer to *Z. excavatus* Turn., than to any other species. The colouring of the head and pronotum is similar to that of the West Australian *Z. ochrocephalus* Sm., but the colour of the wings and abdomen is very distinct.

Family PSAMMOCHARIDÆ (olim POMPILIDÆ).

CALOPOMPILUS ALICIÆ, sp.n.

♀. Nigra; segmento primo, basi excepto, segmento dorsali secundo, apice excepto, femoribus, tibiis tarsisque rufo testaceis; mandibulis fusco-ferrugineis; alis flavo-hyalinis, apice infuscatis, fusco late bivittatis. Long. 11-15 mm.

♀. Clypeus moderately convex, about twice and one-half as broad as long, the apical margin almost transverse, very finely punctured at the base, more coarsely and sparsely at the apex. Antennæ rather stout, a little longer than the thorax and median segment combined, the second joint of the flagellum as long as the first and third combined. Posterior ocelli nearly twice as far from the eyes as from each other, very little further from each other than from the anterior ocellus. Front divided by an obscure longitudinal sulcus, without any prominence at the base of the antennæ. Head and thorax subopaque; the posterior margin of the pronotum forming a broad arch; median segment opaque, divided by a distinct longitudinal sulcus which becomes less distinct on the posterior slope. Abdomen shining, very minutely punctured, the apical dorsal segment more coarsely punctured and clothed with testaceous hairs, the apex of the segment rufo-testaceous and very narrowly rounded. The transverse groove on the second ventral segment is distinctly marked. Second abscissa of the radius as long as the first and third combined, first recurrent nervure received just beyond the middle of the second cubital cell, second at two-fifths from the base of the third cubital cell. The cubital nervure of the hind wing originates a little beyond the transverse median nervure. The fuscous bands on the forewing are situated on the basal nervure and another much broader filling the basal two-thirds of the radial cell, the second and three-quarters of the third cubital cells and uniting below the cubital nervure with the pale fuscous marginal band. Posterior tibiæ serrate.

Hab.—Mt. Wellington, Tasmania, 2,300ft.; January and February; not uncommon.

This is somewhat allied to *C. ornatipennis* Sm., but is a much smaller species, with a very different wing-pattern.

Family SPHEGIDÆ.

Subfamily AMPULICINÆ.

APHELOTOMA RUFIVENTRIS, n.sp.

♂. Niger; mandibulis apice, scapo, abdomine pedibusque rufo-testaceis; alis hyalinis, venis nigris, basi testaceis. Long. 5 mm.

♂. Head finely rugulose; clypeus without a carina; eyes slightly convergent towards the vertex, separated at the base of the clypeus by a distance equal to twice the length of the scape, posterior ocelli as far from each other as from the eyes; a low longitudinal carina from the anterior ocellus nearly reaching the base of the clypeus. Second joint of the flagellum distinctly longer than the third. Mesopleuræ rugose, sides of the median segment obliquely striated. Thorax coarsely rugose; the pronotum about twice as broad as long, the anterior angles produced into short spines; median segment coarsely rugose, abruptly truncate posteriorly. Abdomen shining, finely and closely punctured. First recurrent nervure received near the apex of the first cubital cell, second interstitial with the second transverse cubital nervure; second abscissa of the radius shorter than the first, third longer than the first and second combined.

Hab.—Kuranda, Q.; May to July. One male, in the Brisbane Museum, from Stradbroke Island.

Easily distinguished by the colour of the abdomen, and the spines at the angles of the pronotum. Fairly common on dead Eucalyptus trees.

Subfamily PHILANTHINÆ.

CERCERIS ALASTOROIDES, sp.n.

♀. Nigra; mandibulis, clypeo, fronte sub antennis, fascia pone oculos, macula utrinque pone oculos, antennis, prothorace, mesopleuris maculis duabus antice, scutello, postscutello, segmento mediano area basali lateribusque late, abdomine, segmento tertio excepto, pedibusque rufo-aurantiacis; alis flavo-hyalinis, apice infuscatis, venis testaceis, apice fuscis; clypeo apice late rotundato in medio denticulato, mesopleuris haud tuberculatis, segmento ventrali secundo area basali elavata nulla. Long. 12 mm.

♀. Clypeus large, without a lamina, the middle lobe as long as its apical breadth; the apical margin very broadly rounded, with a distinct blunt tooth in the middle. Head, thorax, and abdomen strongly punctured; antennæ inserted as far from the clypeus as from the anterior ocellus, the second joint of the flagellum longer than the third; the frontal carina narrow and elevated between the antennæ, broadened and depressed towards the base of the clypeus. Basal area of the median segment very finely obliquely striated, with a median longitudinal sulcus. First abdominal segment distinctly broader at the apex than long; pygidial area with the sides almost parallel, very slightly convergent towards the apex, which is truncate. Petiole of the second cubital cell short; first recurrent nervure received before the middle of the second cubital cell, second at one-fifth from the base of the third cubital cell.

Hab.—Borroloola, Northern Territory; February.

Type in Victorian National Museum.

The colour, especially on the head, is probably altered by cyanide, but the reddish-orange colour of the abdomen is seen in several other Australian species of the genus. The shape of the clypeus does not approach any other Australian species. This can hardly be the female of the Northern Territory species *C. cucullata* Bingh., the disposition of the colour, and the sculpture of the enclosed area, at the base of the median segment, being very different.

Subfamily NYSSONINÆ.

SPHODROTES PUNCTUOSUS Kohl.

Sphodrotes punctuosus Kohl, Ann. Naturh. Hofmus. Wien, iv. p.189, 1889,♂.

Hab.—Jindabyne, N.S.W.; 3,000 ft. (Helms). In Australian Museum, two males; Eaglehawk Neck, S.E. Tasmania (Turner), one male.

The Tasmanian specimen was taken in February, 1913; the Jindabyne specimens in March, 1889. I have not seen the female.

GORYTES RUFOMIXTUS, sp.n.

♀. Nigra, clypeo macula utrinque, pronoto, scutello macula utrinque, segmentisque dorsalibus 1-5 fascia lata apicali flavis; mandibulis, antennis dimidio basali, tegulis, mesopleuris antice, scutello in medio, postscutello, segmentis abdominalibus lateribus, segmento septimo, pedibusque sordide ferrugineis; alis hyalinis, venis fusco-ferrugineis. Long. 8·5 mm.

♀. Clypeus broad, truncate at the apex; eyes scarcely convergent towards the clypeus, the inner margin slightly and very widely emarginate. Antennæ short, not as long as the thorax and median segment combined, stout, but only slightly thickened to the apex, the second and third joints of the flagellum equal in length. Head small, clothed with short greyish pubescence, the front with a sulcus reaching the anterior ocellus. Posterior ocelli further from each other than from the eyes or the anterior ocellus. Head and thorax opaque, minutely punctured; the mesosternum with a transverse but without a longitudinal carina; a very deep transverse sulcus between the mesonotum and scutellum, the sulcus coarsely longitudinally striated; basal area of the median segment very coarsely longitudinally striated, the sides of the segment indistinctly striated. Abdomen very finely and minutely punctured, subpetiolate; the first segment short, widened from the base, with one carina beneath, second ventral segment sparsely and rather coarsely punctured; pygidium shining, sparsely and finely punctured, almost pointed at the apex, the pygidial area not as clearly defined as in *G. frenchi* Turn. Third abscissa of the radius less than half as long again as the second; both recurrent nervures received by the second cubital cell, the distance between them about half as great again as that separating them from the base and apex of the cell. First transverse cubital nervure bent outwards close to the cubitus, but not as sharply as in *G. frenchi* Turn., a scar running from the bend to the base of the stigma. Fore tarsi with a comb of very slender spines.

Hab.—Jindabyne, Snowy River, N.S.W.; 3,000 ft.; March (Helms).

Type in Australian Museum, Sydney.

Subfamily LARRINÆ.

LYRODA MICHAELSENI Schulz.

Lyroda michaelseni Schulz, Fauna Südwest Australiens, i. 13, p 479, 1908, ♀♂.

Subsp. *tasmanica*, subsp.n.

♀. Differs from the typical form in the almost total want of the small teeth on the anterior margin of the clypeus; in the position of the recurrent nervures, both of which are situated further from the base of the second cubital cell than in *L. michaelseni*, in the somewhat shorter third abscissa of the radius, and in the somewhat less opaque head and thorax, which are scarcely more opaque than the abdomen. The ocelli are placed in an equilateral triangle, as in the typical form, but the posterior pair are only a very little further from each other than from the eyes, not half as far again, as in the typical form. The median segment is rather longer in subsp. *tasmanica.*

Hab.—Eaglehawk Neck, S.E. Tasmania; February, 1913, 4♀.

I have not seen the typical form, which is from Shark Bay, W.A., and it is quite possible that subsp. *tasmanica* may prove to be a distinct species.

Subfamily PEMPHREDONINÆ.

SPILOMENA HOBARTIA, sp.n.

♀. Nigra ; mandibulis, antennis, pedibusque testaceis ; alis hyalinis, venis nigris. Long. 5 mm.

♀. Mandibles bidentate at the apex, not very stout; clypeus moderately convex, with a low carina from the base to the middle. Antennæ shorter than the head; the flagellum gradually thickened towards the apex, rather more than twice as long as the scape. Eyes convergent towards the apex, separated on the vertex by a distance equal to about twice the length of the scape, the posterior ocelli nearly twice as far from the eyes as from each other and as far from the posterior margin of the head as from the eyes. Cheeks as broad as the eyes, which are elongate-oval and touch the base of the mandibles. Head a little broader than the thorax, a little longer than broad, the hind margin widely emarginate, opaque, with a frontal sulcus from the anterior ocellus to the base of the clypeus. Pronotum depressed below the mesonotum, thorax opaque, minutely punctured. Median segment finely reticulate; the basal area short, broadly rounded and irregularly longitudinally striated; the sides of the segment reticulate; the posterior truncation vertical, minutely punctured, with a median sulcus. Abdomen not petiolate, no longer than the thorax and median segment combined, shining and minutely punctured. Stigma at least two and a half times as long as the greatest breadth, second abscissa of the radius almost as long as the first, the recurrent nervure received by the first cubital cell at a distance from the apex equal to rather less than half the length of the first transverse cubital nervure. The wings are strongly iridescent.

Hab.—Eaglehawk Neck, S.E. Tasmania; also from Hobart; three females, early in March.

Taken on a fallen Eucalyptus tree, going into small holes.

This species and *S. australis* Turn., show a near approach to the genus *Harpactophilus*.

HYDROCYANIC ACID IN PLANTS.

Part ii. Its Occurrence in the Grasses of New South Wales.

By James M. Petrie, D.Sc., F.I.C., Linnean Macleay Fellow of the Society in Biochemistry.

(From the Physiological Laboratory of the University of Sydney.)

The systematic examination of Grasses for cyanogen compounds was the direct outcome of tests made to ascertain the cause of the sudden fatalities among stock, which took place in this State about two years ago. The sheep apparently had eaten nothing besides grass, and this grass when tested was found to contain a cyanogenetic glucoside and the corresponding enzyme.

It was conceived, that at least some of the frequent deaths from unknown causes, and which are often attributed to supposed poisonous plants, might possibly be due to such grasses.

Reference to the literature on this subject shows that hydrocyanic acid in grasses, was first discovered by Jorissen, in 1884, in *Poa aquatica* Linn., and this was followed by its detection in the sorghums, in 1902 (Dunstan and Henry). Up to the present, all the cyanophoric grasses recorded are included in about 14 genera, and are given in Table i.

Some of these exotic grasses have been naturalised in this country, and among them *Briza minor, Lamarckia aurea,* and *Poa pratensis,* are recorded by Couperot, as yielding hydrocyanic acid, when tested by him. (Journ. Pharm. Chim., 1908, 28, 542).

These three grasses growing in this State, have been examined at various seasons, and have never given positive results, neither did they contain any trace of an enzyme capable of decomposing amygdalin.

With regard to this peculiarity, we may compare the results of the Armstrongs and Horton (Proc. Roy. Soc. Lond., B.86, 1913, 265), with *Lotus corniculatus* growing in different countries. In apparently identical plants, they found that most contained both a cyanophoric glucoside and enzyme, but that in certain countries, the plants were acyanophoric. Of the latter, some were rich in enzyme, others contained only a trace. They state in explanation, that the presence of the two correlated factors mentioned is not sufficient, and that a third factor is necessary, probably one influencing concentration. It would appear then, that the conditions of concentration are unsuitable in some instances, such as in our three grasses.

TABLE i.

CYANOGENETIC GRASSES PREVIOUSLY KNOWN.

Bambusa arundinacea Roxb., 1911,* cultivated in N.S.W.

Briza minor Linn., 1908, naturalised in N.S.W.

Catabrosia aquatica Beauv., 1908.

Cortaderia argentea Stapf, 1906, cultivated in N.S.W. *C. conspicua, C. kermesiana,* 1906.

Elymus spp.

Festuca poa Kunth, 1908.

Holcus lanatus Linn., 1908, naturalised.

Lamarckia aurea Mœnch., 1908, naturalised.

Melica altissima, M. ciliata, M. nutans, M. uniflora.

Panicum maximum, P. muticum, 1903, introduced, *P. junceum.*

Poa aquatica Linn., 1884; *P. pratensis* Linn., 1908, naturalised.

Sorghum vulgare Pers., 1902, introduced; *S. halepense* Pers., native; *S. saccharatum, S. tartaricum,* 1903, introduced; *S. nigrum.*

Stipa capillata, S. gigantea, S. hystricina, S. leptostachya, S. Lessingiana, S. tortilis, 1906.

Zea Mays, 1903, naturalised.

We have now to add to the above list of cyanogenetic grasses the names of 17 more species, which are found in New South Wales,

* The dates refer to record of hydrocyanic acid.

and which are here recorded for the first time as containing a cyanogenetic glucoside and the correlated enzyme.

Table ii.

Cyanogenetic Grasses of New South Wales.

Andropogon gryllus Linn., N.S.Wales native grass.
halepensis Sibth., var. *mutica,* N.S.W. native.
sorghum (L.) Brot., vars., introduced.
intermedius R.Br., N.S.W. native.
ischæmum Linn., introduced from N. America.
micranthus Kunth, N.S.W. native (scented grass).

Anisopogon avenaceus R.Br., N.S.W. native.

Bouteloua oligostachya Torr., introduced from Mexico.

Chloris petræa Sw., introduced.
polydactyla Sw., introduced from S. Amer.
truncata R.Br., N.S.W. native (star grass).
ventricosa R.Br., N.S.W. native (blue star grass).

Cortaderia argentea Stapf, vars. *gigantea, rosea, variegata,* S. Amer. Pampas grass, cultivated in N.S.W.

Cyndon incompletus Nees (Stapf), a "blue couch" grass of S Af., perhaps indig. in N.S.W.

Danthonia semiannularis R.Br., N.S.W. native (wallaby grass)
racemosa R.Br., N.S.W. native (racemed oat-grass).

Diplachne dubia Scribn., Mexican grass, cultivated Bathurst, Hawkesbury.

Eleusine ægyptiaca Pers., N.S.W. native(Egyptian finger grass).
indica Gærtn., N.S.W. native (crab grass).

Leptochloa decipiens R.Br. (Stapf), introduced, interior and coast.

Notes on the Grasses in Table ii.

These twenty species were examined at various seasons, and tested for the presence of cyanogenetic glucoside and enzyme The results of the various tests are summarised below :—

Methods.—Cyanogenetic compounds were shown to be present in all the species, by plasmolysis of the tissues with vapour of chloroform. (1) Those classified as "very strong" changed colour within one minute, and yielded, in one case, over 0·015% total hydrocyanic acid. (2) Those marked as "strong" gave the colour change within one hour. (3) Those which required to stand 24 hours before any visible change occurred, are described as "faint."

General Results.—When portions of these grasses are placed in stoppered bottles, with the test paper, but without any reagents, and kept at 37° C. for 24 hours, two species only were found to evolve free hydrocyanic acid, these were *Cynodon incompletus*, and *Diplachne dubia*. The others only gave a positive result after anæsthetising.

Immersing about 10 gm. portions in boiling water does not immediately kill the enzyme; even with 2 minutes' immersion, the grass subsequently liberates hydrocyanic acid when placed in chloroform vapour, but when kept immersed for 2-5 minutes the enzyme is completely destroyed. All the species, when thus treated for 5 minutes, and found to evolve no hydrocyanic acid with chloroform vapour during 48 hours, were then mixed with emulsin, and quickly showed the colour change due to hydrocyanic acid evolution. The compounds were thus shown to be glucosides.

Detailed Results of the Individual Grasses.

Andropogon halepensis.—This grass, which is regarded by Hackel as the original wild species from which the sorghums have sprung, is of very wide distribution, and is now considered indigenous. The reaction of the cyanogenetic glucoside was found to be maximum in January and August, *i.e.*, in the Midsummer growth and the second growth due to the late winter rains. At other times throughout the year, including the flowering period, the grass gave only a "faint" positive reaction.

January ...	+ strong.	August ...	+ strong.
April ...	+ faint.	November ...	+ faint.

No free hydrocyanic acid was evolved from the grass on keeping in a closed bottle for three days.

Andropogon australis has not shown the least trace of hydrocyanic acid at any time of the year.

These two grasses are the only two indigenous sorghums, syn. respectively with *Sorghum halepense* Pers., and *S. plumosum* Beauv.

Andropogon sorghum, vars. *vulgaris, saccharatus.*—Grown in experimental plots these grasses were tested in each month, and gave positive reactions from January to December. There was no period in which healthy growing plants were free. In only one plot growth was arrested, and the plants killed, by cold weather in June, and within a few days the tests varied from "strong" to "faint" and nil, the height being 14 inches. Dunstan and Henry found the Egyptian sorghum to lose its glucoside entirely when 14 inches high, while, on the other hand, the sorghum grown here, on the Richmond River, and also that grown in Queensland, showed the presence of glucoside when over 4 feet high.

The glucoside was present in the inflorescence, leaves, stems, and roots. The top leaves were always strongest, and especially the young uncoiled apex-leaves; the reaction diminished with the position of the leaves down the stem, and frequently the lowest leaves gave none. The stems, too, showed a gradual diminution downwards, though frequently they gave uniform reactions. In the roots the strongest reaction was often obtained from the extreme tips.

The leaves also showed a remarkable variation in enzyme, as the following summary of the results, obtained from tests on the leaves of mature plants, will show:—

i. Leaves anæsthetised, showed strong positive reaction, emulsin added—no evident change produced.

ii. Leaves anæsthetised, showed faint positive reaction, emulsin added—no evident change produced.

iii. Leaves anæsthetised, showed faint positive reaction, emulsin added—very strong positive reaction.

iv. Leaves anæsthetised, gave negative result,
emulsin added—very strong positive reaction.

v. Leaves anæsthetised, showed negative result,
emulsin added—negative result,
amygdalin added—strong positive result.

In i. and ii. class of results we have apparently an abundance of enzyme, in iii. a deficiency, and in iv. entire absence. In iv., certain leaves, chiefly the lowest on the stems, contained glucoside alone, the accompanying enzyme having entirely disappeared. In v., certain leaves are shown to contain enzyme only, without glucoside.

The mature plants when cut, and exposed to the air to dry, undergo very little change, with regard to glucoside or enzyme, during the first week. After this, the glucoside is gradually hydrolysed; but while this action is proceeding, the enzyme, too, appears to be slowly destroyed, and so it happens that sometimes it is the glucoside, at other times the enzyme, which first disappears.

Andropogon gryllus.—This indigenous grass never shows more than a trace of glucoside, and that only in the winter; during the hot summer weather it contains none. In autumn, the flowers and also the isolated seeds gave positive reactions.

January	– (young and green).	August ...	+ faint.
April	+ faint.	November ...	+ very faint.

Andropogon intermedius and *A. ischæmum* are two native grasses, which are closely related, and in the summer months give strong reactions for a cyanogenetic glucoside.

	intermed.	*ischæm.*
January	+ strong	+ strong.
April	+ faint	+ faint.
August	+ faint	+ faint.
November ...	+ strong	+ faint.

Andropogon micranthus.—At no period was more than a trace of hydrocyanic acid detected, even throughout the flowering season, and during the winter months the grass was entirely free.

January ...	+ faint.	August ...	–
April	+ faint.	November ...	+ faint.

Bouteloua oligostachya.—This Mexican prairie grass is growing in the neighbourhood of Tenterfield, and specimens from there growing in the Botanic Gardens, were found, at certain seasons, to react strongly for glucoside. In the autumn it entirely disappeared, to return again faintly in the rainy season, and gradually to increase in the Spring, to a maximum at Midsummer.

January ...	+ very strong.	August ...	+ faint.
April ...	−	November ...	+ strong.

Chloris.—Four specimens of this grass are cyanophoric; of these two are native to N.S.Wales, viz., *C. truncata* and *C. ventricosa,* and are widely distributed over the Eastern States.

The exotic species, from which positive results were obtained, are *C. petræa* and *C. polydactyla*, and are cultivated in the Botanic Gardens.

	January.	April.	August.	November.
C. truncata ...	+ strong ...	+ faint ...	−	− ... ...
C. ventricosa ..	+ strong ..	−	+ faint ...	+ faint ...
C. petræa ..	+ faint ...	−	+ faint	+ very strong
C. polydactyla..	+ very strong	+ very strong	+ very strong	+ very strong

Samples of the native species were collected by Mr. Breakwell in Narrabri, Wagga, and Coonamble districts, from September to December, and these all gave, during this season, negative results.

Cortaderia argentea.—The three varieties, *gigantea, rosea, variegata*, growing in the Botanic Gardens, were tested, and also a number of specimens growing elsewhere in Sydney. All gave "strong" reactions in all seasons.

Cynodon incompletus.—This blue couch-grass is recorded only from E. and S. Africa, and in New South Wales from the Upper Hunter River and Forbes. It is still doubtful whether it has been introduced from S. Africa or is indigenous to Australia (Maiden, Agric. Gaz. N.S.Wales, 1912, 295).

Hydrocyanic acid was first detected in this grass in November, 1911, in a patch cultivated in the Botanic Gardens, and which had been brought by Mr. Maiden from Aberdeen in 1907, from a spot on which cattle had died in November of that year. The cause of the fatality was associated with this grass. Samples were also obtained, through the Chief Inspector of Stock, from Scone and Muswellbrook, and these all gave strong positive reaction at this same season. A second fatality took place at Forbes, where over 100 sheep died on December 9th, 1911. This grass was recognised on the spot, and when tested gave a very strong reaction. A third fatality occurred in the same district in February, 1913; after which some sheep were isolated and fed on this grass alone, when each of them died within half an hour. A sample of this same lot was received for analysis, from the Inspector of Stock at Forbes, and gave the following result:—

	In fresh material.	In grass dried at 100°C.
Free hydrocyanic acid	0·006 %	0·008 %
Combined hydrocyanic acid	0·010 %	0·017 %
Total hydrocyanic acid..............	0·016 %	0·025 %

The free acid was estimated by destroying the enzyme with boiling water, and distilling into standard alkali. The distillate was then titrated with silver nitrate.

The total acid was estimated by previous fermentation of the grass, and then distilling off the volatile acid.

It was calculated from the free acid figure that a sheep of 150 lbs. weight would require, for a lethal dose, to eat about 2 lbs. weight of this grass.

Effect of drying on cut grass.—Grass which gave a very strong reaction for hydrocyanic acid, when exposed openly to the air, showed a gradual diminution of the intensity of reaction during three weeks. At the end of this time the grass reacted only very faintly, and usually in the fourth week gave negative tests. When now, this grass was moistened, and emulsin added, it still gave negative results, but on adding amygdalin instead, a strong positive result followed. The glucoside alone had disappeared, the enzyme was still active.

A similar result was also obtained with grass which had been air-dried for over three months.

Seasonal variations of *C. incompletus*:—

June	... faint.	December	... very strong.
July	... faint.	January	... very strong.
August	... very faint.	February	... very strong.
September	... faint, increasing.	March	... strong.
October	... strong.	April	... decreasing, faint.
November	... very strong.	May	... faint.

The author desires to express his indebtedness, and thanks to the following gentlemen, for supplies of this grass, at the various seasons:—Chief Inspector Symons, of the Stock Department; Stock Inspectors C. Brooks, of Scone, and W. G. Dowling, of Forbes; Police Inspector Nolan, of Forbes; Mr. J. H. Maiden, F.L.S.

Other Couch-grasses.—*Cynodon dactylon* Pers., the common couch grass of lawns was tested from various parts of the State.

Digitaria didactyla Willd., the Sydney blue couch, is found in certain isolated patches only, such as Hunter's Hill, Vaucluse, and Botanic Gardens. These two grasses have always given negative results for hydrocyanic acid, but in a number of instances they showed the presence of an active enzyme capable of hydrolysing amygdalin.

Danthonia semiannularis is generally considered one of the most valuable and nutritious of the native grasses. It gives a faint reaction for cyanogenetic compounds, but towards the end of summer it is parched and dry, and is then quite free, till the autumn rains renew the growth.

January	... + faint.	August	... + faint.
April	... –	November	... + faint.

Samples of this grass were collected by Mr. Breakwell from Narrabri, Wagga, Moree, etc., at the various seasons, and all gave similar results, when tested.

Diplachne dubia, a Mexican grass, cultivated in the Botanic Gardens. This is one of the strongest cyanogenetic grasses tested. It evolves free hydrocyanic acid continually, and if placed in a stoppered bottle with the test paper, shows an intense reaction in a few minutes. The glucoside, enzyme, and free acid, are present in all parts, and throughout the whole year.

January	...	+ very strong.	August	..	+ very strong.
April	...	+ very strong.	November	...	+ very strong.

Eleusine ægyptiaca and *E. indica.*—These two native grasses are widely distributed, the former in the interior of New South Wales, and the latter in the coastal districts. They are very rich in cyanogenetic glucosides, all parts of the plants giving strong reactions, except in the winter.

	ægypt.	*indica.*	
January	+	+	strong.
April	+	+	strong.
August	−	−	
November	+	+	strong.

Leptochloa decipiens.—This exotic grass reacts energetically for cyanogenetic glucoside at all times of the year, and is strongest in Autumn and late Spring. The flowers and seeds are also very strong. It is cultivated in the Botanic Gardens and Centennial Park.

Grasses cultivated in the Botanic Gardens.

By the co-operation of the Director of the Gardens, Mr. J. H. Maiden, 152 different species of native and exotic grasses have been tested at four different seasons throughout the year. A number of the results were confirmed by tests on material collected by Mr. E. Breakwell, B.A., B.Sc., Department of Agriculture, in the pastoral districts and at the Government Farms.

All the specimens have been carefully examined by Mr. E. Cheel in the National Herbarium, and considerable time has been occupied in their identification. The species were checked and confirmed by Mr. Maiden, and a number of doubtful ones were referred to Kew. It will be recognised that the value of the results stated is largely dependent on the fact that the botanical names are as correct as it is possible to give them, and for this essential part of the work much credit is due to my collaborators.

The grasses were tested in a similar manner to the plants recorded in Part i. (These Proc. xxxvii., 1912, 220), *viz.*, (1) grass in vapour of chloroform, for presence of cyanogenetic compounds and free hydrocyanic acid, (2) grass and emulsin, in case of enzyme deficient or absent, and (3) grass and amygdalin, for presence of β enzymes.

These three tests are represented respectively by the three signs in each column.

	Jan.			April.			Aug.			Nov.		
Agropyron scabrum Beauv.	−	.	.	−	.	.	−	.	.	−	.	.
Agrostis alba Linn.	−	−	−	−	.	.	−	.	−	−	.	−
stolonifera Linn.	−	−	−	−	.	.	−	.	.	−	.	−
stolonifera Linn., var. *gigantea*	−	−	−	−	.	.	−	.	.	−	.	−
verticillata Vill.	−	−	−	−	.	.	−	.	.	−	.	−
vulgaris With.	−	.	−	−	−	−	−	.	.	−	.	−
Alopecurus geniculatus Linn.	−	.	−	−	−	−	−	.	−	−	.	−
Andropogon affinis R.Br.	−	−	−	−	.	.	−	.	.	−	.	.
annulatus Forst.	−	−	−	−	.	.	−	.	.	−	.	.
australis Spreng.	−	−	−	−	.	.	−	.	.	−	.	.
bombycinus R.Br.	−	−	−	−	.	.	−	.	.	−	.	.
gryllus Trin.	+	.	.	+	.	.	+	.	.	+	.	.
halepensis Sibth., var. *mutica* Hack.	+	.	.	+	.	.	+	.	.	+	.	.
intermedius R.Br.	+	.	.	+	.	.	+	.	.	+	.	.
ischæmum Linn.	+	.	.	+	.	.	+	.	.	+	.	.
micranthus Kunth.	+	.	.	+	.	.	−	.	.	+	.	.
saccharoides Sw., var. *barbinodis*	−	−	−	−	.	−	−	−	+	−	.	−
schœnanthus Linn.	−	−	−	−	.	.	−	.	.	−	.	.
sericeus R.Br.	−	−	−	−	.	.	−	.	.	−	.	.
Anthoxanthum odoratum Linn.	−	.	+	−	−	−	−	.	.	−	.	+
Aristida ramosa R.Br.	−	−	−	−	.	−	−	−	−	−	.	−
Arundinella nepalensis Trin.	−	−	−	−	.	−	−	.	−	−	−	−
Asperella hystrix Linn.	−	−	−	−	.	.	−	.	.	−	.	−
Astrebla triticoides F.v.M.	−	−	−	−	.		−	.	+	−	.	−
Bouteloua oligostachya Torr.	+	.	.	−	.	.	+	.		+	.	.
Briza minor Linn.	−	.	−	−	.	−	−	.	−	−	.	.
Bromus erectus Huds.	−	−	−	−	.	.	−	.	.	−	.	−

	Jan.			April.			Aug.			Nov.		
Bromus inermis Leyss	–	–	–	–	.	.	–	.	.	–	.	–
Kalmii Gray	–	–	–	–	.	.	–	.	.	–	.	–
madritensis Linn.	.	.	.	–	.	+	–	.	–	–	.	–
Pampellianus Scribn.	–	–	–	–	.	.	–	.	.	–	.	–
racemosus Linn.	.	.	.	–	.	–	–	.	.	–	.	+
tectorum Linn.	–	.	.	.	.	.	.	.	.	.	.	.
unioloides H.B.K.	–	–	–	–	.	–	–	.	–	–	.	–
Catapodium syrticum Murb.	.	.	.	–	.	–	–	.	–	–	.	–
Cenchrus australis R.Br.	–	.	–	–	.	–	–	.	.	–	.	–
Chætum bromoides	–	.	+	–	–	–	–	.	.	–	.	+
Chloris gayana Kunth.	–	–	–	–	.	.	–	.	.	–	.	–
petræa Sw.	+	.	.	–	.	–	+	.	.	+	.	.
polydactyla Sw.	+	.	.	+	.	.	+	.	.	+	.	.
submutica H.B.K.	–	–	–	–	.	.	–	.	.	–	.	–
truncata R.Br.	+	.	.	+	.	.	–	–	–	–	–	–
ventricosa R.Br.	+	.	.	–	–	–	+	.	.	+	.	.
Coix lachrymi-Jobi Linn.	–	–	–	–	.	.	–	.	.	–	.	.
Cortaderia argentea, var. *rosea*	+	.	.	+	.	.	+	.	.	+	.	.
var. *gigantea*	+	.	.	+	.	.	+	.	.	+		.
var. *variegata*	+	.	.	+	.	.	+	.	.	+	.	.
Corynephorus canescens Beauv.	–	–	+	–	–	+	–	.	–	–	.	–
Cynodon dactylon Pers.	–	–	+	–	.	+	–	–	–	–	.	.
incompletus Nees	+	.	.	+	.	.	+	.	.	+	.	.
Dactylis glomerata Linn.	–	.	–	–	.	–	–	.	.	–	.	–
Danthonia semiannularis R.Br.	+	.	.	–	.	.	+	.	.	+	.	.
racemosa R.Br.	+	.	.	.	.	.	.	.	.	.	.	.
Dichelachne crinita Hook.	–	–	–	–	.	.	–	.	.	–	.	–
Digitaria didactyla Willd.	.	.	.	.	.	.	.	.	.	.	.	.
tenuiflora Beauv.	.	.	.	–	.	–	–	.	.	–	.	–
Diplachne dubia Scribn.	+	.	.	+	.	.	+	.	.	+	.	.
Echinopogon ovatus Palis.	.	.	.	.	.	.	.	.	.	.	.	.
Ehrharta calycina Sw., var. *versicolor*	–	–	.	–	.	–	–	.	–	–	.	–
Eleusine ægyptiaca Pers.	+	.	.	+	.	.	–	.	.	+	.	.
indica Gærtn.	+	.	.	+	.	.	–	.	.	+	.	.
Elymus arenareus Linn.	–	–	–	–	.	–	–	.	.	–	.	–
robustus Scribn.	–	–	–	–	.	–	–	.	–	–	.	–
virginicus Linn.	–	–	–	–	.	.	–	.	.	–	.	–
Eragrostis Brownii Nees	–	–	–	–	.	.	–	–	–	–	.	–
curvula Nees.	–	–	–	–	.	–	–	.	.	–	.	–
diandra Steud.	–	.	–	–	–	–	–	.	.	–	.	.

	Jan.			April.			Aug.			Nov.		
Eragrostis leptostachya Steud	–	–	–	–	.	.	–	.	.	–	.	.
major	–	.	–	–	.	–	–	.	.	–	.	.
pilosa Beauv.	–	–	+	–	–	+	–	.		–	.	–
plana Nees	–	–	–	–	–	–	–	–	–	–	–	–
purshii Schrad.	–	–	+	.	.	.	–	.	+	–	.	–
Erianthus ravennæ Beauv....	–	–	–	–	.	.	–	.	.	–	.	–
Festuca bromoides Linn.	.	.	.	.	.	.	–	–	–	.	.	.
duriuscula Linn.	–	–	–	–	.	.	–	.	–	–	.	–
elatior Linn.	–	–	–	–	.	.	–	.	.	–	.	–
elatior Linn., subsp. *arundinacea*	–	–	–	–	.	.	–	.	–	–	.	–
gigantea Vill.	–	–	–	–	.	.	–	.	.	–	.	–
Hookeriana F.v.M.	–	–	–	–	.	.	–	.	.	–	.	.
ovina Linn.	–	–	–	–	.	.	–	.	–	–	.	–
ovina, var. *tenuifolia*, Sibth. ..	–	–	–	–	.	.	–	.	–	–	.	–
rubra Linn.	–	–	–	–	.	–	–	.	–	–	.	–
Glyceria Fordeana F.v.M.	–	–	–	–	.	.	–	.	.	–	.	.
Hæmarthria compressa R.Br.	–	.	+	–	.	.	–	–	+	–	.	–
Isachne australis R.Br.	–	.	–	–	.	–	–	.	.	–	.	–
Lagurus ovatus Linn.	.	.	.	–	.	+	–	.	–	–	.	+
Leptochloa decipiens R.Br. (Stapf)	+	.	.	+	.	.	+	.		+	.	.
Lolium multiflorum Lam.	.	.	.	–	–	–	–	.	.	–	.	–
perenne Linn.	.	.	.	–	.	–	–	.	.	–	.	–
temulentum Linn.	–	.	–	–	.	–	–	–	–	–	.	–
Microlæna stipoides R.Br.	–	–	–	–	.	.	–	–	–	–	.	–
Miscanthus sinensis, var. *zebrina* ..	–	.	–	–	.	–	.	.	.	–	.	–
Oplismenus Burmanni Beauv., var. *variegatus*	–	.	.	–	.	–	.	.	.	–	.	–
Oryzopsis miliacum Benth.	–	–	–	–	.	.	–	.	.	–	.	–
Panicum bicolor R.Br.	–	–	–	–	–	–	–	–	–	–	.	–
bulbosum H.B.K...	–	–	+	–	.	–	–	.	+	–	.	–
colonum Linn.	–	–	+	–	.	–	.	.	.	–	.	–
decompositum R.Br.	–	–	–	–	.	.	–	.	.	–	.	–
divaricatissimum R.Br., var. *normale* Benth.	–	.	+	–	.	.	–	.	.	–	.	+
flavidum Retz.	–	–	–	–	.	.	–	.	.	–	.	–
flavidum, var. *tenuior* Retz ..	–	.	–	–	.	–	.	.	.	–	.	.
gracile R.Br.	–	–	–	–	.	.	–	.	.	–	.	–
leucophæum H.B.K.	–	–	+	–	–	+	–	.	–	–	.	.
marginatum R.Br.	–	.	–	–	–	–	–	.	.	–	.	–
miliare Lam.	–	.	.	–	.	–	.	.	.		.	.

	Jan.			April.			Aug.			Nov.		
Panicum parviflorum R.Br.	–	–	–	–	.	.	–	.	.	–	.	.
plicatum	–	.	–	–	.	.	–	–	–	–	.	–
sanguinale Linn.	–	–	–	–	.	.	.	.	.	–	.	–
strictum R.Br.	–	.	–	–	.	.	–	–	+	–	.	–
teneriffæ R.Br.	–	.	–	–	.	–	–	.	.	–	.	–
Paspalum dilatatum Poir.	–	–	–	–	.	.	–	.	–	–	.	–
distichum Linn.	–	–	–	–	.	.	–	–	.	–	.	–
læve Michx.	–	–		–	.	–	.	.	.	.	.	.
paniculatum Linn.	–	–	–	.	.	.	.	.	.	.	.	.
platycaule Poir.	–	–	–	–	.	.	–	.	+	–	.	+
scrobiculatum Linn.	–	.	–	–	.	.	–	–	+	–	.	–
stoloniferum Desv.	–	–	–	–	.	.	–	.	.	–	.	–
undulatum Poir.	–	.	–	–	–	–	–	.	.	–	.	–
virgatum Linn.	–	–	–	–	.	.	–	.	.	–	.	–
Pennisetum compressum R.Br.	–	–	–	–	.	.	–	.	.	–	.	.
latifolium Spreng.	–	–	+	–	.	–	–	.	–	–	.	–
longistylum Hochst.	–	–	+	–	.	–	–	.	.	–	.	–
macrorum Trin.	–	–	–	.	.	.	–	.	.	–	.	–
orientale Rich., var. *triflorum*	–	–	–	–	–	–	–	.	–	–	.	–
Phalaris bulbosa Linn.	–	.	–	–	.	–	–	.	.	–	.	–
cærulescens Desf.	–	.	–	–	–	–	–	.	.	–	.	–
minor Retz.	.	.	.	–	.	.	–	.	.	–	.	–
Poa annua Linn.	–	.	.	–	.	–	–	–	–	–	.	–
cæspitosa Forst.	–	–	–	–	.	.	–	.	.	–	.	.
compressa Linn.	–	–	–	–	.	–	–	.	.	–	.	–
nemoralis Linn.	–	–	+	–	–	+	–	–	+	–	.	–
pratensis Linn.	–	–	–	–	–	–	–	.	.	–	.	–
Pollinia fulva Benth.	–	–	–	–	.	.	–	–	–	–	.	–
Saccharum officinarum Linn.	–	–	–	–	.	–	.	.	.	–	.	-
sara	–	–	–	–	.	.	–	.	.	–	.	–
Secale dalmaticum Vis.	–	–	–	–	.	.	–	.	.	–	.	–
Setaria imberbis Roem. & Schult.	–	–	–	–	.	.	–	–	–	–	.	–
Spinifex hirsutus Labill.	–	–	–	–	.	.	–	–	–	–	.	–
Sporobolus diander Beauv.	–	–	–	–	.	–	–	.	.	–	.	–
indicus R.Br.	–	–	–	–	.	.	–	.	.	–	.	–
virginicus Kunth.	–	.	–	–	–	–	–	–	+	–	.	–
Wrightiana	–	.	.	–	.	.	.	.	.	.	.	.
Stipa elegantissima Labill.	–	.	–	–	.	.	–	.	+	–	.	–
pubescens R.Br.	–	.	–	–	.	–	–	.	.	–	.	–
tenuissima Trin.	–	–	–	–	.	–	–	.	.	–	.	+

	Jan.	April.	Aug.	Nov.
Stipa verticillata Trin.	– – –	– . .	– – +	– . –
Themeda avenacea	– – –	– . .	– . –	– . .
Forskali Hack.	– – –	– . .	– . .	– . .
gigantea Hack.	– – –	– – –	– . –	– . –
Triodia albescens Munro	– – –	– . .	– . .	– . –
Trypsacum dactyloides Linn.	– – –	– . .	– . .	– . –
Uniola latifolia Michx.	– – +	– . –	– . .	– . –
Zoysia pungens Willd.	– – –	– . –	– – +	– . –

The author desires to express his indebtedness to Professor Anderson Stuart for laboratory facilities afforded for this investigation.

NOTES ON THE INDIGENOUS PLANTS IN THE COBAR DISTRICT. No. ii.

By Archdeacon F. E. Haviland.

The following List is supplementary to that reported in the Proceedings of this Society for 1911 (p.507); and brings the number of species, exclusive of varieties, to more than 500, including a number of Cryptogams.

There are, in this district, certain genera which, from their isolated occurrence and weakened constitutions, appear to be vanishing. Among such may be noted *Thysanotus*, of which only two species, *T. Baueri* and *T. Patersoni* remain; and *Ranunculus*, of which only one species, *R. parviflorus*, remains. Such as these appear only when conditions are specially favourable; indeed, from their texture, one would think that they were quite unsuitable for these droughty parts. Moreover, from a merely casual survey of the vegetation of this district, one becomes convinced that, for ages past, there has been a diminution of that class of vegetation which, though apparently luxurious in the former times with an equable climate, has had, since the present physical features brought about normal conditions of drought, a struggle to live. As may be expected, those species are thriving best which, either by a thickened cuticle, or double and even triple palisade-cells, or by excretions of wax, resins, or gums, have the means of reserving plant-foods.

A matter bidding to become of more than passing interest, in the near future, is the recourse to mixing certain bushes as fodder for starving stock. It is a matter that is self-adjusted by travelling stock thenselves, as they then have an opportunity of picking at various bushes, and are not restricted to one species; and anyone accustomed to watch the habits of travelling stock, well knows how sheep will nibble at a bush, and suddenly leaving it, attack a different species, and so satisfying their tastes by variety; but when sheep have to be hand-fed, on a run, it is a different matter; and here it is that some scientific adjustment is needed. Mr. F. B. Guthrie has done something towards this end, in his computations of the nutrient values of some of our fodder-shrubs (see Agricultural Gazette, Vol. xviii., p.351). There are some of our bushes which would act as a valuable pickle, whereby to aid the digestion of some of the more plentiful edible shrubs not so readily eaten by stock. The mixing, for instance, of the "Apple Rosewood"—*Heterodendron oleæfolium* with the Mulga, *Acacia aneura*, which is more plentiful, but not so nourishing, is reputed to be an improvement upon the latter eaten alone. In Mr. Guthrie's Table, the ratio of the albuminoids to the carbohydrates and fats, in *H. oleæfolium*, is given as 1 to $3\frac{1}{2}$, and the nutrient value as 69; while the ratio of the same constituents in *A. aneura* is as 1 to $2\frac{1}{2}$, and the nutrient value as $30\frac{3}{4}$. The comparative poorness of the Mulga is, therefore, compensated for in the richness of the Apple Rosewood. It must, however, be remembered that what makes the Mulgas the more valuable bushes, is not in their nourishing qualities, but their more widespread distribution, and their endurance in times of extreme drought. If such an adaptation of our fodder-shrubs were to be practised, there would be much economising of the more valuable fodder-shrubs, and some use might then be made of shrubs which so far are problematical as to their profitable uses. Such shrubs as the "Warrior Bush" (*Apophyllum anomalum*), "Budtha Bush" (*Eremophila Mitchelli*), and the "Turpentine Bush" (*E. Sturtii*), according to the Table quoted, would even be of better use than that of making brooms of one, and sand-barriers of the others. On some species noted in my first List, I have added further notes herein, culled from additional observations.

Again I have to acknowledge, with thanks, the co-operation of those friends who have assisted me in the collection of specimens, thus contributing to a more complete census of western plants as represented in the Cobar district.

Synopsis of Plants noted.

(The following numbers represent totals of genera and species contained in this and the previous List.)

DICOTYLEDONS.

Orders.	Genera.	Species.	Orders.	Genera.	Species.
RANUNCULACEÆ ...	1	1	RUBIACEÆ	4	5
PAPAVERACEÆ ...	3	3	COMPOSITÆ ...	40	67
CRUCIFERÆ ...	8	17	GOODENIACEÆ ...	4	10
VIOLACEÆ	1	1	CAMPANULACEÆ ...	2	2
CAPPARIDEÆ ...	2	2	PRIMULACEÆ ...	1	1
RESEDACEÆ ...	1	1	JASMINEÆ	1	2
PITTOSPOREÆ ...	1	1	APOCYNEÆ .	2	3
CARYOPHYLLEÆ ...	6	6	ASCLEPIADEÆ ...	3	3
PORTULACEÆ ...	2	2	GENTIANEÆ ...	2	2
MALVACEÆ ...	7	12	BORAGINEÆ ...	5	5
STERCULIACEÆ ...	1	1	CONVOLVULACEÆ ...	4	4
LINEÆ	1	1	SOLANEÆ	3	8
ZYGOPHYLLEÆ ...	2	5	SCROPHULARINEÆ ...	4	6
GERANIACEÆ ...	2	2	BIGNONIACEÆ ...	1	1
RUTACEÆ	4	6	ACANTHACEÆ ..	1	1
MELIACEÆ	1	1	MYOPORINEÆ ...	2	11
CELASTRINEÆ ...	1	1	VERBENACEÆ ...	2	2
STACKHOUSIEÆ ...	1	3	LABIATÆ	8	11
RHAMNEÆ	2	2	PLANTAGINEÆ ...	1	1
SAPINDACEÆ ...	4	12	SALSOLACEÆ ...	8	28
LEGUMINOSÆ ...	14	53	AMARANTACEÆ ...	3	8
CRASSULACEÆ ...	1	1	POLYGONACEÆ ...	3	7
HALORAGEÆ ...	2	2	NYCTAGINEÆ ...	1	1
MYRTACEÆ... ...	5	17	PROTEACEÆ ...	2	5
ONAGRARIEÆ ...	1	1	THYMELEÆ... ...	1	2
CUCURBITACEÆ ...	1	2	EUPHORBIACEÆ ...	5	5
FICOIDEÆ	1	1	URTICEÆ	2	3
UMBELLIFERÆ ...	4	5	CASUARINEÆ ...	1	3
LORANTHACEÆ ...	1	7	SANTALACEÆ ...	3	4
			CONIFERÆ	1	5

MONOCOTYLEDONS.

Orders.	Genera.	Species.	Orders.	Genera.	Species.
ORCHIDEÆ... ...	1	1	JUNCACEÆ	3	8
AMARYLLIDEÆ ...	1	1	NAIADEÆ	1	1
LILIACEÆ	4	5	CYPERACEÆ ...	4	6
GRAMINEÆ	31	57			

ACOTYLEDONS.

MARSILIACEÆ ...	1	3	MUSCI	3	4
FILICES	4	4	LICHENS	6	6
FUNGI	15	21			

	Orders.	Genera.	Species.
Dicotyledons	59	201	387
Monocotyledons ...	7	45	79
Acotyledons	5	29	38
	71	275	504

INDIGENOUS PLANTS IN THE COBAR DISTRICT.

Class i. **DICOTYLEDONS.**

Subclass POLYPETALÆ.

Series i. **Thalamifloræ.**

PAPAVERACEÆ.

*FUMARIA OFFICINALIS Linn. Wuttagoona. September.

*PAPAVER HYBRIDUM Linn. Wuttagoona. September. Orange-coloured petals, the lower one having a dark blotch.

CRUCIFERÆ.

STENOPETALUM NUTANS F.v.M. Wuttagoona. September.

CARDAMINE LACINIATA F.v.M. Wuttagoona. September.

LEPIDIUM HYSSOPIFOLIUM Desv. Wuttagoona. September.

SISYMBRIUM ORIENTALE. Cobar.

VIOLACEÆ.

HYBANTHUS FILIFORMIS F.v.M. Wuttagoona. September.

CARYOPHYLLEÆ.

GYPSOPHILA TUBULOSA Boiss. "Soapwort." Wuttagoona. September.

STELLARIA PALUSTRIS Retz. Wuttagoona.

POLYCARPON TETRAPHYLLUM Linn.f. Cobar. September, March.

MALVACEÆ.

SIDA PETROPHILA F.v.M. Wuttagoona. September.

ABUTILON CRYPTOPETALUM F.v.M. Cobar. September.

HIBISCUS STURTII var. MUELLERI. Cobar. October, March
var. GRANDIFLORA. Cobar. October, March.

Series ii. **Disciflorae.**

RUTACEÆ.

ERIOSTEMON LINEARIS Cunn. On rocky slopes at Wuttagoona. September.

CORREA SPECIOSA Andr. At Wirlong (Mr. Cambage's List).

STACKHOUSIEÆ.

STACKHOUSIA MURICATA Lindl. On Box-flats at Amphitheatre and towards Louth. Also a stellate, pubescent form at Amphitheatre.

S. FLAVA Hk. This sulphur-coloured specimen comes nearest to this species.

RHAMNACEÆ.

CRYPTANDRA AMARA Sm. On spinifex country at Shuttleton. September.

SAPINDACEÆ.

HETERODENDRON OLEÆFOLIUM Desf. (additional note). The leaves of this species are subject to small pillar-shaped galls formed by leaf-mites of the family Eriophyridæ, "elongated, minute, transparent creatures of which the Pear-leaf Mite is an example" (Mr. Froggatt). The leaves of the two species of this genus, when cut up with Mulga-leaves, make very good fodder.

DODONÆA BORONIÆFOLIA Don. The wings of the fruits of this species are more wrinkled than those of others. It is an attractive shrub in appearance. At Restdown. Fruiting in September.

D. TRIANGULARIS Lindl.

D. sp.(?). Having foliage answering to *D. megazyga* F.v.M. At Shuttleton.

D. ATTENUATA Cunn. Cobar.

CARDIOSPERMUM HALICACABUM Lerida. "Balloon-Climber." November-April.

Series iii. **Calycifloræ.**

LEGUMINOSÆ.

Suborder *Papilionaceæ.*

EUTAXIA EMPETRIFOLIA Schl. On the spinifex-country, 6 miles east of Shuttleton. September.

LOTUS AUSTRALIS var. PARVIFLORUS. Kergunyah. November.

PSORALEA CINEREA Lindl. Wuttagoona. September.

P. TENAX Lindl.

SWAINSONA GALEGIFOLIA R.Br. "Darling Pea." Wuttagoona. September.

S. LUTEOLA F.v.M. At the rifle-butts, Cobar. June.

S. PHACOIDES Benth.

Suborder *Cæsalpinieæ.*

CASSIA STURTII R.Br. A narrow-leaved variety is growing at Shuttleton, and shows a more profuse flowering than that of the typical species.

Suborder *Mimoseæ.*

ACACIA RIGENS Cunn. Wuttagoona.

A. CALAMIFOLIA Sweet. Shuttleton.

A. SALICINA (additional note). The natural habitat of this species is the river-country, where it is easily distinguished by its drooping habit; but in the Cobar district, it grows on the ridges, and its branches are more spreading, so that, when attaining any size, the foliage becomes so heavy as to force the slender stem to bend over to the ground, causing an ascending habit in the extremities of the branches. It is subject to a tender gall much like a gooseberry in appearance, but very bitter.

A. IMPLEXA Benth. At Shuttleton, and on the granite-hills at Nymagee.

A. TRIPTERA Benth. "Wait-a-while." Nymagee and Sandy Creek. September.

A. LINEATA Cunn. A very viscid species about Shuttleton. September.

A. AMBLYGONA Cunn. On hilly country at Wirlong. September.

A. IXIOPHYLLA Benth. South of Wirlong.

A. DECURRENS var. MUELLERIANA Maiden & Betche. At Gilgunnia. September.

A. DEALBATA Link. A green variety near Gilgunnia.

A. OBLIQUA Cunn. On the spinifex-country near Shuttleton. September.

A. UNDULIFOLIA Fraser, var. PUBESCENS. Shuttleton. September.

A. CIBARIA F.v.M., (additional note). On account of its general appearance, it is locally known as "Umbrella-Mulga." The phyllodia are 4-6 inches long, and 1-1½ lines broad, and very thick. Growing in gregarious patches over extensive areas, in the western portions of the district.

A. HOMALOPHYLLA (additional note). There are several varieties about the district. A long-leaved form growing at Lerida; a broad, oblong form 3 miles west of Cobar; and a narrow, slightly falcate form south of Cobar. A peculiarity connected with the "Yarrens" is, that the foliage assumes a light yellow or seared colour during the winter and flowering-season, but regains its natural green colour during the fruiting-season. There is a "Ring Yarren," but beyond seeing a specimen of the wood, I have not yet come across the bush, nor can I get any information as to its varietal characteristics.

A. ANEURA (additional note). A variety having phyllodia 4-6 inches long, and $\frac{3}{4}$-1 line broad, and almost terete, but with the fruit typical of the species, is growing near Lerida. August.

The Mulga-Balls, mentioned in my first List, are formed in the podge of sheep, and are considered to be the result of the sheep eating the young shoots and branchlets of the Mulga, especially of the narrow-leaved forms. A report from the Bacteriological Dept. says :—"This consists, for the most part, of long cells usually tapering at each end, but sometimes truncated at one end, sometimes at both ends. Through the centre of the cells, there runs frequently a narrow canal. The walls of the cells are very thick, and sometimes apparently pitted. These cells have the appearance of bast-fibres, and as several may frequently be found adhering, this view is strengthened. A small number of spiral vessels and wood tracheides are also present. Interspersed among all these, is a brown powdery deposit without cell-structure. It is suggested that the balls are due to the bark of a tree eaten by the sheep. The brown colouring matter of the balls is due to the undigested outer particles of the bark" (Mr. G. P. Darnell-Smith, B.Sc.).

A. HARPOPHYLLA F.v.M. "Brigalow." Tindare and Wuttagoona.

HALORAGEÆ.

HALORAGIS ASPERA Lindl. (*H. ceratophylla* Endl.). On the spinifex-country, 6 miles east of Shuttleton. September.

MYRTACEÆ.

LEPTOSPERMUM ELLIPTICUM Endl. At Restdown. September.

THRYPTOMENE CILIATA F.v.M. Chiefly on ridges of Devonian rocks, at Boppy Mount, but gradually spreading to other soils. September.

MELALEUCA UNCINATA R.Br. On the granite hills at Nymagee, at Mount Boorandara, and Wuttagoona.

KUNZEA PEDUNCULARIS F.v.M. Boorandara.

EUCALYPTUS SIDEROXYLON Cunn. "Red-flowered Ironbark," at Shuttleton.

E. DEALBATA F.v.M. "Cabbage-Gum," "White Gum." Near Shuttleton. September.

E. TERMINALIS. "Bloodwood." Mount Dijou.

E. MELANOPHLOIA(?) probably, but I am waiting for confirmation as to the flowers. This tree, with a deeply furrowed black bark, is growing on sedimentary soils, over a stratum of limestone, at the Meadows, and quite isolated from any other Ironbark; it is the only tree of the Series known in the far west. It is impossible to conjecture as to how it became domiciled there.

E. spp.(?). Three species collected by Mr. Andrews, and of which I am awaiting flowers and fruits. One with ovate, constricted, truncate fruits; a second with foliage resembling *E. viridis*, but with globular depressed buds 3 lines in diameter; and a third somewhat resembling *E. Behriana*.

FICOIDEÆ.

MOLLUGO GLINUS Harv. Wuttagoona. September.

UMBELLIFERÆ.

TRACHYMENE INCISA Rudge, (*Didiscus albiflora* DC.). Near the 23-mile Tank, Wilcannia Road. October.

DIDISCUS ERIOCARPUS F.v.M. In shady spots at Wuttagoona. September.

D. PILOSA Benth. Wuttagoona. September.

Subclass ii. MONOPETALÆ.

RUBIACEÆ.

ASPERULA CONFERTA Hk. On Box-flats and other damp places at Amphitheatre. October.

COMPOSITÆ.

VITTADINIA TRILOBA DC. Scarce about Cobar. September.

MINURIA CANDOLLEI F.v.M.

CALOTIS SCABIOSIFOLIA Sond. & F.v.M. Wuttagoona. September.

C. PLUMULIFERA F.v.M. Wuttagoona. This answers in all respects to the type, but has no plumose hairs on the achenes of my specimen.

C. MICROCEPHALA Benth. Cobar. June.

EPALTES AUSTRALIS Less. O'Gorman's Tank, and at other places about Cobar.

MYRIOCEPHALUS RHIZOCEPHALUS Benth. Meryula. September.

LEPTORRHYNCUS WAITZIA Sond. Towards Louth and Wuttagoona. September.

CHTHONOCEPHALUS PSEUDOEVAX Steetz. Wuttagoona. September. A peculiar sessile Composite growing in crevices and hollows of rocks.

HELICHRYSUM BRACTEATUM Willd. A variety differing from the type in having narrow linear leaves.

H. DIOTOPHYLLUM F.v.M. At 4 miles south of Shuttleton. September.

HELIPTERUM FLORIBUNDUM (additional note). This is considered a good sheep-fodder herb while dry weather lasts, but heavy rain turns it black, and sheep will not then eat it. Spreading very quickly and thickly, it kills out all other herbs. I have seen areas of quite two miles square quite covered with it, and when in flower, the ground has the appearance of being snow-covered.

H. LÆVE Benth. A small herb of only a few inches. Wuttagoona. September.

HYPOCHŒRIS GLABRA Linn. "Hogweed." The leaf-veins of my specimen are scabrous. Hospital Hill, Cobar. September.

*SONCHUS OLERACEUS. This was wrongly recorded as *S. arvensis* in my first List. My specimen was an abnormal growth having a glandular-pubescent calyx, and I mistook it for a modified form of the latter.

*CARTHAMUS LANATUS Linn. "Saffron Thistle," but known to some as a "Star-Thistle." A troublesome weed, getting a great hold on several runs, and spreading both west and south. When dry, young sheep will eat it; but when advanced, nothing can get near it on account of its long spines. Being chiefly confined to damp spots, it is hoped that it will kill itself out.

CARDUUS PYCNOCEPHALUS Linn. Wuttagoona.

TARAXACUM DENS-LEONIS Desf. "Dandelion." In places.

GOODENIACEÆ.

VELLEYA PARADOXA R.Br. Scattered over the western portions of the district. September.

GOODENIA GLABRA R.Br. Cobar. March and October.

G. HAVILANDI Maiden & Betche (*antea*, p.250). On left side of Louth Road, 11 miles from Cobar; and at Alley Trig. Station. September.

GENTIANEÆ.

LEMNANTHEMUM sp.(?). At Wuttagoona. October.

BORAGINEÆ.

ECHINOSPERMUM CONCAVUM F.v.M. At rear of Hospital Hill, Cobar. August.

CONVOLVULACEÆ.

PORANA SERICEA F.v.M. A first record from New South Wales. Growing near Amphitheatre Station, and thus connecting its habitat with West Australia and North Queensland.

DICHONDRA REPENS Forst. Near the old Reservoir at Cobar.

SCROPHULARINEÆ.

MIMULUS PROSTRATUS Benth. At Fort Bourke Reservoir. September.

M. GRACILIS R.Br. Wuttagoona. September.

*LINARIA CYMBALARIA Mill. Cobar. June.

MYOPORINEÆ.

MYOPORUM ACUMINATUM R.Br. A narrow-leaved variety growing on the quartzite and felspar porphyry-ridges towards North Peak, Shuttleton. Fruiting in September.

EREMOPHILA LATIFOLIA (additional note). This shrub has become subject to a scale-insect known as *Eriococcus buxi*; though often covering the leaves and branches, it does not apparently injure the shrub.

LABIATÆ.

PROSTANTHERA NIVEA Cunn. On ridges of Pre-Silurian age, near Shuttleton. The flowers are mainly of a pure white, but occasionally relieved with a tinge of lilac. September.

P. ASPALATHOIDES Cunn. (*P. coccinea* F.v.M.). On hills of Pre-Silurian age, near Shuttleton. A profusely flowering bush with scarlet flowers. September.

WESTRINGIA RIGIDA R.Br. On spinifex-country south of Shuttleton. September.

TEUCRIUM CORYMBOSUM R.Br. On dense quartzite-ridges, north of Nymagee. September.

*STACHYS ARVENSIS Linn. Wuttagoona. September.

Subclass iii. MONOCHLAMYDEÆ.

SALSOLACEÆ.

ATRIPLEX VESICARIA Hewart. A diœcious form, at Springfield. October.

A. MUELLERI Benth. North Cobar.

A. PROSTRATA R.Br.

KOCHIA HUMILLIMA F.v.M. Cobar.

K. VILLOSA var. ERIANTHA Lindl.

BASSIA (SCLEROLÆNA) DIACANTHA Benth. North Cobar.

B. ENCHYLÆNOIDES F.v.M.

AMARANTACEÆ.

PTILOTUS ALOPECUROIDEUS Lindl. (additional note). There is a form of this species, which sometimes appears at Kergunyah, which is quite devoid of floral bracts and stem-leaves, and has a perianth of a reddish colour, though, upon boiling, the reddish colour gives place to the typical green-yellow of the species.

P. HEMISTEIRUS F.v.M.

POLYGONACEÆ.

RUMEX HALOPHILUS F.v.M. Cobar.

R. CRISPUS Linn. Occidental Tank, Wrightville. September.

POLYGONUM PLEBIUM R.Br.

PROTEACEÆ.

HAKEA LEUCOPTERA R.Br. On red sandy soil, in several places. September.

EUPHORBIACEÆ.

EUPHORBIA DRUMMONDII Boiss., (additional note). "Poison-Weed." I had, in my first List, written this as a poisonous plant; but though drovers are very emphatic about it as such, in laboratories it is not considered as containing any virus. Probably, therefore, it is only mechanically dangerous to stock, especially when animals, having empty stomachs, after a long and hot day's journey, are turned on to it.

E. EREMOPHILA Cunn. Wuttagoona.

PORANTHERA MICROPHYLLA Brongn. Nymagee. September.

PHYLLANTHUS FUERNROHRII F.v.M. Wuttagoona. September.

SANTALACEÆ.

EXOCARPUS CUPRESSIFORMIS Labill. On granite-hills at Nymagee.

Subclass iv. GYMNOSPERMÆ.

CONIFERÆ.

CALLITRIS VERRUCOSA R.Br. "Turpentine-Pine." On sandy slopes, 40 miles south west of Cobar, and south of Nymagee.

C. GRACILIS (additional note). There is an abundance of this Pine growing on the Meadows runs, about 45 miles west of Cobar. It seems to choose low-lying ridges of crushed sandstone, over a substratum of limestone. It freely intermixes with *C. glauca.*

The local Pines, though by some authorities said to be suitable for sleepers, etc., are quite useless when once the timber is dry, to bear any such strain; it has a habit of breaking up almost like earthenware.

Class ii. MONOCOTYLEDONS.

Amaryllideæ.

Calostemma purpureum R.Br. Wuttagoona. Growing among the rocks at the Falls. The rock-wallaby is very partial to this plant.

Liliaceæ.

Anguillaria dioica R.Br. Wuttagoona. September.

Thysanotus Patersoni R.Br. A few instances of this climbing species at Shuttleton. September.

Juncaceæ.

Juncus pauciflorus R.Br. Cobar and Amphitheatre. September.

J. polyanthemus. Meryula. October.

Fimbristylis ferruginea Vahl. Wuttagoona. This is favoured as a good fodder-plant.

F. communis Kunth. Wuttagoona.

Naiadeæ.

Potamogeton crispus Linn.

Cyperaceæ.

Cyperus sanguineo-fuscus Hk. Wuttagoona.

Scirpus debilis Pursh. In a garden, at Cobar. September.

Carex inversa R.Br. Towards Louth. September.

Gramineæ.

Eriochloa annulata Kunth.

Andropogon pertusus Willd. Wuttagoona.

Phalaris minor Retz. This grass has become well established over the district, and is sometimes called "Canary Grass."

Aristida arenaria Gaud. Wuttagoona.

A. ramosa R.Br. Cobar. October.

Stipa (additional note). The most prevalent forms in this district are *S. scabra* Lindl., and *S. semibarbata* R.Br. The seeds of these species are ripe at shearing-time; hence to avoid depreciation in the value of the clip by reason of grass-seeds, it is necessary to get the shearing over before the shedding of the seeds. These seeds are also troublesome to the eyes of the sheep: the reflexed hairs, towards the point of the achene, give a pushing motion to the awn, while the "corkscrew" arrangement higher up forces the point to bore into the cornea, causing blindness, and then starvation.

S. SETACEA R.Br. Wuttagoona. September.

DICHELACHNE SCIUREA Hk. Cobar. October.

D. CRINITA Hk. Mount Boppy. October.

DEYEUXIA FORSTERI Kunth. Growing in a watercourse at the Meadows. October.

AMPHIBROMUS NEESII Steud.

DANTHONIA SETACEA R.Br. About three miles from Cobar, on the Louth Road. September.

AMPHIPOGON STRICTUS R.Br. Cobar. May.

PAPPOPHORUM COMMUNE F.v.M. Cobar. October.

P. NIGRICANS R.Br. Cobar and Mount Boppy. October.

TRIODIA IRRITANS R.Br. "Spinifex." This grass gives its name to the south and south-west portions of the district.

LEPTOCHLOA DECIPENS Hof. A rare grass, collected on the hill-tops of Wuttagoona, by Mr. L. Abrahams.

ERIACHNE MUCRONATA R.Br. Near Louth. October.

ERAGROSTIS FALCATA Gaud. Near Louth. October.

BROMUS UNIOLOIDES Humb. Cobar. October.

*FESTUCA BROMOIDES Linn. Cobar. September.

AGROPYRUM SCABRUM Beauv. Scattered over the district. October.

Class iii. ACOTYLEDONS.

Subclass i. ACROGENÆ.

MARSILIACEÆ.

MARSILEA DRUMMONDII A.Br. Fort Bourke Tank, Cobar.

MUSCI.

FUNARIA APOPHYSATA Tayl. Mount Boppy.

P. TASMANICA. Fairly common in shaded spots at Yanda Creek, Meryula.

GIGASPERMUM REPENS Hk. Mount Boppy.

GONIOMITRIUM ENERVE. Meryula.

Subclass ii. THALLOGENÆ.

LICHENES.

PERTUSARIA sp.(?).

THELOSCHISTES CHRYSOSTHALMUS. Two species only were seen, both growing on dead wood, and were conspicuous by their golden colour.

USNEA BARBATA. On trees at Bulgoo.

PARMELIA CONGRUENS. Wuttagoona and elsewhere.

RHIZOCARPON GEOGRAPHICUM. This is a remarkable form, found on outcrops of rock in the roughest of exposed situations. In appearance, it resembles a greenish-yellow mineral stain.

GRAPHIS SCRIPTA (?). Very rare in the west.

FUNGI.

Lycoperdaceæ.

MYCENASTRUM CARIUM. Mount Boppy and Meryula. This specimen was of giant-proportions, being 4 inches in diameter, globular in shape, like a puff-ball, and having purple spores.

TULOSTOMA MCALPINANUM. Mount Boppy.

T. MAXIMUM. In a cultivation-paddock at Cobar.

T. ALBICANS. Yanda Creek, Meryula.

SCLERODERMA sp.(?). A hard ball-formation. Meryula.

LYCOPERDON sp.(?). Mount Boppy.

L. PUSILLUM. A small puff-ball. Meryula.

CALVATIA LILACINA. A bluish-coloured puff-ball. Brura Tank.

GEASTER sp.(?). "Earth-Star." An ash-coloured species, on damp shaded flats at Meryula.

BOVISTA SCABRA. Of a dark brown colour. Meryula.

Polyporaceæ.

HEXAGONA sp.(?). Mount Boppy.

H. GUNNI. Mount Boppy.

POLYSTICTUS SANGUINEUS. Red fungus, generally on dead wood.

P. CINNABARINUS. Snuff-coloured; generally found on dead wood. Mount Boppy.

P. VERSICOLOR(?). Cobar.

POLYPORUS sp.(?). Meryula.

Nidulariaceæ.

CYATHUS sp.(?). Yellow-coloured "Birds' Nest" fungus. Brura Tank.

Phalloideæ.

PHALLUS sp.(?). A gigantic specimen, 6 inches long.

Videphoraceæ.

HYMENOCHÆTE sp.(?). Mount Boppy.

CALOSTOMA sp.(?). Mount Boppy.

Podaxaceæ.

PODAXON ÆGYPTIACUS. Wuttagoona. Dark brown, and having a fine, dark brown spore-dust.

ORDINARY MONTHLY MEETING.

NOVEMBER 26th, 1913.

Mr. W. S. Dun, President, in the Chair.

Mr. WILLIAM ANDERSON, F.R.S.E., F.G.S., Sydney, was elected an Ordinary Member of the Society.

The President reminded Candidates for Fellowships, 1914-15, that Saturday, 29th inst., was the last day for submitting their applications.

The Donations and Exchanges received since the previous Monthly Meeting (22th October, 1913), amounting to 5 Vols., 43 Parts or Nos., 4 Bulletins, 4 Reports, and 9 Pamphlets, received from 39 Societies, etc., and three individuals, were laid upon the table.

NOTES AND EXHIBITS.

Mr. D. G. Stead showed examples of a frog, *Crinia signifera*, common on the Kosciusko Tableland, even at the highest elevations, near water.

Mr. Froggatt exhibited cotypes of eight species of Cicadidæ, part of a collection made by Mr. H. Brown, at Cue, N. W. Australia, and recently described by Mr. W. L. Distant; also a cotype of another species, from Cooma, N.S.W. Mr. Froggatt showed also, a number of small Chalcid wasps, parasitic upon the maggots and pupæ of the Sheep Maggot-Fly (*Calliphora rufifacies*). These were obtained, in large numbers, by Mr. J. L. Froggatt, Officer in charge of the Government Sheep-Fly Experiment Station, and himself, emerging from dried pupæ beneath a dead foal at Yarrawin Station, Brewarrina district. Each pupa examined, contained, on an average, twenty Chalcid wasps.

Mr. Fred Turner exhibited specimens, and a drawing, of *Strychnos psilosperma* F.v.M., the source of the alkaloid strychnicine, described in Dr. Petrie's paper. The specimens were gathered from a tree growing near the source of the Tweed River, New South Wales, in 1897.

Mr. Bassett Hull exhibited the nest and eggs of the Lord Howe Island "Rainbird" (*Pseudogerygone insularis* Ramsay). The nest is similar to those of the Australian members of the genus, but the "tail" is very short, in fact almost rudimentary. The eggs, three in number, resemble closely those of *P. fucsca* Gould, the shell being white, slightly glossy, covered with dull pink spots or freckles, forming a cap at the larger end. A set of three eggs of the Lord Howe Island Crow-Shrike (*Strepera crissalis* Sharpe), a variety of the mainland species, *S. graculina* White, was also exhibited. These eggs cannot be distinguished from those of the last-named species. The specimens were taken in the Erskine Valley, Lord Howe Island, in September and October, 1913.

Mr. Mackinnon, for Mr. G. P. Darnell-Smith and himself, showed a number of specimens from the Biological Branch, Department of Agriculture, including, "Take All" [*Ophiobolus graminis* (Sacc.)] on (*a*) wheat, (*b*) barley, (*c*) Algerian oats (Col. G. Johnston), from Bathurst Experiment Farm, a new record on oats for Australia, but recorded, last year, on oats from North Wales by Mr. G. Massee, Kew; -*Sclerotina* sp., on Common Lemon seedlings, one-year old, from Wyong (E. Mackinnon);—*Sclerotinia* sp., on Garden Stock; Burrowa, August, 1913;—*Podosporiella*(?) on wheat-grains; Henty;—*Diplodia zeæ*, previously exhibited, on maize-stems and ears; from Tenterfield district. Also inflorescences of *Plantago lanceolata* in a teratological condition, from Ashfield.

Mr. G. A. Waterhouse exhibited a fine series of butterflies, representing the five subspecies of *Tisiphone abeona* Don. The Victorian race, and the New South Wales race occurring south of the Hunter River, are almost alike, differing only in the breadth of their markings, and in their colouration. The individual variation, in specimens of either of these races, is very slight. In Northern New South Wales and South Queensland occur two other races, very different from the typical form, differing from one another only in degree, and also showing slight individual variation. At Port Macquarie, a fifth race occurs; this exhibits remarkable variation. Specimens caught during October, 1913, showed every gradation between the Northern New South Wales race, and that occurring in the south. The transition from one race to the other, is not a gradual one, for the characters of either race may be combined, in every possible way, in individual specimens. It is suggested that *Tisiphone* originally was confined to the Main Dividing Range, and became differentiated into two distinct forms concomitantly with the changes which gave rise to the low drier area through which the Hunter River flows. Subsequently, the species were able to reach the coast, and, at Port Macquarie, we have the result of the refusion.—Mr. Waterhouse also exhibited two historically interesting examples of butterflies caught in the Eastern Archipelago, by the late Alfred Russell Wallace.

Mr. E. Cheel exhibited and contributed notes on a series of interesting grasses, comprising *Vulpia Myuros* Gmel., Syn. *Festuca Myuros* L., spelt "Myurus" by several authors,(Rat's-tail Grass); and *V. ciliata* Link, Syn. *F. ciliata* Pers., (Ciliated Rat's-tail Grass). Both species are from Centennial Park, and Government Domains, Sydney; and there are also specimens in the National Herbarium from South Australia, and from several localities in West Australia. They have been mixed up with *V. bromoides* S. F. Gray (*Festuca bromoides* L.), but are more common than the latter.—*Avena barbata* Brot., (Slender Oat-Grass); Centennial Park (E. Cheel; November, 1899), and Government Domain (November, 1912). For two additional localities, see These Proceedings, 1912, p.653; and Victorian Naturalist, 1913, p.85, for previous records.—*Cynosurus echinatus* L., Cock's-comb Grass); Hunter's Hill (W. F. Blakely; January, 1913).—*Panicum queenslandicum* Domin, New South Wales, without specific locality (ex herb. Dr. Woolls); plains near Barradine (W. Forsyth; October, 1899); Bongbilla, Moulamein (T. Grieve; March, 1903); Zara, viâ Hay, (Miss E. Officer; February, 1904); Gulargambone (G. Ryder; March, 1908); Burren Junction (J. L. Boorman; June, 1907); Brewarrina (C. Stewart; June, 1909); Collarenebri (W. E. Turnbull; June, 1908); Yanco (G. S. Redley; August, 1910; and Wenholz; April, 1913); Murray Downs, Cryan, viâ Walgett (G. Clark; March, 1911); Hay (E. Breakwell): Victoria, Wimmera (ex herb. Hooker), Swan Hill, Murray River (C. Walter). The above specimens have been variously included under *P. prolutum* F.v.M., but are separable from that species by the narrower leaves and more spreading panicle.—*P. proliferum* Lam., Coolabah (R. N. Peacock; June, 1900); Lachlan River (W. S. Campbell; March, 1901); Zara, viâ Hay, (Miss E. Officer; February, 1904); Hawkesbury Agricultural College (W. M. Carne; March, 1909); Botanic Gardens, Sydney (W. F. Blakely; March, 1913).—*P. notochthonum* Domin. Specimens of this species, in the National Herbarium, are from Yandama (A. W. Muller; April, 1906); Tongo Station, Wilcannia, (W. J. Hourigan; January, 1912); Girilambone (Grigg; April, 1913). Domin points out that this is *P. helopus* of Bentham's Fl. Aust. (vii., 476), but not of Trinerius. It is also quite distinct from *P. helopus* var. *glabrior* of Bentham.—*P. Buncei* F.v.M., Darling Downs (Dr. Woolls); Breeza (W. Court; May, 1899); Moree (Max Farland; April, 1203); south-west of Boggabri (D. A. Porter; March, 1906); Gravesend, viâ Moree (E. Breakwell; March, 1913). Previously recorded only from Queensland.—*P. Benthami* Domin, Brisbane River (F. M. Bailey); Breeza (W. Court; April, 1899); Ben Lomond and Stonehenge (J. H. Maiden; December, 1899); Inverell (E. O. Thomas; December, 1912); Lochinvar, Singleton, and Moree (E. Breakwell; June, 1912); Gular (W. D. Brown; June, 1913); Narandera (Stock Inspector; April, 1913). This species has previously been included under *P. trachyrhachis* var. *tenuior* Benth., but, as pointed out by Domin, it is quite distinct from that variety, and *P. trachyrhachis* of North Australia is also quite distinct from this series.—*P. strictum* R.Br., Blue Mountains (E. Betche; December, 1882); Randwick (E. Betche, May, 1885); Mount Victoria (J. H. Maiden; December, 1896); Mount Seaview (J. H. Maiden; November, 1897); Woronora River (J. H. Camfield; January, 1898); Como (J. H. Camfield; March, 1898); Centennial Park (E. Cheel; December, 1898); Conjola (W. Heron; September, 1899); Farm Cove (J. H. Camfield; January, 1903); Port Jackson (J. H. Maiden; October, 1900); Bateman's Bay (J. L. Boorman; June, 1906); Hurstville (E. Cheel; November, 1910); Richmond (C. T. Musson; April, 1907); Lawson (W. M. Carne; March, 1912); Barber's Creek (J. H. Maiden). This is included under *P. marginatum* R.Br., as a variety, by Bentham; but the different habit, and the wide distribution indicate that it is worthy of specific rank, as pointed out by R. Brown in his Prodromus (p.190).—*Sporobolus australasicus* Domin. Specimens of this species, in the National Herbarium, are from Camooweal. It is separated from the closely allied *S. pulchellus* R.Br., by the longer and coarser leaves, the larger panicle, and the more globular grain. It has been figured in the Agricultural Gazette of New South Wales (xix., 1908, opposite p. 1010), under the name *S. pulchellus.*—*Notochloë microdon* Domin, (*Triraphis*(?) *microdon* Benth., and *Triodia microdon* F.v.M., of Moore and Betche's Handbook, p. 493), Lawson and Wentworth Falls (E. Betche; December, 1882, and 1894); King's Tableland (W. Forsyth; November, 1898); Govett's Leap, Blackheath (E. Cheel; December, 1900).

By sanction of the Curator of the Australian Museum, Mr. North sent for exhibition the eggs of seven species of birds collected by the late Dr. P. H. Metcalfe on Fanning Island, North Pacific, during 1912-13—*Tatare pistor*, *Sula sula*, *S. piscatrix*, *Phaëthon lepturus*, *Anous stolidus*, *Micranous leucocapillus*, and *Gygis candida*. The eggs of *Tatare pistor*, three in number for a sitting, were taken on the 15th March, 1913, from a deep cup-shaped nest, constructed throughout of fibre, and built in an "Umbrella-tree." The eggs are elongate-oval in form, the shell being close-grained, smooth, and lustreless, of a greyish-white groundcolour, over which are uniformly and freely distributed freckles, dots, and small irregularly shaped spots of umber-brown and blackish-brown, with which are intermingled similar underlying markings of faint slaty-grey, the markings being rather larger on the thicker end. Length (A) 92 × 0·65 ; 0·91 × 0·63 ; 0·9 × 0·63 inches. The eggs of this species closely resemble those of a variety of the introduced House Sparrow (*Passer domesticus*). The egg of the Noddy Tern (*Anous stolidus*) is remarkable, from its being taken from a nest near the top of a Screw Palm, 30 feet from the ground.

Mr. E. I. Bickford showed a seedling, and also dried flowers, of the Black Kangaroo-paw (*Macropodia fumosa* Drumm.) of West Australia.

THE GEOLOGY AND PETROLOGY OF THE GREAT SERPENTINE BELT OF NEW SOUTH WALES.

Part iii. Petrology.

By W. N. Benson, B.A., B.Sc.

(Plates xxv.-xxvii.)

Before commencing the detail of this chapter, I wish to record my indebtedness to many friends, for advice and assistance in this portion of the work. Professor Bonney has given me constant help, placing his unrivalled knowledge and collections of ultra-basic rocks at my disposal. Mr. Harker has rendered every assistance possible in checking petrological determinations, and directing me to the broader aspects of the work, and the most useful literature. Mr. Hutchinson has guided me through analytical difficulties, and has given every facility for working in the Mineralogical Laboratory at Cambridge. To the guidance of Dr. Flett in the Lizard area, and of Mr. Dewey in North Cornwall, I am indebted for field-knowledge of English serpentines and spilitic rocks; while, by permission of the Director of the British Geological Survey, and the Petrologist, Mr. H. H. Thomas, I have been able to examine the official collections of slices of these rocks Many useful facts, also, were gleaned from a study of the collections of the University of Paris, to which I was given access by Professor Lacroix. To all these gentlemen, I offer most hearty thanks.

The following chapter is based upon a collection of about 900 specimens, and over 320 microscopical slides of rocks gathered from all parts of the area. These are very varied in character, and must be described under many heads. The igneous rocks are treated in the first portion of this chapter; the breccias, agglomerates, tuffs, and normal sedimentary rocks in the second portion.

A. Igneous Rocks.

These are described in the order of their geological age, as far as is known, and the following divisions are adopted:—

1. Devonian spilite-lavas.
2. Keratophyre of Hanging Rock.
3. Dolerite-intrusions associated with the spilites.
4. Lower Carboniferous lavas.
5. Middle Carboniferous peridotites, etc.
6. Gabbro-rocks associated with the peridotites.
7. Certain post-peridotite dolerites, and some acid dykes in the serpentine.
8. The Blue Knob group of dolerite and dolerite-porphyrites.
9. Granites, granodiorites, and porphyries, varying in age from late Carboniferous(?) to early Mesozoic.
10. Lamprophyres.
11. Alkaline rocks of the Nandewar Mountains.
12. Tertiary basalts, with the basanites, teschenites, and dolerites of the Nundle district.

(1) *The Spilites.*—The name spilite, according to Brongniart's original definition and Continental usage, indicated somewhat altered lavas of a gabbroid composition, characterised by an amygdaloidal structure, platy or spheroidal parting (pillow-structure), a tendency to a variolitic texture, and an abundance of secondary silicated minerals, the last feature being especially emphasised. Messrs. Dewey and Flett, however, have confined the term to those rocks which are characterised by the presence of a very sodic plagioclase, primary or secondary. Such rocks are very widespread, very uniform in mineral-features and chemical composition, and should certainly be classed under a specific name; but it is very questionable whether the old term "spilite" should be revived and redefined for this purpose. Many of the rocks, formerly classed as spilites, do not fall into this narrowed division, as *e.g.*, the only spilite-analysis quoted by Rosenbusch (Elemente der Gesteinslehre. Edition of 1910, p. 410). Moreover, the rocks described below, while their mineralogical and chemical composition is clearly that of the spilites of Messrs. Dewey and Flett, their

freedom from secondary silicates, and frequently non-amygdaloidal character remove them entirely from the group of spilites as recognised by Brongniart. The major primary characters, and not the accidental secondary features, are surely those of specific value. The name spilite, therefore, is applied to them, but in the hope that a better one will eventually be adopted.*

The spilites are extremely abundant in the lower portion of the Devonian System. They form several important flows in the Woolomin and Tamworth Series, and occur interstratified in the Baldwin agglomerate. The breccias of the Tamworth Series, and the above agglomerate, are largely made up of fragments of spilite, and in the latter it is often very pumiceous. In hand-specimen, they are more or less vesicular, but rarely amygdaloidal. Very frequently they are quite compact, and sometimes resemble a dark green hornfels. The grain-size is usually small, and even, but porphyritic examples are not infrequent. About two dozen specimens have been sliced. The texture varies considerably; usually it is pilotaxitic, and exceedingly finely crystallised; often it is more coarsely grained, with more or less variolitic character. Again, it may approach the granular structure of some basalts.

The least altered specimen [N.T., 415*] occurs on the Frenchman's Spur, near Nundle. It is rather less finely grained than usual, and has a granulitic to sub-variolitic ground-mass, with an occasional idiomorphic crystal of augite (Plate xxv., fig.1). The felspar is primary acid oligoclase; the augite is but slightly decomposed, with production of chlorite and epidote. In chemical composition (see Table i., p.704), this rock is quite analogous to the Cornish spilites described by Messrs. Dewey and Flett.

---

* Messrs. Dewey and Fletts' use of the term Spilitic Suite is even less justifiable. Surely a group of rocks embracing picrites, dolerites, soda-porphyries, and keratophyres is not well described as the "altered basic lava suite." I understand that these authors have, in preparation, an extensive memoir on these rocks, and I trust they will take the opportunity of reconsidering their nomenclature before establishing more firmly such inappropriate terms.

† These numbers refer to specimens in the Mining Museum, Sydney Duplicates of nearly all the slides specially mentioned here, have been deposited in the Sedgwick Museum, Cambridge.

The more altered rocks are far more common. In these, the augites are generally changed to chlorite, with the development of much carbonates; more rarely they pass into fibrous amphibole. The felspars are frequently too decomposed for determination, and have been changed to paragonitic mica sprinkled with epidote. If the specimen has come from the eastern side of the serpentine-line, it is usually crushed and sheared, and veins of quartz, paragonite, epidote, or rarely prehnite may have been introduced. In other rocks, there is a varying amount of glassy residuum, with crystallites of magnetite and felspar, and globulites probably of augite. In others, the glass appears to be devitrifying. Felspar and augite are the main constituents, the former usually very altered, clouded with secondary mica, but when fresh it is usually very acid. Magnetite varies exceedingly in quantity, from great abundance to complete absence. It contains most of the titanium in the rock, as the augite is rarely purplish. A single pseudomorph, doubtfully referred to olivine (bowlingite), is the only approach to an indication of that mineral.

Porphyritic spilites are less abundant. One [M.B., 50], which occurs on the upper Bingara track, six miles south of Bingara, is quite free from magnetite. It contains felspar-phenocrysts (oligoclase albite), 3 mm., in diameter, in a very finely granular augite and felspar ground-mass. The spilite-flow in the agglomerates on Anderson's Creek [M.B., 17] contains large phenocrysts of andesine, but with a hypocrystalline base filled with microlites of felspar, augite, and magnetite. In one southern rock [N.T., 277] the phenocrystic constituent, augite, is completely changed to actinolite.

The hypocrystalline types are best exemplified by the lava [N.T., 31] which flowed over the coral-reef, now forming the limestone on Moonlight Hill, south of Nundle (See p. 575). This is an excellent instance of skeleton-crystallisation. Magnetite has formed in small plates, standing perpendicularly out from the felspar microlites and from the long, ropy masses of dusty material, augite-globulites and carbonates (?), while there is some glassy background. The few larger felspar-crystals, with their swallowtailed extremities, are a very marked feature (Plate vxv., fig.2), In some of the spilite-fragments included in the Baldwin agglomerate, this becomes even better marked. Among these, there are strongly pumiceous types.

The spilites, that occur east of the serpentine-line, are very abundant, and are greatly altered by pressure. Sometimes they have received a schistose structure, with phacoidal cleavage, and, if not vesicular, are easily mistaken for altered sedimentary rocks. An excellent example of these is M.B., 56, from Woods' Reef. This, when seen microscopically, shows that it has been sheared in several directions. Some shear-lines are marked by finely pulverised rocks, the adjacent felspar-laths being sometimes dragged out and bent. Crossing these, are numerous carbonate-filled veins, which have been slightly sheared also.

N.T., 283, is a spilite from Folly Creek, near Nundle, occurring adjacent to the serpentines on Folly Creek, that have been changed to carbonates, and has been affected by the same solutions that altered the serpentine. The ferromagnesian minerals are gone, and much carbonate, talc, and a little pyrites have been introduced, while the rock has been much bleached.

(2) The keratophyre on Opossum Creek, Hanging Rock, forms a roughly circular area about 30 yards in diameter, and is probably a volcanic plug. It is buff-coloured, fine-grained, with calcite-filled vesicles [N.T., 195]. It is pilotaxitic in texture, composed almost entirely of laths of acid oligoclase. A few magnetite grains occur, but the augite, which occurred interstitially and in small phenocrysts, is completely replaced by chlorite.

(3) *Devonian Dolerites.*—These rocks have a medium grain-size, varying from 1-3 mm., in diameter. The texture of the rock is not constant; in one instance only is it gneissic; in the others, it is never more than subophitic, and, more usually, the augite is more prismatic and idiomorphic than the felspar, and is sometimes bent, through movement during consolidation. In these rocks, with both main constituents partially idiomorphic, there are interstitial areas filled in with finely crystallised, lath-like felspar or quartz-grains, or quartz and felspar conjointly. The constituent minerals are

plagioclase, augite, titaniferous magnetite, apatite, and a little quartz and pyrites, but the proportions between the minerals vary greatly, as also does the type of felspar present. The handsome rock, forming the bold cliffs of Hanging Rock [N.T., 327] is one of the most felspathic (See analysis). It is composed of large, platy crystals of albite, very slightly decomposed. Between these, and eating into the main crystals, is a matrix composed of small, lath-like albite, sometimes with a roughly parallel structure, sometimes with an irregular, confused mat, like the felspar of some trachytes. The pyroxene is in irregular grains, sometimes imbedded in the large felspar crystals, frayed out at the ends, and rarely well bounded; often also it forms small wispy patches lying in the phenocryst or in the felspar mat (Plate xxv., fig. 3). The pyroxene is almost entirely converted into actinolite. Ilmenite and apatite, in small amount, make up the rest of the rock, together with a few grains of epidote. The spongy nature of the felspar, in this rock, seems good evidence of its secondary origin by recrystallisation through the action of sodic solutions. In others [*e.g.*, M.B., 12; see analysis], the felspar is quite fresh in appearance, not at all spongy, and is albite. The pyroxene, however, is entirely changed to pale, fibrous amphibole. This rock is the "country" of a small quartz-reef, south-east of Bingara, and is associated with Tamworth rocks, though east of the serpentine-line.

The majority of the rocks, however, have a plagioclase of about the composition of andesine. Some slides [*e.g.*, N.T., 197; also from Hanging Rock], show well how albitisation is proceeding inwards, with clarification of the dusty andesine. Its change of composition is clearly not zonal, as it occurs chiefly on the exposed parts of the crystals, *i.e.*, where they project into the interstices. Concurrently, the amphibolisation of the pyroxene is in process. This rock is noteworthy for the abundance of the interstitial quartz, which is clearly primary. In other rocks, [e.g., N.T., 172, from near the Swamp Creek Falls (Nundle)], the pyroxene and felspar (andesine) are both comparatively fresh. This rock intrudes into a fine-grained tuff, and contains small interstitial areas of pilotaxitic rock like spilite.

The very coarse-grained dolerite-pegmatite, that occurs in the dolerite of Bowling Alley Point ('Possum Mine), is also not albitised; the felspar is andesine and the pyroxene is only slightly uralitised. It is intersected by many small veins of quartz and epidote.

In the neighbourhood of Horsearm Creek, Attunga, there is a series of dolerites altered by the granite-intrusion, and closely resembling the contact-altered albite-dolerites of Cornwall(35). A typical example [M.B., 177] has a structure approaching the ophitic type. Plagioclase is the dominant mineral, in large grains and smaller laths. The strongly pleochroic, green hornblende is probably derived from ophitic augite. Some crystals of the same mineral are scattered about interstitially. Numerous aggregates occur, composed of small crystals of biotite, together with some magnetite. A little interstitial quartz occurs with magnetite and abundant apatite-needles.

(4) *Lower Carboniferous Lavas.*—It has been shown that the Rocky Creek conglomerates are interbedded with flows of rhyolite and other lavas, and contain numerous beds of acid tuff. The pebbles of the conglomerate largely consist of material derived from the interstratified flows, together with much quartz, porphyry, granite, *et cetera.* While, as yet, the actual lava-flows have not been studied in detail, and the collections made are entirely from the pebbles of the conglomerate, it will be best to describe the lavas among them in this place, rather than as inclusions in the sedimentary series, to show better the sequence of igneous activity in the area studied.

A dozen rocks were sliced, which have all proved to be rhyolites of very varying character. The ferromagnesian minerals are very subordinate, and are usually biotite, often containing zircon. Magnetite is present in small quantity only.

The structures present differ considerably. In some [M.B., 9], the rock is holocrystalline, with phenocrysts of quartz and oligoclase, full of glassy inclusions set in a matrix of small felspar-grains, in a granophyric ground-mass. In another [M.B., 10], the flow-structure is well pronounced, the flow-lines being marked by long rows of axiolites, with a central string of minute magnetite grains. Here and there, the flow-lines diverge around some phenocryst of orthoclase, or spherulitic patch, or quartz-area free from flow-structure (Plate xxv., fig.5). The glassy rocks have similar quartz and felspar phenocrysts, set in a ground-mass which may be purely glassy, with a definite flow-band on a rippling structure, or may be more or less homogeneous. This is usually devitrified, to a greater or less extent. In one interesting rock [M.B., 7], the phenocrysts, quartz, oligoclase, biotite, hornblende, and magnetite, are greater in amount than the glassy matrix in which they are imbedded.

In the last rock, the felspar is nearly all plagioclase, but, in the majority of the rocks, orthoclase is abundant. This point is important, as it would show this series of rocks to be normally potassic lavas, not sodic keratophyres; and, therefore, not part of the spilite-keratophyre group, as instituted by Messrs. Dewey and Flett. The lavas, here described, have not been chemically investigated, but they are almost certainly comagmatic with the Carboniferous rhyolites of the Maitland District, described by Walkom and Browne(**13**), which are normally potassic, as may be seen from Mr. Mingaye's analysis. Walkom and Browne's analysis of a pitchstone, from the same region, would, however, show that sodic rocks are also present.

A rock [M.B.,233] occurs in Jerry's Creek, four miles south of Crow Mountain, which may possibly be connected with this series. It consists of xenocrysts of plagioclase and augite, which have been rolled about in a cooling lava. The rock has a regularly slaggy structure, and bent microlites of felspar throng its brown, glassy ground-mass (Plate xxv., fig.6).

(5). *Peridotites and associated Rocks.*—The ultrabasic rocks are fairly constant throughout the whole length of the serpentine-belt. As shown by Mr. Anderson(**1**), the dominant rock was a harzbergite, but locally, by diminution in the amount of enstatite, the rock approaches to the dunites, while the presence of diallage throws the rock into the lherzolites. Diminution or absence of olivine gives an enstatite-rock, "Enstatolite" of Pratt and Lewis(**35**).

Chromite is not common in the pyroxenites, but, in the peridotites, it may increase in amount, until it becomes the dominant constituent.

Associated with the peridotites and pyroxenites, are rarely amphibolites and olivine-gabbros, more frequently eucrites and anorthosites. No picrites, troctolites, and norites have been found yet.

The rocks will be described under the following divisions:—(*a*) Peridotites; (*b*) Pyroxenites; (*c*) Amphibolites.

(*a*). The peridotites are almost entirely harzbergites. It is rare that diallage is present in sufficient amount to cause the rocks to pass into the lherzolites, while the proportion of rhombic pyroxene is almost always too great to allow the rock to be classed as a dunite. There are three main structures developed, the granular, porphyritic, and poikilitic. In the first, the grains of olivine and enstatite are roughly equal in size, being about 2 mm. in diameter, while the small chromite-grains rarely exceed ½ mm. in diameter. This last mineral has two forms of occurrence. In most cases, it forms irregularly shaped, but not angular grains. In other cases, it is quite granophyric in habit, running in irregular, twisting and branching strings; and while not forming a definite granophyric intergrowth with its host, it seems generally associated with monoclinic pyroxene. Sometimes the strings of chromite rise perpendicular from the outer boundary of the enclosing crystal [bastite in N.T., 238].

In the porphyritic rocks, the pyroxenes are distinctly larger in size than the olivine. As is seen elsewhere, in thoroughly serpentinised rocks, there may be developed a false porphyritic appearance, owing to the enstatite changing intact to large plates of bastite, while the olivine has formed a small meshwork of serpentine. In the poikilitic or lustre-mottled types, large bronzite crystals form the ground-mass of the rock, in which smaller olivine-grains are set. The best examples of this type of rock may be obtained on Chrome Hill, behind Bowling Alley Point, where plates of bastite four inches long, studded with serpentinised olivine, have been collected. They are a deep brown in colour.

So far no examples of bending, as an original structure, ("Schlieren") have been obtained.

No rocks yet found in the belt have escaped chemical alteration. The processes of alteration may be classed as :—(α) Normal serpentinisation ; (β) Change to antigorite ; (γ) Carbonation ; (δ) Silicification with oxidation.

The two latter occur together, the one or the other predominating, and both are subsequent to the two former. The products of these processes further differ according to the degree of pressure they have undergone during their change.

(α). The formation of normal serpentine has been so often described, that a brief note will here suffice. The process affects, but in different ways, olivine, enstatite, and diallage. Olivine produces its well-known mesh-structures, with, frequently, separation of magnetite, which is generally deposited in the strings of the mesh, along the first-formed cracks; occasionally these cracks are quite free from magnetite, and the deposition is in the interstices of the mesh [*e.g.*, N.T., 132]. Enstatite forms large, clear, platy pseudomorphs, with occasional deposition of magnetite in the cleavage-cracks. Usually the enstatite becomes very cloudy while the change is in process, but the finished product, bastite-serpentine, is quite clear. The alteration of the diallage is not exhibited by any of the New South Wales serpentines, further than the grain becoming cloudy, and a small amount of serpentine forming in the narrow cracks. The chromite is quite unaltered during this change, and in all subsequent changes also.

There are two types of massive serpentine, which are more clearly distinguished in the field than under the microscope. One marks a strong outcrop, with a rough weathering surface stained red or brown. The olivine-serpentine is etched out on weathering, the bastite and talc remain in high relief. On fracture, the rock is dark, often poikilitic, and frequently contains small, irregular, white patches of steatite, which is exceedingly finely divided and nearly isotropic, owing to mutual compensation. The chemical and physical difference between this type of rock and its derived soils is shown by the difference in soil-colour, here reddish, and in the vegetation.

The other massive serpentine is more purely magnesian, weathers to a fairly smooth surface, and whitens by change to talc, which mineral also forms small veins rarely. Frequently, the rocks show green and cream-coloured patterns, in varying shades, of great beauty, reminding one of "alligator-skin" leather. Rarely they are reddish, and, in one instance, the rock is vesicular [N.T., 218]. Some constituent has been removed, leaving very irregular cavities, but what that mineral was, is not at all obvious. On fracture, the rock shows a fairly smooth, sometimes oily, green surface flecked by bastite-crystals.

The least altered rock [N.T , 388] occurs in the lower portion of Munro's Creek. It is chiefly yellowish serpentine, with very numerous olivine-residuals in its meshes. The pyroxene is diallage, which has a poikilitic structure. It is but slightly altered, the serpentine growing out from its cleavages, or inwards from its outer margin. The presence of the monoclinic pyroxene makes this rock one of the few lherzolites yet observed in the area. Chromite is present in only small amount, but white, cloudy masses of steatite are not infrequent.

The effect of pressure is first marked by the production of an undulose extinction in the bastite, and the development of chrysolite-veins throughout the rock. In these, further movement shears the fibres, breaking them into frayed wisps; small veins are formed, traversing the olivine and bastite serpentine, filled by fibres and plates crossing them perpendicularly, and these later become sheared out of position. The movements naturally tend to take place along the major mesh-lines of the original serpentinisation, which are marked by the presence of long strings of magnetite. In such rocks, the original enstatite may be represented by only an oval patch, with a slightly less sheared structure, and a greater freedom from bastite than the rest of the rock. Ultimately even this distinction is lost.

A few examples may be specially noted. The serpentine, in the highly displaced rocks of Gulf Creek Mine, shows shearing developed to its greatest degree. The lenticle is apparently fairly narrow. Its best exposure is in the Mine-workings, for it is scarcely seen on the surface; and it seems quite impossible, that the hydration of that small band of serpentine could be the cause of its own shearing and the local dislocation. In the main intrusion, the schistose serpentines tend to occur along the east wall, and, to a less extent, on the west wall of the intrusion, points where the easterly thrust would be most felt. Here, the massive serpentine is locally drawn out into schistose serpentine, leaving " eyes " of massive rock imbedded in the schist, gradually diminishing in size till the zone of maximum shear is reached. This is a feature sometimes observed in Alpine serpentines (*fide* Professor Bonney).

A few rocks occur, in which pressure has produced a linear-parallel, rather than a lamellar-parallel or schistose structure. This seems to be the result of simple pressure without shear. Such rocks are rare, but instances occur at the Lone Hand Mine, south of Bingara [M.B., 199] and elsewhere, less well developed.

From Mr. D. A. Porter, I have received a serpentine occurring probably near the head of Attunga Creek. It is a bastite-serpentine traversed by numerous parallel veins of chrysotile, about half an inch apart, narrow where traversing the bastite-crystals, but splitting up into finer, anastomosing veins where crossing the intervening olivine-serpentine (Plate xxvi., fig.7).

(β). Before describing typical antigorite-serpentines, a group of rocks should be mentioned, that appear to show the first stages in the transformation into antigorite-serpentine. For convenience, these may be termed "felted serpentines." The mass of the rock is a fine, grey-brown, felt-like mass of a dusty nature, polarising in yellowish tints. In the main, its appearance suggests derivation from a pyroxene, perhaps diallage, for true bastite occurs also, and a kind of mesh-structure in some portions likewise. Small, branching veins traverse the rock, bordered perpendicularly by chrysolite-fibres; and sheared chrysolite-veins may be present also [*e.g.*, N.T., 143; a compact, mottled-green serpentine from the mouth of Sheep Station Creek, Bowling Alley Point]. The further stage in alteration is exemplified by N.T., 103, occurring on the Peel River, a mile to the north-west. In this, the dusty-brown material has diminished in quantity; wide zones, separating the dusty areas, consist of mica like antigorite-flakes growing out perpendicularly from a central crack, and stabbing into (clearly replacing) the dusty portions. Some pseudomorphs of bastite present, are also being replaced in the same manner, but the process has not gone on so far. Granophyric chromite is also present.

An interesting series of slides shows the successive steps in the replacement of normal mesh-structure serpentine by antigorite. An early stage is shown in N.T., 258, from Munro's Creek. This rock is a harzbergite, so poor in pyroxene as to pass almost into the dunites. It has first been serpentinised in the normal manner, and the typical mesh-structure is well seen, accompanied by the usual disposition of the lines of magnetite-particles. The pyroxene has passed into bastite. The rock is traversed by major cracks, marked by a plentiful amount of magnetite-dust, on either side of which, the normal serpentine has been recrystallised as antigorite, forming large flakes parallel, transverse, or inclined to the direction of the vein, and stabbing, dagger-like, into the brownish mesh-serpentine on either side. Here, again, the replacement of the bastite is not so far advanced (Plate xxvi., fig.8).

More advanced in this alteration, is N.T., 383 (Plate xxvi., fig.9), a massive serpentine from the Razorback, in Munro's Creek. The rock was a bastite-serpentine. The whole of the ground-mass has now become antigorite, disposed in small plates aggregated into sheaf-like bundles, spreading and fraying out at either end. Often two sheaves cross one another at right angles, their separate elements appearing as if interwoven, while the outer portions may spread so widely as to give the whole mass the appearance of a spherulite. The large bastite-plates are still present, but in them, also, the change to antigorite is in process. The mineral is arranged in similar though large sheaf-like masses, single or crossed, the warp and woof of the matted plates being very distinct. Single flakes of antigorite also occur, with their characteristic, sharp, dagger-like outline in the bastite groundmass The position of the strings of magnetite-particles alone remains to show the original mesh-structure of the matrix of the rock. A little chromite and carbonates are present. The chemical composition of this rock is of the normal serpentine-character (See analysis, Table ii.).

Finally, the completely changed rock is seen in N.T., 491, from the same locality. All the bastite has passed into antigorite, its former position being indicated by areas in which the magnetite-dust occurs in parallel bands. In the remainder of the rock, the magnetite is in the irregular bands and kernel-aggregates, characteristic of ordinary olivine-serpentine mesh-structure. The position of the pseudospherulites of antigorite is quite without relation to the magnetite-bands, and, consequently, without any reference to the original cleavage of the pyroxene-minerals, of which they are the second derivative. Moreover, the appearance of the interwoven sheaves, both in the olivine and pyroxenic areas, as combined with the straight extinction of the antigorite, which makes just those portions that are at right angles, in the 45° position, in polarised light, gives so close a similarity to what has been termed "gitter struktur" as to strongly support Professor Bonney's contention, that this structure is more apparent than real, and by no means a valid indication of the presence of pyroxene(**36**). This rock also contains a small amount of carbonate.

Antigorite-serpentines also occur in the northern region, but differ in structure from those described above. A good example of these is M.B., 319, which occurs in Hall's Creek, fourteen miles south of Bingara. This is a dark green rock, with a granular fracture. It consists of blade-like, platy antigorite, usually arranged standing perpendicularly to a parallel series of cracks. Often the arrangement is much more irregular. Scattered about the rocks are irregular grains of chromite. The rock passes, in the spaces of an inch, into a mass of fibrous, radiating, pale green tremolite. The small width of passage-rock is very beautiful in microscopic section, the antigorite being interspersed with long prisms, diamond-shaped cross-sections, or isolated, radiating aggregates of tremolite-prisms (Plate xxvi., fig. 10). The tremolite is frequently surrounded by that most perplexing, greenish decomposition-product, which Lacroix, while retaining the original name bowlingite, considers to be probably a variety of iddingsite(**37**). It has a very fine, confusedly fibrous structure, high birefringence, often low by mutual compensation, and varying green to brown pleochroism. A careful description of this mineral was given by me, in a paper on some basic inclusions in the Dundas volcanic pipe near Sydney(**38**). The suggestion there was, that the mineral was produced by the action of atmospheric agencies, as is usually the case.

As pointed out by Professor Bonney (*op. cit.*), it is nearly always possible to distinguish an antigorite-serpentine in the field. It is peculiarly tough under the hammer, and breaks with a rather rough, granular fracture.

As antigorite-serpentine is frequently present in the Alpine areas that have suffered the greatest pressure, a series of density-determinations was made, to discover whether there was any change in the passage from normal to antigoritic serpentine. Five rocks were chosen, which, from their colour and microscopical appearance, were considered to be the most nearly allied in composition, and two carefully selected chips of each were used. The results were as follows :—

N.T.,215.	Mesh-serpentine and bastite rather deficient in magnetite	2·570 to 2·598
N.T.,230.	Mesh-serpentine and bastite ...	2·602 to 2·611
N.T.,240.	Mesh-serpentine and bastite ...	2·612 to 2·615
N.T.,383.	Antigorite-serpentine with bastite	2·597 to 2·617
N.T.,491.	Antigorite-serpentine	2·620 to 2·632

The difference in specific gravity, between an antigorite- and a normal serpentine, is thus within the limit of variability of a single specimen. Though the antigorite appears slightly the higher, this may be due to the presence of magnetite, the specific gravity of which is 3·1. It may be concluded that the formation of antigorite from mesh-serpentine is not accompanied by any noteworthy change in density. The first serpentinisation is, of course, associated with a decrease in density. The least altered peridotite present, N.T., 212, has a mean specific gravity of 2·815, while a rather more serpentinised rock has a mean density of 2·739. Fresh harzbergite varies, as a rule, from 3·17 to 3·35 in specific gravity (Rosenbusch).

(γ). The carbonation of the serpentine naturally resulted in the freeing of a considerable amount of silica, so that the rocks of this group may be considered as overlapping, to some extent, those of the next group, (δ) the silicated rocks. They are developed to a great extent between the Folly and Quackanacka Creeks, near Nundle, and occur at intervals along the western side of the intrusion, from Crow Mountain northwards, forming very large masses near the head of Hall's Creek, "Red Rock," and on Myall Creek, near Bingara. The Folly Creek rocks are pseudomorphous after massive bastite-serpentine. They consist of talc and carbonate in varying proportions, with dusty magnetite, which is so disposed as to show conclusively that it was developed during serpentinisation, prior to the carbonation, for it lies in the mesh-structure of olivine-serpentine, on the parallel lines of bastite-serpentine.

In N.T., 280, and, to a less degree, N.T., 176, 294, and 297, the bastite pseudomorphs can be seen, in hand-specimen, as large, purplish-grey plates, splitting along the original bastite-cleavage. Microscopically, they are composed partly of fine, matted talc, with a general arrangement parallel to the lines of magnetite, and partly of roughly idiomorphic carbonate-crystals without regular orientation, though, in some, the magnetite-lines are the major diagonals of their cleavage-rhombs, *i.e.*, the original bastite cleavage-planes become the basal planes of the carbonate-crystals. Occasionally [*e.g.*, N.T., 176], there is developed a little micaceous mineral parallel to the same bastite-cleavage, with a marked green to yellow pleochroism. It is probably clinochlore. The olivine-serpentine ground-mass is also composed of talc and carbonates, the latter being more irregular in shape, and appearing occasionally to replace residual olivine. The arrangement of talc is sometimes radial, generally matted. The chromite-grains, in the specimens examined, are usually granophyric, and analysis shows that one [N.T., 280] contains 0·55 per cent. of chromic oxide (See Table ii., p.705).

The schistose carbonate-rocks show also, though not so definitely, their derivation from serpentine by chemical changes. The rock near the Trevena Mine, on Folly Creek, is strongly sheared, and is composed of light and dark carbonate-grains, with numerous cross-veinlets. The talc and carbonates are very irregularly distributed, and the former presence of chrysolite-veins is occasionally indicated. The distribution of the magnetite is typically that of a sheared serpentine-rock. Sometimes the rock is silicified by the development of chalcedonic veins.

The rocks on Eumur Creek, Crow Mountain, 20 miles south-east of Barraba, are also interesting. They are both massive and schistose. The surface is brown, and the silica-veins are etched out by chemical erosion. On fracture, they are flesh-pink, with carbonate and clear siliceous veins. Small, green patches occur, which prove to be chalcedonic replacements of serpentine, stained with a little green chlorite. They are sometimes very finely granular, but occasionally are quite coarsely grained; the carbonate-mineral (ankerite?) is quite idiomorphic, and grows out on either side of the shear-lines that anastomose throughout the rock.

The ore-body of the Trevena Mine mentioned above, should also be described here. It is a creamy-white rock, sometimes quite friable, with a glistening appearance suggesting a decomposed, fine-grained greisen (and it is locally termed greisen). It is full of large and small cubical pyrites. Microscopically, it varies somewhat in character. One specimen consists of radiate spherulites of talc, 1 mm. in diameter, dotted with small apatite-crystals and well-developed, sagenitic webs of rutile. The pyrites-crystals are in strings, with perfectly formed, minute rhombs of siderite deeply stained by the separation of hæmatite. In other examples, *e.g.*, N.T., 504, the talc is in little flakes, placed in such a manner as to suggest derivation from antigorite. There is a little brownish, almost isotropic, matrix, chiefly chalcedony; and into this, the talc-plates cut sharply, rather in the dagger-like manner of antigorite. A little quartz is present, with pyrites and sagenite. Some rocks are very siliceous [*e.g.*, N.T., 499], consisting of quartz with very undulose extinction, talc with pyrites, carbonate, etc. The footwall of the ore-body [N.T., 492], is a green and grey mottled rock, consisting of finely divided talc, with an antigorite (pseudo-gitter) arrangement. It is dotted with grains of carbonate, and the disposition of the abundant magnetite-dust suggests the former presence of bastite.

(δ). The silicated rocks are also widespread. They are best developed at the head of Oakenville Creek, near Nundle, at the head of Munro's Creek, and the mouth of Sheep Station Creek valley, near Bowling Alley Point. While silicification may occur with carbonation, it is often quite a separate process. In the Sheep Station Creek rocks, normal, partly sheared bastite-serpentine passes into isotropic opal, and becomes veined, small openings are dissolved out, and these become lined with radiating chalcedony [N.T., 130]. In the further altered rocks, such as those of Oakenville Creek, the greater part of the serpentine may be dissolved away. The magnesia is removed, and the iron remains as limonite-powder, in the meshes of a network of large and small silica-veins, with vughs lined with chalcedony and quartz-crystals. In fact, a regular sinter is produced. In some of these "vughs" the magnesite is deposited in dense white, roughly mammillated masses. Particularly fine specimens of chalcedony, in mammillated or stalactic form, used to be obtained on Dangar's Gully, a tributary of Oakenville Creek.

In Spring Creek, about two miles south of Moonbi Railway Station, is an opaline sinter, passing into massive, white opal, stippled with small dendrites [N.T., 471].

Non-sintery, secondary silica-rocks are also divisible into massive and schistose groups. Among the massive types are some pyritous chalcedony-rocks, products of extreme silicification, associated with the carbonate rocks of Folly Creek [N.T., 181, 182]. These appear to contain finely divided talc. The rocks between this point and Munro's Creek consist of bottle-green opal with white veins, and a considerable amount of talc. The hæmatite thrown out forms a deep red, silicified covering around the green interior in some cases [N.T., 150], while in others, there are small cavities lined with chalcedony [N.T., 122]. In the same locality is a slightly schistose, pale green rock with dark green kernels [N.T., 153]. This consists of pale brown opal crowded with tiny plates of talc, and containing a few small crystals of chromite. A somewhat similar green-veined talc-bearing rock is the sole representative of the serpentine on Cope's Creek, five miles north of Bowling Alley Point. On Chrome Hill, the eastern side of the serpentine is highly schistose, streaked with grey and green in an opaque white, talc-bearing, siliceous ground-mass, which has thin films of limonite in all its shearing surfaces [N.T., 44].

We see, therefore, that, here, change to normal serpentine may be followed by a further change to antigorite, or by carbonation and silicification, with introduction of metalliferous minerals. The significance of these observations will be fully discussed in a later communication.

(*b*). The pyroxenites are those rocks in which pyroxene becomes dominant over the olivine. They are not at all abundant. In two localities only have they been found to any extent. At the head of Hall's Creek, south of Bingara, they are most abundant. They consist [M.B., 323] of olivine passing into serpentine with the mesh-structure and talc; enstatite, changing along the cleavages and on the periphery to green and brown anthophyllite, and white, colourless tremolite passing from the boundaries out, parallel to the vertical axis of the crystals; and diallage interlaminated with the enstatite, and in separate grains which are less altered. A little granophyric chromite is present also.

The rock from the head of Yellow Rock Creek, south of Crow Mountain [M.B., 197] is almost a pure enstatite-rock. It contains very little diallage and olivine, and is decomposing directly into talc, with here and there a little serpentine.

(*c*). The amphibolites are even more rare. They occur at the Paling Yard, north-east of Barraba, and form the country of the peculiar orbicular chromite. The unaltered rock [M.B., 189] is compact, green, rough to the touch, and exceedingly tough under the hammer. It is composed entirely of nearly colourless, tremolitic hornblende, which is prismatic in habit, rarely reaching a greater length than 1 mm., and often multiply twinned. Scattered about interstitially is a very small amount of clinochlore with a noticeable pleochroism, yellow-brown to pale green. The double refraction is too strong to allow it to be pennine, which it resembles in pleochroism. The chemical analysis of this rock is fully confirmatory of the microscopical determination. The excess of potash over soda was unexpected, but a duplicate analysis gave almost identical figures.

The rock passes into a serpentine like antigorite; it does not appear so crystalline to the naked eye, but cleavage-surfaces remain, showing a bronzy lustre [M.B., 186]. These are due to the development of small schiller-plates in the amphibole-cleavages. The serpentine, like antigorite, grows inwards from the periphery of the grains, and forms small, dagger-like flakes stabbing the residual kernels (Plate xxvi., fig.11).

Two curious rock-types, associated with the serpentine, may be mentioned here. The chrome-bearing rock at Paling Yard, east of Barraba, is quite unique as far as has been seen. It is pale green in colour, crowded with spheroidal aggregates of chromite about 5 mm. in diameter (or less). They may vary in amount, from about 25% of the rock till, in extreme cases, they are present almost to exclusion of the serpentine-matrix. These spherules are made up of exceedingly minute, but perfectly crystallised chromite-cubes, and sometimes contain a little antigorite. The matrix is made up of bladed antigorite and kämmererite, the pink chrome-bearing chlorite. The latter is in plates, with a low birefringence and straight extinction. Occasionally, it shows a radial structure. The chemical composition of this rock [N.T., 475] is given in Table ii., p.705.

The other rock-type is very different. It occurs in fragments, in a water-race near the head of Oakenville Creek, Nundle; and, though not found *in situ*, it probably forms veins in the serpentine. The previous notice of this rock was by Mr. W. A. Dixon(**39**), who referred to it as a kind of chlorite. He described it as forming a vein in the serpentine, and stated it to be "massive translucent, with a sea-green colour, waxy lustre, and unctuous feel; gives a white streak and powder. In a sealed tube gives off water and becomes white; before the blowpipe it is infusible, but becomes opaque and reddish-white, and is not acted on by hydrochloric acid. Hardness 2. Specific gravity 2·68."

All the above statements hold for the specimens collected by the writer. The physical properties are those of pseudophite. Dixon's analysis (see Table ii.) does not give any recognisable formula, but a new analysis [N.T., 321] gives figures approximating to the chlorite-formula :

$$5(Mg\,Fe)O,\ (Al\,Fe\,Cr)_2O_3,\ 3\,SiO_2,\ 4\,H_2O.$$

The earlier analysis shows a great excess of alumina and deficiency of magnesia, and this is doubtless due to the use of only one or two precipitations of alumina with it. In the newer analysis, the first alumina-precipitate was noticeably more bulky than the second and third, and five reprecipitations, in all, were employed. Mr. Mingaye, on my calling attention to the unsatisfactory nature of the older analysis, made another, of a specimen in the Mining Museum in Sydney, with the result tabulated. This shows more alkalies and nickel, and less water than N.T., 321. The latter analysis was, therefore, checked and confirmed in the figures for those oxides. A real variation does, therefore, exist.

Other occurrences of pseudophite are quite different from this. Dr. Flett, in the Lizard(**40**), and Professor Lacroix, in the Pyrenees(**28**), have both noted pseudophite occurring with peridotite; but, in both cases, it replaced alkaline felspar, and showed a pseudomorphous character, and want of homogeneity.* The Hanging Rock specimen is absolutely homogeneous and structureless, and so finely divided it is with difficulty possible to make out the individual chlorite flakes in the mutually compensating mass.

(6). The gabbroid rocks occur here and there, and in greater or less amount, all along the serpentine-belt. In the localities where they are but slightly developed, it is clear that they intrude into the serpentine; but where they are most abundant, as east of Cobbadah, their relationships are not so obvious. The original rocks must have been fairly uniform in character They were eucrites composed of pale green diallage and bytownite, and had an even, granitic texture, and medium grain-size. The exceptions to this were comparatively few, and comprise pegmatitic eucrites and olivine-gabbro.

* Mr. Howard Fox, who first noted this mineral at Kynance (Mineralogical Magazine, 1891, p.275) thought it replaced plagioclase. That is not possible at Gew Graze, but may be elsewhere in the Lizard.

Many alterations have taken place. The most frequent change is the passage of the felspar into saussurite, so often described from other areas; but, in addition, grossularite and prehnite-bearing rocks are developed, as well as other types.

Very few fresh specimens of eucrite are obtainable The least altered [N.T , 118] occurred south of Chrome Hill, Bowling Alley Point. Its pyroxene (chrome-diopside) is pale green in colour, almost mica-like, and is set in a matrix of clear, even-grained plagioclase. The pyroxene, which is moulded on the felspar, has commenced to change into tremolite, and the specific gravity of the felspar (2·751) indicates that it is anorthite. This determination is confirmed by the analysis given [Table ii.].

The only olivine-gabbro found, occurs intruding into the serpentine in Spring Creek, Moonbi. It is a dark grey in colour, and very decomposed superficially. It consists of saussuritised plagioclase, with a little prehnite forming along the cracks; diallage irregularly bounded and intergrown with the plagioclase; and olivine in fairly idiomorphic grains, more or less decomposed into serpentine, and bordered by a band of noticeably pleochroic pink to white hypersthene, which is quite fresh.

The pegmatitic types are best developed on Chrome Hill, Bowling Alley Point. They consist of grey-brown pyroxene and white felspar. Sometimes the crystals are comparatively small, *i.e.*, 3-5 mm., in diameter, but usually they are much larger; diallage-plates more than 5 cm., in length, have been collected. These rocks frequently show ophitic structure very well developed in hand-specimens. A little magnetite may also be visible. Under the microscope, the diallage of most coarse-grained specimens was found to be more or less altered to tremolite, lying parallel to the vertical axis, or occasionally in a small knot of fibres. Dotted about the plate, and occurring especially around the periphery, are small, brown flakes and bands of hæmatite(?). The felspar is completely saussuritised, and there are a few irregular veins of prehnite. The smaller-grained examples [N.T., 7] are more interesting. The felspar is less altered. The diallage shows some peculiar intergrowths of several individuals of pyroxene. Along lines of cleavage, fracture, or other plane of weakness, the mineral has commenced to pass into tremolite. Usually this is placed parallel to the vertical axis of the diallage, and developed fairly evenly throughout the grain, giving it a peculiar, mottled appearance. In other cases, the whole plate will have passed into tremolite, forming a multiply twinned mass of parallel amphibole-fibres.

The normal types of highly altered, fine-grained eucrites in hand-specimen are opaque white, with dull green spots, just like the typical euphotides or saussuritic gabbros of the Alps and Appenines; and, under the microscope, show the same features. They consist of dusty diallage more or less completely changed to tremolite, and dull grey-white saussurite traversed by small veins of clinozoisite. The original twin-lamellæ of the plagioclase can still be seen in some cases, *e.g.*, M.B., 327, from Upper Bingara. Occasionally, the saussurite would be flaked with lighter spaces, which consist of optically continuous prehnite. Rarely, hypersthene is found in these rocks, a good instance occurring at the old Paling Yard Diggings [N.T., 481]. The mineral is in rounded grains, about 3 mm., in diameter, and is faintly pleochroic. In this rock, the felspar has altered in an unusual manner The cracks in some grains have been marked by the development of grey-brown, dusty bands, increasing in number until the whole mass becomes opaque. These pass into areas without sharp demarcation, which consist of very finely divided prehnite(?), while some of the diallage has passed into serpentine, partly fibrous, and partly platy; the hypersthene is quite unaltered.

In N.T., 469, from Moonbi, the felspar has changed entirely to rather coarsely granular zoisite, with characteristic blue interference tint. The diallage is much strained, but is otherwise unaltered.

Another modification occurs at Upper Bingara, and is distinguished by the presence of much prehnite. This striking mineral forms in veins; the individual grains are rarely as much as 1 mm., in diameter. Its large, optical, axial angle, optically positive character, straight extinction, and high refractive index and birefringence are very characteristic. The saussurite, on either side, is seen to have passed almost entirely into a fine mosaic of prehnite-grains. It is evident that this change has taken place after the felspar has been partly saussuritised, with the development of dust-filled cracks; these now remain in the prehnite. The diallage in this rock [M.B., 17] is being altered, partly to tremolite, but chiefly to antigorite and pale pink garnet, occurring as little irregular blebs, formed owing to reaction with the felspar.

In another example of the development of garnet, the case is rather different. This rock [N.T., 417] occurred at Bowling Alley Point, and, in some features, recalled the rocks of the Paringû massif in Roumania, studied by G. M. Murgoci(**41**). The original minerals were apparently diallage and plagioclase only. The diallage is sometimes fresh, but usually only an outer shell remains, the central portion having passed into antigorite, which is bordered by numerous, small, colourless crystals of fassaite. The plagioclase, where in contact with the ferromagnesian minerals, has passed into a dusty aggregate of finely granular garnet, and small strings of these grains are working into the main mass of the felspar along the cleavage-cracks.* The development of prehnite, from the felspar, is also in progress, and this mineral, with the garnet and cloudy saussuritic products, completely replaces the original plagioclase. The cleavage of the felspar is preserved in the pseudomorph, even though it has become merely a patchwork of brightly polarising, variously oriented prehnite-grains. This mode of occurrence of prehnite, is considered by Weinschenk (Petrographic Methods, p.299) to be the same form described as lotrite by Murgoci.

Another type of saussurite-gabbro is shown by M.B., 181, from south of Gulf Creek. It is quite similar in appearance to the other saussurite-gabbros, but differs in the presence of coarsely crystallised clinozoisite. The rock, as a whole, is extensively altered. The diallage is sometimes bent, but may remain otherwise unaltered, or have passed into tremolite, and, locally, still further into fibrous and platy serpentine. This last passes parallel

* The saussurite-gabbro, described by Prof. Bonney from the Saasthal, shows also this feature, of a garnet-border to the pyroxenes. See Phil. Mag. 1892, p.243.

to the vertical axis of the diallage up into veins, where it becomes twisted and irregular. Sometimes it is without definite orientation, and exhibits the thorn-structure. The clinozoisite occurs in isolated grains, and is very irregularly distributed. The grains are unusually large, sometimes 2 mm., in length. They are prismatic in habit, usually twinned singly or multiply, and such twinning throws the basal cleavage-lines, on each side, into a herring-bone or zigzag pattern. Optically, it is distinguished by its high refractive index, low anomalous birefringence, low extinction, and large, optical, axial angle. The grains are usually surrounded by prehnite (Plate xxvi., fig.11).

South of Bingara, there are a number of other peculiar modifications of gabbro. In the field, they are remarkable for their density; they are either greenish-white in character, or translucent and grey, and are spotted with greyish or greenish serpentine-masses pseudomorphous after pyroxene. M.B., 36, of the translucent grey type, has a specific gravity of 3·420, while that of the unaltered gabbro, N.T., 118, is 2·930. The rock consists entirely of garnet locally darkened by the segregation of dusty particles. It contains lakelets of antigorite representing the residue of the original pyroxenes, for there can be no doubt that the garnet has encroached considerably on the pyroxene-boundaries. The chemical composition of this rock is given in Table iii. The whitish rocks [*e.g.*, M.B., 43] differ from this, in that there is a considerable development of prehnite in little scales, quite invisible in ordinary light.

The garnet-gabbros are also developed at Bowling Alley Point, as for instance, N.T., 261, which consists of minute grains of colourless garnet and serpentine. In this connection may be mentioned Mr. Porter's discovery of well crystallised, colourless garnet (topazolite) in the serpentine of Sheep Station Creek, in the same neighbourhood.

A most interesting slide [N.T., 486] from the mass east of Cobbadah, shows that decomposition of the pyroxene is not an essential part of the process of garnet-making. The rock, which is aphanitic, pale green and translucent, consists of a few distorted, but otherwise unaltered diallage-crystals in a ground-mass of translucent, finely divided prehnite developing at the expense of the colourless garnet, which forms the ground-mass.

This garnet-rock is, doubtless, that described by Professor Judd(42) as forming a vein near Bingara; and which has been compared by Professor Marshall to the grossularite-diallage rock from the Dun Mountain, New Zealand, which he has termed rodingite(43). The comparative study of some of his material, as well as chemical analysis, shows the correctness of this identification, but I cannot concur in Professor Marshall's views as to the origin of this rock. Abandoning his former view, that they were gabbros modified by absorption of limestone(44), he now considers them to have crystallised out in their present state; and he compares them with the ariègite group of garnet-peridotites. I have studied Professor Lacroix's type-collection of ariègites, and cannot see that they resemble rodingite at all. The long series of alterations of eucrite recorded above, and the regular increase in specific gravities, show clearly that the grossularite-rock is an extremely altered form of eucrite. It often occurs with prehnite, as seen above, and as recorded by Marshall. The Bingara rodingite occurs among saussuritic eucrites, but, until field-evidence has been more fully studied, I cannot suggest how they have become so altered. It was certainly not by absorption of limestone.

A final and entirely different manner of alteration is shown by M.B., 51, from Upper Bingara. In hand-specimens, it appears to be a gabbroid rock that has been highly sheared and veined. Mineralogically, it is altered beyond recognition as a gabbro. It consists chiefly of tremolite aggregated in ragged, multiply-twinned plates. These have a rough parallelism with a single shearing direction, but are locally contorted and interwoven. They are set in a ground-mass of clear albite-felspar, occasionally showing bent, multiple twinning. The rest of the rock is made up of large veins of prehnite.

The various changes in the gabbros, that have been described, are usually those considered as taking place under pressure. Besides the very frequent distortion which the altered rocks have suffered, an interesting confirmation is obtained by the gradual increase in density. The following table shows the condition and density of a number of specimens so chosen that the proportion between pyroxene and felspar should be, as far as possible, equal in each, to exemplify truly the change in rock-density.

TABLE SHOWING THE INCREASE IN THE DENSITY OF THE GABBRO WITH INCREASING METAMORPHISM.

Rock.	Nature.	Density.
N.T., 118	Eucrite-gabbro, almost quite fresh	2·930
	Felspar from the same (anorthite)	2·751
	Chrome-diopside	3·202
M.B., 181	Rock much more felspathic than N.T.,118, entirely changed, with formation of saussurite, a little prehnite and scattered crystals of clinozoisite...	2·823
N.T., 417	Rock with less pyroxene than N.T., 118, and this changed to serpentine; the felspar is saussurite with commencement of formation of garnet ...	2·945
N.T., 477	Gabbro rich in pyroxene, with saussuritised felspar and prehnite...	3·001
M.B., 17	Very felspathic gabbro entirely saussuritised, with further changes to prehnite, affecting nearly half	3·011
N.T., 486	Rock in which the felspar is almost entirely changed to grossularite, which is passing in turn into prehnite; but the pyroxene is unaltered	3·194
M.B., 43	Rock almost entirely garnet, with a minor amount of prehnite	3·352
M.B., 36	Garnet-rock, with a very little serpentine... ...	3·420
	Prehnite .. .. 2·8	to 2·95
	Grossularite ... ... 3·55	to 3·66
M.B., 51	Highly crushed gabbro, composed of tremolite, prehnite, and albite	2·940

(7*a*). The post-peridotite dolerites differ in microscopical characters from the earlier dolerites, They have been most studied between the Paling Yard and Crow Mountain, and as yet their equivalents have not been discovered in the Nundle district. They vary considerably in character. Some are intimately associated with the gabbros and peridotites, and have suffered the same alterations to grossularite- and prehnite-bearing types as are seen among the gabbros, with which they are probably genetically connected. A series of rock exist, however, which show increasing amounts of quartz, and approach to a panidiomorphic structure, thus exhibiting some resemblance to certain of the lamprophyres.

The following may be considered as typical examples—M.B., 225: intrusive into the serpentine, five miles south of Crow Mountain. In hand-specimen resembling the Nundle dolerites, medium grain-size, and dark greyish-green colour, with grey and pinkish felspars. It consists of rough idiomorphic augite, making up about one-half the rock-mass. It has usually a large, optic, axial angle, but, in one instance, this was only 65°. Hence there may be some excess of the enstatite-molecule present. It is partly converted to actinolite. The felspar is slightly zoned, and is basic andesine; a little orthoclase is present, and possibly a little quartz. A similar rock [M.B., 229] intrudes into the serpentine at Crow Mountain, and is noteworthy for the presence of a clear zone of secondary plagioclase (andesine) around each felspar-prism.

The dyke of dolerite in the serpentine at the Paling Yard [M.B., 68], and that three miles south of Gulf Creek [M.B., 194], on the eastern side of the serpentine, differ from the above in their greater approach to panidiomorphism, and the abundance of the interstitial quartz, either granular [M.B., 194] or granophyric. Small veins of prehnite occur in the Paling Yard rock.

There are others, however, which are quite free from quartz. A dyke in the serpentine on Eumur Creek [M.B., 198] consists of plagioclase, and small, roughly idiomorphic augite, giving a granulitic structure. This felspar is very clear, and the augite quite undecomposed. It occasionally has sahlite-striation, but the optic, axial angle is always large. Veins of prehnite are abundant, and small, isolated patches of the same mineral occur throughout the rock. A little pennine and titanomorphite are also present. M.B., 187, from the same locality, appears exactly similar in ordinary light, save for the greater roughness of the colourless portion. This is due to the fact, that the whole of the felspar has been replaced by prehnite, which forms very irregularly shaped, interlocking patches. The crushing of the rock has induced a very undulose, sometimes anomalous, extinction in the prehnite, making its determination difficult. In unstrained areas, and especially on the borders of the slide, where the cleavage shows better, the following observations were made, which determine the mineral to be prehnite. The refractive index is greater than anorthite, but less than pyroxene, the extinction being parallel to the cleavage. The optical character is positive, the optic, axial angle slightly greater than 125°, and the axial plane is perpendicular to the cleavage. The double refraction-colours are often low, but tints, higher than those of the highest colour for the diallage, have been observed. Sometimes rocks such as this are porphyritic, with prehnite as phenocrysts, *e.g.*, M.B., 236, a dyke on Crow Mountain.

Another curious rock forms a dyke in the serpentine on the road near Wood's Reef [M.B., 83]. It forms a dense, red, weathering skin on an interior of hard, aphanitic, buff-coloured rock. This consists of small twinned pyroxenes, sometimes with the herring-bone structure, lying in a ground-mass of finely granular, almost homogeneous garnet. A similar but more coarse-grained rock, [M.B., 28] differs in being pale green in colour; the garnet is clouded with dusty, oblong areas, both large and small, the appearance of which strongly suggests that they represent the original felspar-laths and phenocrysts. The rock was probably somewhat sheared before its alteration.

Finally may be mentioned, a dyke-rock [M.B., 185] occurring at Paling Yard. It is greenish, recalling a dunite, but consists of kaolinised felspar with secondary albite, epidote, and streaks of chlorite.

The mineralogical changes in these rocks are closely analogous to those that have been undergone by the gabbros, and are clearly pressure-effects, which, as will be seen, have not been suffered by any subsequent rocks to anything like such an extent, It must, therefore, be taken that these dolerites were closely associated with the serpentine and gabbro intrusions, and modified by the same dynamic action as these. They are to be sharply separated, therefore, from the entirely distinct dolerites of the Blue Knob group.

In Dr. Bonney's collection are some specimens indistinguishable from M.B., 83, described above, which were obtained by Dr. J. M. Bell, from the Serpentine Belt, Narsatas Hill, (Urals?) Siberia. They have not yet been described, and I am much indebted to Dr. Bonney for permission to mention them here.

(6,*b*). There is a small series of acid dykes intruding into the serpentine at several localities. M.B., 316, occurs near the Devonian limestones, 14 miles south of Bingara. It is a purplish-blue in colour, with small, white felspar-phenocrysts. It consists of albite in three forms. The idiomorphic phenocrysts are slightly clouded by decomposition, and twinned on the albite and manebach laws. They are sometimes corroded, and show also strain-effects. The ground-mass consists of very finely divided albite in a mosaic, with irregularly shaped patches and lenticles of water-clear, larger crystals. Set all through, are radiating fibrous aggregates of pleochroic pennine, changing from pale purplish-blue to green. There are also numerous, small, irregular fragments of sphene, and some yellow clinochlore.

M.B., 230, which intrudes into the serpentine, south of Eumur Creek, is a paler rock. It consists of large, strained albite-crystals, with more or less granulated edges, lying in a mosaic of highly strained, interlocking quartz-grains. A very little of the fibrous pennine is also present. In M.B., 21, the granulation has proceeded still further, and the felspars are almost entirely replaced by exceedingly, minutely powdered albite, lying in a mass of larger, recrystallised but strained quartzes. Where still intact, the albite is passing into tiny flakes of mica. The pennine is absent, but small strings of granular diopside(?) occur. There are also a few grains of rutile. This specimen is a hard, white, granular rock, occurring near the limestone and serpentine at Spring Creek, Bingara, in such a way as to seem an alteration-product of the marble produced by the peridotite-intrusion. The microscope, however, shows that it must be a dyke later than either.

The presence of albite-bearing dykes, in the serpentine, calls for some remark. Prof. Lacroix(28) instances dykes similar to the above, accompanying the ultrabasic rocks, in support of his contention that the ultrabasic magmas gave out alkaline emanations. The "granite" of Gew Graze, at the Lizard(40), which is changed locally into pseudophite, is very similar in microscopical appearance, and contains identical needles of pale green pennine. Similar rocks again occur in the Serpentine Belt at Narsatas Hill, Siberia, where it was found by Dr. J. M. Bell. The slices studied were found in the collection of Dr. Bonney, by whose kind permission they are here noted. The association of serpentine with sodic solutions may possibly account for the production of glaucophane in the sediments altered by the intrusion of the peridotite at Angel Island, California(49).

(8). So far as they have been examined, the dolerites and dolerite-porphyrites of the Blue Knob group of intrusions are a fairly homogeneous series of rocks within certain limits. They are quite different in character from both the older dolerites, and the post-peridotite group of rocks, and are probably younger than either.

The typical dolerite of the Blue Knob laccolite [M., 312] is a medium-grained rock, composed chiefly of idiomorphic labradorite, which is strongly zoned, and clouded with epidote and probably zoisite. With this is a large amount of idiomorphic augite, partly quite fresh and pale yellow in colour, but, in the main, completely decomposed to bright yellow-green chlorite. Large grains of ilmenite are abundant. Between the crystals, there is a small amount of more finely crystallised matter. This consists of quartz, decomposed felspar, and abundant, small crystals of apatite, which mineral does not occur in the plagioclase-phenocrysts, except in their outer edges.

The porphyrites occur in the narrower intrusions, dykes, and sills. As typical of these, M.B., 326, may be described. It occurs on the main road, two miles south of Cobbadah. It is a handsome rock, with a fine-grained, dark green ground-mass, a few darker augite-phenocrysts, and abundant, pale green crystals of plagioclase, 3 mm. in diameter, showing zonary banding very distinctly. This is labradorite. The augite-phenocrysts have passed into peculiar, spherulitic masses of chlorite. The ground-mass is finely crystallised, lathy andesine, with a little epidote and chlorite, and much leucoxene. Some pyrites is present. Occasionally, the rock is very rich in veins and spherules of white prehnite, as in M.B., 64, from the intrusions on the Manilla River at Plumthorpe, 10 miles west of Barraba.

Possibly there should be classed with this group M.B., 285, a purplish-green rock forming a narrow band in the mudstone one mile west of Eulowrie homestead, on the Horton River. It consists of large and small phenocrysts of zoned plagioclase, with pseudomorphs of calcite and chlorite after a pyroxene, possibly hypersthene, though they are not unlike the augite-pseudomorphs in the Blue Knob dolerite. The ground-mass is quite subordinate. It consists of orthophyric plagioclase-crystals, with a little augite and some magnetite, set in a small amount of glassy base.

(9). *Granites, Granodiorites, and Porphyries.*—The grouping in order of age, given in Part i., was as under :—

(*a*) Felsites, etc., of the Bingara District.

(*b*) Granodiorites of Nundle and their associated porphyries.

(*c*) Sphene-granites of Moonbi.

(*d*) Tingha granite.

(*e*) Acid granite.

(*f*) Tourmaline-granite.

(*a*) An example of this group occurs near the Ruby Hill basalt-neck, south of Bingara. Mr. Pittman describes it as a microcrystalline quartz-felsite.

(*b*) The chief feature of the second group is the immense number and variety of the porphyritic apophyses. As typical of the plutonic members, are described N.T., 384, from the upper end of Duncan's Creek, and N.T., 413, from Mt. Ephraim. The former has a hypidiomorphic, granular texture, and consists of zoned oligo-clase-andesine, a very little orthoclase, abundant quartz showing strain-effect, biotite (slightly chloritised, with haloed zircon-inclusions), twinned hornblende sometimes idiomorphic, well crystallised magnetite, and apatite, together with a little secondary epidote. This may clearly be classed as a granodiorite. N.T., 413, will fall into the same group, though it differs in its smaller grain-size, greater amount of orthoclase, absence of hornblende, rarity of magnetite, and presence of a little sphene. The grain-size is less regular, and the orthoclase occurs in a few large grains poikilitically enclosing quartz and plagioclase.

Of the apophyses, the most striking are the black felspar-porphyries, or malchites. These are very abundant, especially east of Munro's Creek. They have a dark, aphanitic ground-mass, with white phenocrysts of plagioclase, and sometimes smaller, dark phenocrysts of hornblende. Microscopically, the rocks are seen to consist of idiomorphic prisms of brown hornblende, with usually small, fibrous extensions of actinolite, as described by Cross. The felspar is also idiomorphic; it is zoned and twinned on the albite, pericline, carlsbad, and (rarely) manebach laws; its average composition varies from acid labradorite to basic oligoclase. It is often much decomposed, with formation of zoisite, sericite, etc. The ground-mass is exceedingly fine-grained, consisting of lathy or granular plagioclase crowded with very minute, but perfect hornblende-prisms. Some magnetite is present in the phenocrysts and ground-mass. Sometimes a little biotite is present. In N.T., 89, is a large, chloritising flake encircled by small hornblende-prisms. This interesting specimen shows also a contact-surface with the spilites and the edge of the epidote-veins in these basic rocks. A vein in the spilite stops short at the boundary of the porphyry. Along the surface of contact, there is a zone only 2 mm. thick, crowded with phenocrysts with general flow-direction. In places, a small vein of quartz appears in the actual line of contact (Plate xxvii., Fig. 13).

Sometimes these porphyries are entirely decomposed (*e.g.*, N.T., 62), and are then dense, cream-coloured rocks, in which the original hornblende is represented by limonite-pseudomorphs.

Related to these rocks, are two other groups of porphyries. The first group may be termed the grey porphyries, being less dark than the last group. They are very frequent about the head of Munro's Creek, and are characterised by the more coarsely crystalline nature of the felsitic base. The felspar-phenocrysts are generally smaller and often fresh. The hornblende is usually much smaller, and is considerably decomposed to chlorite, or to chlorite, biotite, and calcite [N.T., 82], and the secondary material is distributed about the rock. In one [N.T., 33], hornblende forms long, faintly coloured prisms of a brownish-pink tint, and decomposes to red-brown chlorite. There is often apatite noticeably present, and quartz is not infrequent in the base, and occurs occasionally as xenocrysts [N.T., 82]. The ground-mass is usually a mosaic of irregularly granular material, but sometimes [N.T., 319], it is pilotaxitic. This last rock is remarkable in containing a little pyrite. Its porphyritic character is not pronounced, and still less so is that of N.T., 387, which has quite a schistose appearance in hand-specimen. Orthoclase is present in these rocks, but only in small amount.

A second variation is afforded by the granophyric porphyries, in which there is a considerable amount of micrographic structure. A regular sequence can be traced, from rocks in which spherulitic structure is just suggested in the base mosaic [N.T., 42, 99], to those in which it becomes well marked in the base [N.T., 142, 516]; and finally, to those rocks in which the whole base is granophyric, and set with seriate* phenocrysts of plagioclase. In this rock, biotite replaces hornblende.

The quartz-porphyries have also their fine- and coarse-grained varieties. Several, very fine-grained examples occur on the water-shed between Duncan's and Munro's Creeks. They are grey or creamy-pink in colour, and consist of more or less idiomorphic quartz-grains often strained, in a micro-felsitic base, which some-

* A useful term suggested by Iddings.

times shows strong fluxional arrangement [*e.g.*, N.T., 87]. The rocks are almost free from ferromagnesian minerals, or may contain a small amount of biotite. Finally, there is a rock [N.T., 404] occurring on the same ridge, composed of rounded grains of quartz and acid plagioclase about 1 mm. in diameter, with a very little, fine-grained base. It may be considered a soda-aplite.

(*c*) The sphene-granites of Moonbi have been described by Mr. G. W. Card(**18**, p.210). Summarising his remarks, the rock is not conspicuously porphyritic. It contains hornblende and biotite, with a tendency to segregate with magnetite into basic patches. Sphene is plentiful. Felspars predominate, with orthoclase and plagioclase in varying proportion, the latter zoned oligoclase. Quartz is not very abundant. An analysis is given of the granite from Walcha Road, a portion of the same massif (Table iii., p. 706).

These granites also extend northwards from Tamworth to Attunga, and, in Horsearm Creek, many basic segregations were noticed by the present writer. In these, the colourless and coloured minerals are present in about equal amounts. Orthoclase and oligoclase are about equal, quartz is rather less abundant. The predominant, coloured constituent is biotite, which contains a little zircon. Almost colourless augite is rather subordinate, and decomposes peripherally to actinolite. A little magnetite is present in small cubes.

(*d*),(*e*),(*f*) The Tingha granite (*d*), and the acid tin-bearing granites occur near the great bend on the Gwydir River, 30 miles south-east of Bingara. They have been described by Mr. Andrews and Mr. Cotton. Mr. Andrews classes the Bendemeer granite with the acid granite(**18**, p.212, 219; **19**, p.742).

The Tingha granite is porphyritic with plagioclase and quartz phenocrysts, with biotite, hornblende and accessory apatite, and a second generation of quartz and felspar in the base. Local modifications are very porphyritic, and contain pegmatites and tourmaline felsite dykes. The acid granites are coarsely crystalline, consisting of quartz and orthoclase, with sometimes a little biotite and magnetite. Mr. Cotton, at first, classed the tourmaline-granites as a modification of the acid granites (*op. cit.*), but he now considers them to be a separate intrusion. He found them near Tingha. Mr. Stonier has reported them to occur "east of Bingara," and the present writer found them near New England Creek, east of Manilla, 50 miles south of Tingha.

(10) The lamprophyric rocks are of uncertain age and affinities. They intrude into Devonian, and probably Carboniferous rocks, forming small dykes, and all the occurrences noted are within a few miles of the serpentine-belt. In the absence of definite evidence to the contrary, they will be considered to be a late phase of the granitic intrusion, as is usual. The rocks collected, show a considerable range of character, and may be referred to several types. The minettes are represented by M.B., 145, occurring in a dyke near the contact of granite and serpentine at Attunga. It is a dark, medium to fine-grained rock, with glistening mica-plates. It contained abundant idiomorphic biotite, decomposing with separation of magnetite and diopside in well defined prisms, slightly uralitised. The felspathic constituent is chiefly orthoclase in singly twinned prisms or more irregular grains, while a minor amount of oligoclase is present. Interstitial quartz occurs in small amount, and apatite is abundant. There is a little secondary calcite. The analysis indicates the strongly potassic character of the rock (Table iii.).

A very fine minette [M.B., 200] occurs about one-quarter of a mile south-west of Eumbra homestead, Crow Mountain (Plate xxvii., Fig. 14). It forms a small intrusion in the mudstone, beside an intrusion of dolerite, but the relation of the rocks to each other has not been ascertained. Unfortunately, the minette is very decomposed and friable. It consists of coarsely granular orthoclase, and abundant, hexagonal plates of strongly pleochroic biotite, containing minute zircons. Small, idiomorphic prisms of diopside, thick needles of apatite, and a very little interstitial quartz are also present.

The vosgesites are more abundant, and have been found on the Frenchman's Spur, near Nundle [N.T., 190, 317], and on Tom

Tiger Hill, opposite N.T., 390; on Wiseman's Arm Creek, north of Attunga [M.B., 144], on Bungemullagalarno Peak [M.B., 275], and north of Namoi River. They are fine-grained rocks, usually pink in colour, with abundant, small crystals of green hornblende. Rarely, in the freshest specimens, they are grey. Microscopically, they are seen to be chiefly composed of lath-like felspar, orthoclase dominating over plagioclase, while there is a good deal of interstitial quartz. The hornblende-prisms are up to 2 mm. in length, and are passing into chlorite. A little apatite and magnetite occur, also a small amount of secondary calcite.

Augite-vosgesite occurs on Deep Lead Creek, Mt. Sheba [N.T., 207]. It is a light greenish-grey, fine-grained rock, with patches of dark chlorite, which weathers easily, giving a pitted surface. It consists of idiomorphic, thick, fresh prisms of augite, about 1 mm. in length, set in a very fine-grained ground-mass of thin augite-prisms, and plates of chloritised biotite, on a background of felspar, chiefly orthoclase, and a little quartz. Some calcite is present, and masses of chlorite, with quartz and calcite, occur, probably replacing augite.

N.T., 77, which occurs as a dyke on the slope east of the Peel River, three miles south of Bowling Alley Point (Moonlight Creek), may be classed as an odinite, though differing in some respects from the type-rock. It consists of a network of acid plagioclase-crystals, generally rather elongated, and sometimes 1 mm. in length. There is a considerable amount of interstitial quartz. The ferromagnesian mineral was chiefly hornblende, in long, thin prisms, but it is now almost entirely decomposed to chlorite and carbonates.

A beautiful camptonite [M.B., 228] was found, unfortunately not *in situ,* but as a boulder by the Manilla track, four miles south of Crow Mountain. It is dark blue-black, fine-grained, and has glistening mica-plates. It consists of small, idiomorphic crystals of diopside, vivid brown biotite-plates, and large olivine-crystals, the last completely replaced by quartz, carbonates, and pilite. There is a little magnetite. The ground-mass is composed of finely granular plagioclase, with abundant, small crystals of apatite (Plate xxvii., Fig. 15).

(11) The alkaline rocks of the Nandewar Mountains have been described in detail by Dr. Jensen(9). He considers them to be of Eocene age, and he determined the occurrence of the following types:—

Volcanic—alkaline rhyolite, trachytes, phonolites, alkaline andesites, and basalts.

Hypabyssal—alkaline syenite-porphyry, pulaskite-porphyry, augite-porphyrites and teschenites, monchiquitic lamprophyres.

(12*a*) The Tertiary basalts are of several varieties. In general, they are normal, fine-grained olivine-basalts, quite holocrystalline and undecomposed. In other places, they are hypocrystalline, and, east of Hanging Rock, some layers of very decomposed basalt-scoria have been discovered. There are also more coarsely grained and porphyritic types. For convenience, we will describe the Nundle and Barraba basalts separately, as they present somewhat different features, and are possibly not of the same age.

The following rocks are the most typical of those developed in the northern district. M.B., 75, which occurs four miles east of Barraba, and forms portion of the Bell's Mountain flow, is a medium-grained, holocrystalline rock, with well developed ophitic structure, consisting of laths of andesine, faintly purple augite, small olivine-grains, well formed ilmenite-plates, long apatite-needles, and a few minute flakes of biotite. M.B., 193, occurred in Chain of Ponds Creek, eight miles north-west of Barraba. It was not *in situ*. It is a fine-grained rock, with a pilotaxitic texture, composed of labradorite-laths, olivine, granular augite, platy ilmenite, and apatite-needles. In this matrix are large, clear crystals of bytownite, free from schiller-plates, and considerably corroded. Here and there, felspar has been secondarily deposited on the previously corroded surface. These large crystals are not zoned, and are probably xenocrysts, though it is not impossible that they should have been derived from the magma by an intratelluric crystallisation. M.B., 341, which covers the auriferous gravels of Tea-Tree Gully, is a fine-grained rock, with small olivine-crystals visible in hand-specimen. It consists of idiomorphic laths of basic labradorite, olivine, and numerous smaller grains of augite. There is a considerable amount of dark groundmass, which contains, in a glassy base, microlites and skeleton-crystals of felspar, augite-needles, and abundant, minute plates of ilmenite standing perpendicularly to the crystal-surfaces of the earlier-formed crystals and the microlites. As noticed by Mr. Card, in his description of the basalts overlying the diatomaceous earths near Chain of Ponds Creek(32a), all these basalts are remarkably fresh, a fact supporting their comparatively recent extrusion.

The basaltic neck in the Hall's Creek Valley, near Bingara ("Ruby Hill"), has been described petrologically by Mr. Card(45), from specimens collected by Mr. Pittman. He drew attention to the occurrence, in it, of an eclogite, with kelyphitically bordered garnet, and omphacite which was included in the basalt, either in fragments of rock (xenoliths), or in isolated xenocrysts. The basalt rises up, in dykes, through a breccia, with fragments and xenocrysts from the same rock.

The basalts of the Nundle region are also varied. The fine-grained rocks may be divided into two types, the granular, and the fluidal. The granular rocks have a rough surface on weathering, and break with a hackly fracture, appearing to be an aggregate of pellets of basalt, rather than a simple rock. Some rocks can be divided into granular masses of the size of small peas, *e.g.*, N.T., 160, which occurs on the Yerrowinn-flow, one mile west of the summit. Microscopically, this rock shows no sign of such a structure; it is a normal, fine-grained rock, consisting of very small felspar-laths, augite-prisms, magnetite-cubes and octahedra, and larger crystals of olivine, decomposing with the formation of limonite. Here and there are inclusions of a rather more coarsely-grained, ophitic basalt, in which the olivine is in tiny, ovoid grains. The

---

* Rec. Geol. Surv. N.S.W. 1897, Vol. v., Part 3, p.20.

main basalt shows a cooling rim of more dense crystallisation about such inclusions. The fluidal basalts have a smooth weathering surface, break with a more regular fracture, and atmospheric corrosion etches out the flow-lines as they twist round xenocrysts, or pass regularly through the rock [N.T., 174]. Microscopically, these are distinctly fluidal, the felspar-laths have a general direction, the magnetite and augite of the base are very minute indeed, while the olivine-crystals are larger. They are decomposing into bowlingite. Fluxional structure is also seen in the bending of the rock, in zones of slightly different grain-size, and the enrichment of some zones in magnetite. There are small inclusions of coarse-grained rock, chiefly composed of felspar-laths and ilmenite, while large xenocrysts of olivine are visible in hand-specimens.

Other normal basalts occur, without this granular or fluidal structure, and, in them, the usual nodules of olivine-enstatite and picotite occur, together with large grains of pleonaste(?) nearly half an inch in diameter.

Associated with these basalts are some dolerites very rich in chlorite, occurring south and east of Sheba Mountain. As an example, N.T., 171, may be described. It is subophitic in texture, with medium grain-size. About half the augite is replaced by a yellow-green aggregate of chlorite-spherulites, surrounded by a double layer of chlorite, the inner, green, the outer, brown. These consist of minute fibres standing perpendicularly to the enclosing and included laths of felspar. The augite is purplish, and there are a few pseudomorphs after olivine. Ilmenite and apatite occur in small amount. Other rocks differ in the presence of one chlorite layer only.

The interesting alkaline rocks of the Nundle district, and similar rocks in the Mount Royal Range, have been already described by the present writer, and reasons have been given for considering that they occur as sills in the Tertiary basalt(14). A few more particulars may now be given.

The rock capping Square Top Hill, three miles west of Nundle, is dark grey in hand-specimens, with purple-brown augites, and, on weathered surfaces, white felspar-laths can be distinguished. Microscopically, the augites are seen to be strongly zoned, purplish and weakly pleochroic in the centre, greyish-green in the outermost portion. The outer zone is usually full of irregular cavities, probably originally filled with liquid, while fragments of felspar, olivine and magnetite are also present. Numerous small phenocrysts of olivine occur and well shaped cubes of magnetite. Occasionally, there are long black rods composed chiefly of minute magnetite-crystals, which are, possibly, decomposed crystals of hornblende. The ground-mass consists essentially of plagioclase, sanidine and nepheline, the last being very abundant. The plagioclase varies considerably in amount. In N.T., 414, though subordinate, it is present in notable amount, and has the composition of sanidine; but in another example, N.T., 418, very little is present, and sanidine is more abundant. In addition, there are numerous, small prisms of augite and apatite, magnetite and chlorite forming, with sanidine microlites, small aggregates interstitial in the base of the rock. In some rocks, more or less natrolite is present, forming small, dusty patches. The rock, which is clearly to be classed as a nepheline-basanite, may pass into a nepheline-basalt, when the plagioclase is not developed. The chemical composition of N.T., 418, is given in Table iii.

The coarse-grained dolerites of the Peel River gravels have been further studied, and their description, as originally given, is here slightly modified. They consist of large, purple phenocrysts of augite, sometimes half an inch in diameter, strongly pleochroic, and not infrequently containing laths of plagioclase, and olivine-grains. Olivine-phenocrysts occur also, smaller, and subordinate to the augite. Ilmenite is abundant, and apatite is present in small amount. Green ægyrine-augite, of the second generation, forms in the base, in small but long, ragged prisms. The felspar forms irregular tabulæ, and is andesine. Interstitially, there are masses of chlorite-stained analcite and natrolite, associated with minute laths of sanidine, apatite, and green augite. The mineral, here stated to be analcite, is the brown, platy mineral of zeolitic nature, mentioned in the Preliminary Note. The dolerites have, then, teschenitic characters, and their relation to the basanites is quite obvious.

The rock, N.T., 163, described in the Note as forming a small neck, one mile from Goonoo Goonoo, is of quite similar character, and less decomposed. Analcite, not previously recorded, has since been found, and sanidine and orthoclase are present in small amount. Apatite and abundant ilmenite also occur, the latter often surrounded by tiny mica-plates, perhaps the result of the interaction of the analcite and ilmenite. The augite shows hourglass-structure, and is free from inclusions. Small grains of the second generation are also present. Olivine forms large, fresh crystals. It is possibly better to regard this rock as a teschenite-dolerite than as an essexite. There seems little reason to doubt the primary nature of the analcite.

In the Preliminary Note on these rocks, their extension from Mt. Warrawalong to Nundle was shown, but a large increase in this area can now be indicated. The Prospect essexite near Sydney, recently described by Jevons, Jensen, Süssmilch, and Taylor(**46**) is, in its nature, related to the essexitic or teschenitic dolerites of Nundle. The analcite-dolerites and essexites described by Jensen, in the Nandewar Mountains [N., 17; N., 28; and N., 57]; (**9**, pp. 880-883), are clearly of this type, and are found in sills; while the rock of Delungra Peak, near Gragin, 20 miles east of Warialda, described by Mr. Carne and Mr. Card(**27**), is also one of this series, and is probably similar to that of Mt. Warrawalong in its manner of occurrence. I have also received, from Mr. R. A. Wearne, a specimen from Mt. Melora, near Ipswich, which has proved to be a most beautiful example of teschenite, showing partial replacement of the plagioclases by analcite and natrolite There can be no doubt that it belongs to this intrusive series, and is well worth further investigation. This emphasises the remarks, made formerly, of the close association of these with the Tertiary basalts, and the manner in which they reflect the varying degree of alkalinity of those basalts. The extent now proved for these rocks is nearly 500 miles (Sydney to Ipswich).

Table i. CHEMICAL COMPOSITION OF ROCKS OLDER THAN THE SERPENTINE-INTRUSION.

	Spilite, Frenchman's Spur, Nundle, N.T., 415.	Spilite, Tregidden, Cornwall.	Spilite, Mullion Island, Cornwall.	Albitised Dolerite, S.S.W. of Bingara, M.B., 12.	Albitised Dolerite, Hanging Rock, Nundle, N.T., 327.	Carboniferous Rhyolite, Pokolbin, N.S.W.	Carboniferous Pitchstone, Pokolbin, N.S.W.
SiO_2	48·22	48·58	47·56	53·17	54·88	77·82	58·79
Al_2O_3	14·82	14·58	14·27	9·36	12·62	11·46	17·51
Fe_2O_3	0·56	1·89	1·63	1·29	3·02	0·30	2·11
FeO	9·25	7·65	6·80	9·62	7·11	0·09	3·87
MgO	5·58	6·36	4·90	7·46	3·73	0·23	2·23
CaO	8·81	9·80	10·95	9·00	4·16	0·22	6·18
Na_2O	4·95	4 02	4·61	4·26	6 01	0·86	4·84
K_2O	0·44	0·43	0·27	0·48	1·10	7·19	0·68
H_2O+	2·54	2·93	2·65	1·80	1·76	1·40	2·61
H_2O-	0·15	0·68	0·42	0·07	0·23	0·36	0·71
CO_2	1·40	1·00	2·95	1·11	tr.	0·03	tr.
TiO_2	2·68	1·77	2·40	1 85	3·63	0·02	1·21
P_2O_5	0·23	0·19	0·19	0·12	0·44	0·04	...
FeS_2	0·37	0 26	0·22	0·30	0·71	0·07*	...
Cr_2O_3	nt.fd.	...	...	nt.fd.	nt.fd.	...	...
Ni,CoO	0·03	0·03	0·08	0·04	0·05	...	...
MnO	0·23	0·46	0·30	0·19	0·25	tr.	...
SrO	tr.	...	...	...	...	...	...
BaO	nt.fd.	nt.fd.	nt.fd.	nt.fd.	nt.fd.	0 02	...
Li_2O	...	...	...	...	...	tr.	...
	100·26	100·63	100·25	100·18	99·70	100·11	100·74
Analyst	W.N.B.	Pollard.	Radley.	W.N.B.	W.N.B.	Mingaye.	Walkom.

* SO_3.

51

Table ii. CHEMICAL COMPOSITION OF ROCKS ASSOCIATED WITH THE SERPENTINE.

	Antigorite-Serpentine, Bowling Alley Pt., N.T., 383.	Carbonated Serpentine, Folly Cr'k., Nundle, N.T., 280.	Enstatite-rock, south of Crow Mt., M.B., 197.	Tremolite-rock, Paling Yard, M.B., 189.	Pseudophite, Hanging Rock, Nundle, N.T., 321.	Pseudophite, Hanging Rock, Nundle.	Pseudophite, Hanging Rock, Nundle.	Chromite-Serpentine, Paling Yard, N.T., 475.
SiO_2	38·23	28·78	53·55	54·51	33·43	33·38	35·72	17·23
Al_2O_3 ...	0·43	0·63	1·53	2·00	16·86	15·58	38 60	5·16
Fe_2O_3 ...	4·27	0·27	0·53	0·94	0·55	0·74	...	...
FeO	1·73	4·18	4·27	4·85	4·18	3·33	8·64	13·51
MgO	38·99	36·89	35·01	23·50	33·71	34·54	5 40	21·80
CaO	1·09	0·13	1·79	10·99	nt.fd.	abs.	0·61	...
Na_2O ...	nt.fd.	nt.fd.	nt.fd.	0·12	nt.fd.	0·17	...	...
K_2O	nt.fd.	nt.fd.	nt.fd.	0·34	nt.fd.	0·20	...	...
H_2O+ ...	12·80	1·26	2·26	1·46	12·47	11·42	10·96	4·80
H_2O- ...	0·55	0·08	0·14	0·07	0·13	0·34	...	...
CO_2	2·57	25·19	nt.fd.	nt.fd.	nt.fd.	0·12	...	...
TiO_2	0·04	tr.	0·17	0·24	0·05	...	...	...
FeS_2	...	0·22	...	...	...	...	...	...
Cr_2O_3 ...	0·36	0·55	0·42	0·29	0·08	0·04	...	37·73
Ni,CoO ...	0·06	0·14	tr.	0·05	0·03	0·23*	...	...
MnO	0·21	0·37	0·12	0·08	0·22	0·07	...	...
SrO	...	...	...	...	...	tr.	...	...
BaO	...	...	nt.fd.	tr.	.	abs.	...	...
Li_2O	...	.	...	...	...	tr.	...	...
	100·42	99·99	99·89	99·40	101·68	100·16	99 93	100·23
Analyst ..	W.N.B.	W.N.B.	W.N.B.	W.N.B.	W.N.B.	Mingaye.	Dixon.	W.N.B.

* NiO only, CoO merely a trace.

Table iii. CHEMICAL COMPOSITION OF ROCKS NEWER THAN THE SERPENTINE.

	Eucrite-Gabbro, Bowling Alley Pt., N.T., 118.	Garnet-Gabbro, Bora Ck., Bingara, M.B., 36.	Rodingite, Dun Mt., New Zealand.	Grossularite, Roding River, New Zealand.	Minette, Willow Tree Creek, Attunga, M.B., 145.	Sphene-Granite, Walcha Rd., nr. Moonbi.	Nepheline-Basanite, Square Top, Nundle, N.T., 418.
SiO_2	48·45	35·68	33·95	36·33	52·06	69·14	47·56
Al_2O_3	16·96	22·37	19·91	25·64	13·36	14·74	15·20
Fe_2O_3	0·02	0·33	1·28	abs.	1·26	0·70	4·75
FeO	2·96	1·87	6·98	0·50	5·24	1·98	6·12
MgO	11·80	3·33	5·23	0·20	6·75	1·58	5·44
CaO	15·86	33·27	26·95	36·19	6·73	3·14	6·15
Na_2O...	0·48	tr.	0·15	0·14	1·38	3·36	6·40
K_2O	0·26				6·03	4·13	2·32
H_2O+	1·82	abs.	4·85	0·62	0·98	0·38	2·20
H_2O-	0·13	3·87			0·14	0·18	0·26
CO_2	abs.	abs.	abs.	abs.	2·20	0·23	abs.
TiO_2	0·30	0·04	0·42	0·05	2·08	0·36	2·40
P_2O_5	...	...	...	...	0·91	0·18	0·55
FeS_2	abs.	...	...	...	0·17	...	0·50
Cr_2O_3	0·28	0·09	abs.	0·05	tr.	abs.	0·05
Ni,CoO	...	...	0·28	...	...	tr.	...
MnO	0·07	0·04	0·28	0·15	0·11	tr.	0·23
SrO	...	...	...	...	tr.	tr.	tr.
BaO	nt. fd.	...	...	...	0·12	0·02	0·08
Li_2O	...	...	...	...	...	tr.	...
	99·31	100·81	100·00	99·87	99·52	100·15*	100·21
Analyst	W.N.B.	W.N.B.	Maclaurin.	Maclaurin.	W.N.B.	Greig.	W.N.B.

* Including Cl, 0·04%.

B. Sedimentary Rocks.

Classification.—The sedimentary rocks will be described in order of their stratigraphical succession, an arrangement which, while necessitating some slight repetition, will best indicate the resemblances and differences, in the lithological characters, of the various series.

(1) The rocks of the eastern series are all much altered. They consist of phyllites, jaspers, and metamorphosed members of the western Devonian, and possibly Carboniferous groups. As before pointed out, spilite-lavas occur in great abundance throughout this series, and, where greatly sheared, veined, and otherwise altered, they are easily mistaken, in hand-specimen, for altered, sedimentary rocks, more especially if the spilite be one of the highly felspathic type.

Unfortunately, only a small collection of eastern rocks was made, and hence this paragraph can give but an incomplete description of the series. Such studies, as have been made, show that it is only by the microscopical study of a large series of these rocks, that the nature and stratigraphy of the eastern series can be finally elucidated.

The following are the rocks that have been determined, and their probable equivalents, among the unaltered types, are indicated. The mudstones and clay-shales are represented by sericitic phyllites. In the neighbourhood of the red jaspers, these may become more ferruginous, and pass locally into hæmatitic schists. Conglomerates, such as cross the Peel River, south of Nundle, are represented in the narrow band of schistose conglomerate on the Namoi River, near its junction with Ireland Creek. They contain fragments of granite, etc.

The altered breccias, that occur on Wiseman's Arm Creek, M.B., 273, can be clearly correlated with the Tamworth breccias; while green, schistose greywackes may represent the tuffs of the Upper Tamworth beds. Occasionally, these may contain small, circular or oval areas, suggesting the presence of radiolarian casts. A typical, altered tuff [*e.g.*, M.B., 53; from Woods' Reef] is composed of crystals of felspar, and grains of quartz, in a fine-grained ground-mass, greatly sheared and decomposed. Some tuffaceous rocks, like M.B., 243, are fine-grained, black, aphanitic, and non-schistose; and consist of fragments of felspar, quartz, spilite, and felsite in a very fine-grained ground-mass. Here and there, lenses of white, saccharoidal marble or limestone occur, usually fairly pure, but sometimes containing a considerable amount of siliceous material in parallel planes of bedding.

The most notable rocks are the jaspers, which occur parallel to the serpentine-belt, all along its length. In several localities, radiolarian casts have been found in them, *viz.*, at Woods' Reef and Bingara, by Messrs. David and Pittman; at Nundle, the Namoi River, and near Warialda by the present writer. The radiolaria occur as chalcedonic casts in a siliceous matrix coloured by extremely finely divided particles of hæmatite. Frequently, the rock is seamed with small veins of chalcedony, and considerably brecciated, radiolarian, and non-radiolarian fragments being pressed together in a most irregular fashion [*e.g.*, N.T., 101, from near Bowling Alley Point]. In places, the jasper-like rocks are banded; for instance, in Gulf Creek, about one mile below the mine, the rock is a yellow and red, banded chert, which proves to consist entirely of radiolarian remains, the faint outlines of the oval patches being just visible. Except for the red colour and the absence of finely divided epidote, etc., this rock is identical with the crushed, radiolarian cherts of Bowling Alley Point.

Here and there along the serpentine-line, now east, now west of the intrusion, are peculiar rocks full of holes, which are clearly due to the dissolving out of limestone-fragments. The insoluble matrix of these, when non-schistose, appears to be identical with the breccias of Tamworth and Bowling Alley Point; and the whole rock is more or less analogous to the limestone-bearing breccias of Moonlight Hill, near Bowling Alley Point. If this be so, a definite horizon is thus obtained, for the commencement of the study of the stratigraphy of the eastern series.

(2) The Tamworth Series consists of radiolarian claystones, cherts, limestones, tuffs, and breccias, with coralline limestone

The intrusion of granite into this series has further complicated matters, by providing a number of very interesting metamorphic rocks.

The clay-shales and mudstones of the series have been described by Professor David and Mr. Pittman, from the railway-cuttings east of Tamworth. They consist of very finely divided quartz with biotite, chlorite, and a little carbonaceous matter, with some iron-staining; felspar is present in some amount; sometimes, it may be of secondary origin. Occasionally, tourmaline and apatite are present, but rutile is remarkably rare. Frequently, the layers of deposition are very well marked. Radiolaria are present, in some specimens, in enormous abundance, about one million to the cubic inch, according to the above authors. Occasionally, they can be seen with a pocket lens, or even with the naked eye. The rocks are fine-grained, and evenly interbedded with bands of submarine tuff.

The cherts are banded light and darker green in colour, as a rule, though sometimes black. Very little can be determined from these in microscopical examination; they are more or less completely made up of radiolaria. Pressure has frequently forced all these into an oval shape. The material of the radiolaria is chiefly chalcedony, while the ground-mass of the rock contains finely granular quartz, felspar, epidote, and carbonate with or without carbonaceous matter. Analysis of a black chert showed that it contained 91·06 per cent. of silica(**3**, p.32). These cherts are intimately mixed with tuff; and the peculiar entanglement of chert and tuff, figured by Professor David and Mr. Pittman, is repeated all along the horizon of the cherts. In the neighbourhood of Horsearm Creek, Attunga, these rocks have been metamorphosed by the intruding granite. A considerable variety of specimens may be obtained, but few have been studied as yet. It has been considerably recrystallised, and is now a mosaic of quartz and acid felspar, chiefly water-clear albite, dotted with numerous, small, brown biotite-flakes. The aluminous portion of the rock has been segregated into needles of sillimanite, pale brown in colour, and very abundant. A little magnetite is also present.

The breccias are generally greenish in colour, and consist of finely divided, volcanic material, with large, angular pieces of radiolarian chert, which are not infrequently much bleached around their edges. A few limestone-fragments are sometimes present. The igneous fragments consist of finely crystallised, vesicular, or hypohyaline spilites and andesites, which are sometimes little more than pumice. The vesicles of the pumice are filled in with calcite, chlorite, and epidote. There are also crystals and grains of plagioclase and augite, that might have been derived from a dolerite, rounded or angular fragments of quartz, rarely a little orthoclase.

The chief difference between the breccias and the tuffs is that the latter are finer-grained, and more usually consist of single minerals than rock-fragments. On the other hand, by increase in size of the fragments, the breccias pass into the agglomerate-type. Radiolaria are sometimes present in these rocks, occasionally perfectly preserved.

The tuffs are more rare in the Tamworth Series than the breccia, but are more important in the rocks of the Nundle Beds; they are greyish or brownish in colour, with an even, medium grain-size, with occasionally larger felspars. They consist of fragments and crystals of andesine, augite, which is decomposing to actinolite and chlorite, less commonly quartz, also fragments of chert, and pilotaxitic and hyalopilitic spilite with chlorite-filled vesicles. The ground-mass consists of finely divided material of the same composition. Occasionally, radiolarian casts are observable. Magnetite, pyrites, epidote, and carbonates are developed to a varying amount. The tuffs differ from one another in the amount of augite and quartz, the perfect crystal-outline, or the fractured or rounded nature of the mineral-grains, the proportion between base and large grains, and the nature of the volcanic rock-fragments. In one tuff, occurring with the limestone at Attunga (M.B., 147), the volcanic fragments are of an extremely basic glass, crowded with dusty magnetite and felspar-microlites. A similar inclusion has been observed in the breccia near Bingara. There are, in addition, a few fragments of the usual type of lava and radiolarian chert.

The chief mineral-particles are large plagioclase-grains, with a few quartzes, suggesting origin from a grano-dioritic rock.

Where the Moonbi granite intrudes into these rocks, some interesting contact-rocks are developed. They have been crushed, and recrystallised into a fine mosaic of quartz and plagioclase, with larger crystals of the latter mineral. The ferromagnesian portion appears as green hornblende or actinolite. The foreign fragments have suffered more or less alteration. Sometimes, when easily affected, they appear only as minutely comminuted areas, or the quartz-grains are crushed to single, small, clear mosaics. The augite-crystals and grains pass into hornblende, and epidote or clinozoisite is developed. The felspar-fragments generally seem to suffer least, and occasionally they are enlarged. The fragments of spilite are more or less sheared, and their original augite is changed to actinolite. The most advanced stage, in the alteration of these rocks, appears to be the development of long bands of green hornblende, and biotite running irregularly parallel through the finer-grained ground-mass.

Specimens N.T., 460-465, exemplify this series of rocks, which will repay more detailed study.

The limestones of the Tamworth Series are of two kinds. The radiolarian limestone, described by Messrs. David and Pittman, and the purer, coralline limestone. The former, they say, is a dark bluish-grey rock, weathering into a deep chocolate-brown, pulverent crust, with greenish patches. The greater part of the rock is insoluble in hydrochloric acid; no primary quartz is present. In some examples, there are fragments of a chiastolite-bearing clay-shale, and patches of chalcedonic quartz. The radiolarian tests have their original substance preserved, in most cases, lie imbedded in calcite, and are filled with the same material. Generally, the tests are broken, the spines and outer tests suffering more than the medullary tests.

Near the Cuerindi homestead, on Hall's Creek (Manilla), a similar, brown, weathering-grey limestone occurs [M.B., 65]. It consists very largely of tuffaceous material, such as fragments of spilite, felspar-crystals, and grains of quartz.

The coralline limestone has been described as being of a greyish-blue character, near Bowling Alley Point. It is associated with tuffs, and contains a considerable amount of foreign, insoluble matter. In places, it has been entirely swamped by spilites and breccias, and is represented by the occurrence of isolated fragments of limestone, frequently fossiliferous, in these two pyrogenic rocks. Southwards, on Folly Creek, white, crystalline limestone occurs, containing bands of insoluble, siliceous material. Northwards, on Black Jack, the rock is a pinkish, brecciated marble, with much secondary calcite. Further north, white and pink crystalline limestone occurs, near Moonbi, but it is much altered by contact with the granite. Altered limestones, again, occur at Carmichael's farm, east of Tamworth. The crystalline limestones of Tamworth are greyish in colour, and stretch northwards to Attunga, where they are greatly altered by contact with the granite, in two localities. Further northwards, the limestones are unaltered. The few specimens of this limestone that have been analysed, all show a surprisingly small percentage of magnesia. The following are the figures for some of these rocks, obtained from Mr. Carne's "Copper Mining Industry in New South Wales," pp.325 and 332(**47**).

	Warialda, Kelly's Gully.	Warialda, Hamilton's.	Near Gulf Creek.
$CaCo_3$	98·28	98·07	92·35
$MgCO_3$ & undetermined	0·08	0·43	0·37
Fe_2O_3 and Al_2O_3 ...	0·22	0·28	1·60
Gangue	1·42	1·22	5·68
	100·00	100·00	100·00

At Moonbi, Tamworth, and Attunga, where the limestone is invaded by granite, some very interesting rocks occur.

The Moonbi rocks form an intricate complex, and, as yet, have been little studied. Besides the altered forms of the more or less pure limestones, there are several rocks which probably originated from calcareous shales. Of these, M.B., 172, and 173, are most peculiar. The former contains a ground-mass of finely-divided quartz and green omphacite, with a little felspar and bands of coarse oligoclase, wollastonite, irregularly shaped diopside and calcite. A few, large, clear plates of scapolite are present. Irregular patches of sieve-like garnet occur in the ground-mass, full of inclusions of diopside, and there is also a little irregularly shaped vesuvianite.

M.B., 173, is a dark green rock, with lighter, yellowish-green patches, containing small aggregates of macroscopic crystals of epidote and plagioclase. The main mass of the rock consists of a fine mosaic of quartz, with dusty orthoclase and some plagioclase, and much irregularly shaped, partly sieve-like epidote. A little zircon is also present.

The limestones at Carmichael's, near Tamworth, furnish several interesting specimens. Rocks, like N.T., 444, consist of brownish garnet in a grey, silicate matter, set in a matrix of crystalline calcite. The silicate matter is made up of very finely divided orthoclase and oligoclase, quartz, wollastonite, and diopside. The garnets are pale brown, and are filled, sieve-like, with inclusions of the above minerals. In addition, there are small, square patches of more coarsely crystallised wollastonite, frequently associated with a little garnet and calcite. There are also grey-green, silicate rocks, containing coral-fossils (*Syringopora?*), the tubes of which have been filled with wollastonite, which, weathering more quickly than the main mass, exposes the markings on the coral tube-walls, in naturally etched specimens. The matrix differs from the last rock in containing green omphacite.

The rocks that occur on Horsearm Creek, near Attunga, are most handsome. They are chiefly composed of a cinnamon-brown garnet, frequently forming idiomorphic crystals. They are charged with chalcopyrite, which decomposes to azurite, colouring the rock very brilliantly. Certain parts of the rock become dark or black by the development of much magnetite with the chalcopyrite. One of the rocks [M.B., 128] consists chiefly of brown or reddish garnet, very irregular in outline, and full of inclusions of calcite, hornblende passing to chlorite, small plates of brown mica, chloritising omphacite, and irregular reddish-brown areas, recalling the pleochroic decomposition-products of olivine in certain gabbros and basalts, though not quite like iddingsite. Magnetite, which is very abundant, and chalcopyrite, occur in irregular grains, the former having been the earlier to crystallise. The carbonate-matrix contains the same ferromagnesian minerals, and small grains of sphene. Another example contains calcite, garnet, and diopside only; while several are analogous to N.T., 444, at Carmichael's Farm. They consist of orthoclase and albite in intimate mosaic, together with finely granular quartz. Orthoclase predominates. Green diopside occurs, scattered about in irregular, isolated but optically continuous areas. Garnet forms highly irregular plates, and is sieve-like on the margin; it may contain groups of narrow calcite-plates.

Some rocks also occur, differing from the above in the presence of granular, green omphacite, and the dominance of oligoclase over orthoclase.

These rocks are distinguished from all the other limestones by the character of the garnets, and the presence of the copper-minerals.

The small patch of altered limestones in Portion 159, of Attunga Parish, is the most complex. All the specimens to be described, occurred within a yard or two of each other, and no granite was seen, *in situ,* nearer than two miles away. It is probable that this small occurrence of metamorphic limestone lies at the extremity of an apophysis of the granite-massif, and has been in a favourable situation to receive much new material from the granitic emanations.

The intrusive rock is probably M.B., 167, a grey rock, with pink felspar-crystals. It consists of oligoclase and orthoclase, both coarsely granular, and the former showing well marked pericline twinning. There are also numerous, large grains of sphene. Much of the limestone has been absorbed, and has given rise to diopside in numerous prisms, and phlogopite in small flakes. Both of these are decomposing to chlorite. Birefringent garnets also occur. Much carbonate still remains, in one slice forming about one-third of the rock. The action of pneumatolysis is shown in the passage of the plagioclase into scapolite, which is commencing to form in isolated, but optically parallel plates throughout the felspar.

The limestone, before its alteration, was almost pure, and, in all probability, it had a composition little different from those cited above.

The types of altered limestones are many and varied, but a few will be described here.

M.B., 164, is a glistening, white, crystalline rock, consisting chiefly of wollastonite, often twinned, diopside, a little dark green, pleochroic hornblende, and some calcite. Orthoclase occurs interstitially, but is very decomposed. There are a few birefringent, reddish-brown garnet-grains, and some irregular grains of a highly birefringent, optically positive, uniaxial, pleochroic mineral, that is probably cassiterite, its refractive index being less than that of rutile.

There are also white crystalline rocks studded with idiomorphic and granular vesuvianite. Microscopically examined, the vesuvianite generally shows a sieve-like structure, containing numerous inclusions of phlogopite and calcite. It is set in a ground-mass composed of calcite, orthoclase, and prehnite, the last showing undulose extinction. The vesuvianite is zoned, and where it exhibits crystal-outline, there are peculiar, comb-like extensions from the crystal-surface into the matrix. The orthoclase is curiously stippled, and the carbonate is scattered through the rock in sharply bounded plates, elongated along (0001), and frequently well terminated. It also forms rhombohedra, and irregular grains. A small amount of irregular, brown garnet also is present. There are, in addition, a few small rods, and shorter prisms of colourless diopside.

Another type of rock, here, is the prehnite-garnet rock, which consists entirely of these two minerals, together with a few, irregular carbonate-grains or crystals, and a little, brown phlogopite. The garnets are in rounded grains and dodecahedral crystals, red-brown in the centre but paler on the periphery. They lie in a matrix of prehnite, with undulose extinction, and rarely showing spherulitic arrangement (Plate xxix., Fig. 16). The garnets are often surrounded by one or two thin shells of garnet, separated from the main crystals by prehnite, sometimes optically continuous with that of the ground-mass. Finally may be noticed, a pink crystalline rock, studded with deep red garnets [M.B., 165]. This is a most complex rock. It consists of beautifully zoned, red garnets, a small amount of vesuvianite, with very anomalous, unusually high, birefringence, and positive optical character (a rare feature); a considerable amount of orthoclase, and also albite, some calcite, and a brightly polarising ground-mass, part of which is wollastonite, but which has undergone some alteration, and recrystallisation that cannot be traced throughout in the single specimen available.

If the determination of cassiterite in 164 be correct, it is evident that these rocks must have been affected by highly active, pneumatolytic solutions.

(3) The Baldwin Agglomerates present an exaggeration of the features of the Tamworth breccias. In the northern part of Hall's Creek, near Bingara, where they become finer-grained, it is impossible to distinguish them from the breccias, but, further south, the size of the inclusions and their general characters become very distinct. They were partially described by Messrs. David and Pittman(3), who state that the matrix of the Cleary's Hill rock has the appearance of the interstratified tuffs. It consists of much fractured and corroded, macroscopic crystals of felspar and augite, and calcite, with interstitial felsitic material, and here and there small fragments of microcrystalline felsite, and larger, pebble-like lumps of porphyritic andesite. The felspar is plagioclase, and, in addition, quartz, ilmenite, pyrites, and epidote occur. In other instances, much chlorite and prehnite are found. In this matrix, a wide variety of pebbles is found. The following may be noticed: granite and quartz-porphyry (rarely); keratophyres with phenocrystic albite and orthoclase(?), in a felsitic, sometimes spherulitic, base; black keratophyre with albite-orthoclase and augite-crystals in a glassy, fluidal base, enclosing fragments of other glassy keratophyres, rich in magnetite; trachytes; spilites, very similar to those in the Eastern Series; trachy-andesites, with car-

bonate replacements of their ferromagnesian minerals, andesites, porphyritic, holocrystalline, or more or less glassy, vesicular or even pumiceous, with the cavities filled with calcite and chlorite; basalts, vesicular or glassy, differing from the andesite only in the amount of magnetite; augite-diorite porphyries, as described by David and Pittman, with phenocrysts of plagioclase, orthoclase, augite, and sphene in a greyish felsitic ground-mass (in hand-specimen, this rock resembles the malchites of the Nundle district, but the microscope shows it to be distinct, and allied to the Tamworth tuffs); dolerite containing granophyric quartz, and very similar to the rock of Hanging Rock, near Nundle; chert, in large or small angular fragments, often radiolarian; limestone, either in dense blue rocks or more crystalline, sometimes containing fossils, as *Heliolites, Syringopora, Stromatopora* and crinoid-stems, or indeterminable traces of microscopic forms; and numerous, isolated crystals or fragments of felspar, quartz, and augite.

These rocks rest directly on radiolarian rocks at Tamworth; they rest on, or are interbedded with the same cherts west of Bingara; they contain interstratified bands of chert with radiolaria, or, as in Cobbadah Creek Gorge, fine-grained tuffs, composed of minute felspar-laths with pyroxene, and secondary chlorite and prehnite in a very finely granular ground-mass of quartz and felspathic material, which also contains some radiolarian casts. In three localities, flows of porphyritic spilite-lava have been found, inter bedded in these agglomerates.

(4) The Barraba Series consists of mudstones, tuffs, breccias, and limestones. The mudstones and claystones do not differ in microscopical character from those of the Tamworth Series, to any great amount. The chief changes are in the coarse grain of the majority of the series, and in the abundance of narrow bands of felspathic tuff. The rocks are well bedded, and consist of fragments of quartz and felspar, with a little chlorite and an irresolvable base, the whole stained more or less with iron-oxide. Carbonaceous matter may, or may not, be present. In certain rocks, it is very abundant. The tuff is interlaminated, usually in very thin bands, perhaps

only 1 mm., across, but sometimes increasing up to a yard or more in width. The rocks are sometimes richly radiolarian, and at other times quite free from these organisms. The only apparent distinction is in the size of the constituent particles, for the radiolaria do not usually occur in rocks in which the grains of sediment, quartz, etc., are more than about one-third of the diameter of a radiolarian test, and are best preserved in rocks of the finest grain-size. This rule does not hold, however, for the tuffaceous bands, and abundant radiolaria may be present in association with quite large felspar-grains, as will be seen in Plate xxix., Fig. 18, from a rock [M.B., 71], occurring one mile east of Barraba. Nor is it true that the radiolaria are most abundant in the fine-grained rocks; the well preserved radiolaria of the exceedingly fine-grained rock [M.B., —], occurring near the limestone on Hall's Creek, 15 miles south of Bingara, are not nearly so abundant as in the more coarsely-grained rocks of Barraba and Upper Manilla, or as in the rock, N.T., 410, from near Nundle, shown in Plate xxix., Fig. 17, which exhibits the effect of crushing. This rock is very rich in carbonaceous matter.

The breccias and agglomerates occur in narrow bands here and there, but need no special description, being very similar to the Baldwin agglomerates, but are not so coarsely grained. Locally also, the presence of pebbly and sandy bands has been noted among the Barraba rocks.

The tuffs are remarkable for the sharply bounded character of their grains and in their acidity, for they are albite-oligoclases with a refractive index distinctly lower than that of Canada balsam. In some rocks, however, the plagioclase is a more basic oligoclase. In some specimens, a few grains of orthoclase occur. The felspathic tuff is usually a creamy-coloured rock, and sometimes it may contain plant-stems. Occasionally, there are very fresh, hard layers which, in hand-specimen, are most difficult to tell from true igneous felsite, and the intrusions would be mapped as sills, were it not for the absence of contact-effects. Such occurrences are found on Hawkin's Creek, near the Horton Road, west of Barraba, in the hills east of Upper Manilla, and, again, on the other side of the area of older rock to the east. These are almost identical, microscopically [see M.B., 76, and 263], and their clastic nature is quite obvious. They are chiefly acid plagioclase in crystals and grains, with a little quartz, and a finely felsitic groundmass. Considering the geological occurrence of the rock, there is a surprising amount of crushing and bending of the felspar. Magnetite, chlorite, epidote, and calcite occur in varying amounts; apatite very rarely. The impression given by the felspar-grains, that they have been derived from a granodiorite or diorite, is strengthened by the investigation of M.B., 63, a tuff on Cobbadah Creek, about one mile west of the serpentine, of which, however, the stratigraphical horizon is not known. It is practically a disintegrated diorite, consisting of hornblende, quartz, and minor amounts of colourless augite; biotite, orthoclase, magnetite, apatite, zircon, and pyrites, together with small fragments of cherty mudstone, and andesite. There is a small amount of fine-grained matrix composed of the same minerals, comminuted and decomposed. A rather similar rock occurs on Borah Creek, west of the Black Mountain fault.

The limestones of this series are a fairly constant feature, dark blue in colour, with a white or greyish weathering surface, They are exceedingly finely grained, and never show any sign of original, organic structure. Occasionally, there are a few lighter rhomboid or rectangular patches, which stand out on weathered surfaces, and are probably pseudomorphs, but the original mineral is quite indeterminable. There is more or less carbonaceous matter present, and sometimes finely divided quartz.

(5) The Burindi Series consists of mudstones, tuffs, agglomerates, and limestones, with occasional conglomerate-bands. The mudstones are indistinguishable from the coarser type of the Barraba Series, until the fossil-bearing horizons are reached, where the rock becomes finer-grained, and darker green in colour, probably due to increase in the amount of chlorite and carbonaceous matter. The tuffs and agglomerates, also, are identical with those of the Barraba Series. A rock, the stratigraphical position of which is quite uncertain, though mapped as of Burindi age, is that

occurring adjacent to the serpentine, west of Gulf Creek. It should possibly be classed with the Rocky Creek beds, for it consists of a mass of rhyolite and trachyte-fragments of several types, with quartz-grains in a finely divided quartz and felspar ground-mass [N.T., 483].

The limestones are of several types. Where fossiferous, they are remarkable for being composed almost entirely of crinoid-ossicles, and are sometimes quite pure, at other times very ferruginous. Oolitic limestones occur at several localities. That near the junction of the Horton River with Rocky Creek, was briefly described by Mr. Etheridge (see Stonier's Map, 6d). Oolitic limestones occur also near Mr. Hamilton's house on Oakey Creek, five miles south of Warialda. That near the serpentine, half a mile east of the house, consists of normal, zoned, radially fibrous oolites, about 3 mm., in diameter, in a tuffaceous matrix of quartz-grains, felspars, chlorite, and fragments of a basaltic rock. Crinoid-ossicles are also present abundantly.

Some limestones of this series, as, for instance, a small band by the Hall's Creek Falls [M.B., 284] are very impure, full of pebbles, weathering with a brown crust, and are indistinguishable from the Devonian limestone occurring near Cuerindi [M.B., 85, p. 711]. Nothing especially noteworthy, petrologically, is to be remarked in the very fossilferous *Lithostrotion* limestone near here. It is fairly pure and crystalline.

(6) The Rocky Creek Series consists of volcanic flows, tuffs, conglomerates, grits, sandstones, and cherty rocks. The clastic rocks all contain fragments of the interbedded lavas, and of other igneous rocks also. Even the finest-grained cherty rocks contain fragments of granite. There are not, however, as far as has been noted, any red jaspers or other rocks comparable with the rocks of the Eastern series, to be found as inclusions in the Rocky Creek beds. The suspicion that arose, in one or two cases, has been dispelled on microscopical examination. The following are micropetrological notes on a few slides:—

Cherts: [M.B., 16]. Interbedded in the conglomerates on Rocky Creek. Composed of very finely grained, angular quartz and felspar-fragments, with a very little kaolin, chlorite, and magnetite. Fragments of trachyte and granite, and, occasionally, large, broken crystal-grains.

Jasper: [M.B., 120]. Pebble in conglomerate; composed of very fine, even-grained quartz, and abundant biotite; no signs of radiolaria are visible.

Pebbles of igneous rocks: all the rhyolites described in the earlier portion of this chapter (p. ,). Many varieties of trachyte and rhyolite-tuff in various stages of decomposition. Several kinds of granitic rock, *e.g.*, M.B., 8, a rock composed of phenocrysts of felspar and quartz, in a coarse-grained, granophyric matrix, with a little magnetite, sphene, and chlorite after biotite. Also, M.B., 347, a granodiorite with included fragments of a finer-grained rock (microdiorite), differing from its host only in grain-size, the rarity of quartz, and the abundance of the ferromagnesian minerals. It consists of hornblende, magnetite, sphene, and oligoclase, with a little orthoclase.

Aplites and quartz or felspar porphyries are abundant. Rocks of a basic character, however, are notably absent.

I am indebted to Mr. A. B. Walkom, B.Sc., for sections of many of these rocks, and for comparison of the rhyolites with those he has studied from Pokolbin, 200 miles to the south.

(7) The Permo-Carboniferous rocks are sandstone, in Bowling Point and in the Nandewar region. The former consists of abundant, rounded or subangular, fairly fresh grains of plagioclase, with smaller, angular grains of quartz; fragments of keratophyre (?) and spilite in a fine-grained, felspathic matrix, coloured with chlorite, limonite, etc. There are no signs of straining or crushing (Slide, N.T., 204).

Rocks of Uncertain Origin.—A most remarkable rock occurs, forming a large, oval patch in the serpentine, at the head of Yellow Rock Creek, south of Crow Mountain. It consists of a white, granular matrix, containing long, green, prismatic (?) crystals. Microscopically [M.B., 231, and 262], it is seen to consist chiefly of zoisite and clinozoisite. The former is the more abundant. It has a well marked, prismatic habit and cleavage, and characteristic, low, anomalous birefringence, and is in grains 1 mm., or more, in diameter. The clinozoisite has a less well-marked cleavage, and its polarisation-tints pass zonally from low outer colours, to bright second order tints, in the kernel of the grain. In addition, there are large flakes of white mica, and, interstitially, large plates of felspar, chiefly oligoclase and possibly some orthoclase. Large grains of apatite are present in some amount, and there are a few grains of sphene; a very little calcite is also present. The greenish mineral, though in hand-specimen it suggests hornblende, is microscopically without definite structure, consisting of aggregated chlorite-spherulites.

The origin of this rock is unknown; the only suggestion, at all reasonable, seems to be, that it is a highly altered gabbro-pegmatite; but that is quite unproven.

The statement, that glaucophane-schist occurs near Barraba, has appeared in print. The specimen at first attributed to the Barraba district, later was stated to some from Gilgai, near Inverell; and the specimen was carefully described by Mr. H. P. White(48) as from that locality. Mr. L. A. Cotton informs me, that he knows of no locality, near Gilgai, where it might have occurred; and no signs of such rocks were found near Barraba by me, though, mindful of Ransome's discoveries in Angel Island(49), I carefully searched the whole length of the serpentine-belt for glaucophane-rock. Possibly it was brought by a miner from New Caledonia, at the northern end of which, such rocks are abundant.

BIBLIOGRAPHY;

Additional to References cited in Parts i. and ii.

34. Geol. Survey of Great Britain. "The Geology of the Launceston and Tavistock District Sheet." Memoir 337, p.63.

35. Pratt, J. H., and Lewis, J. V.—"Corundum and Peridotites." Bull. Geol. Surv. North Carolina, No.1, p.30.

36. Bonney, T. G., and Raisin, C. A.—"The Microscopical Structure of the Minerals forming Serpentine, and their Relation to its History." Quart. Journ. Geol. Soc., 1905, pp.690-715.

37. Lacroix, A.—"La Minéralogie de France et ses Colonies."

38. Benson, W. N.—"The Volcanic Necks of Hornsby and Dundas." Journ. Proc. Roy. Soc. N. S. Wales, 1910, p.509.

39. Dixon, W. A.—Ann. Rept. Dept. Mines N. S. Wales, 1879.

40. Flett, J. S., and Hill, J. B.—"The Geology of the Lizard and Meneage." Memoirs Geol. Surv. Great Britain, 1912.

41. Murgoci, G.—Ueber die Einschlusse von Granatvesuvianfels in dem Serpentin des Paringû Massifs." Bulletinul de Sciinte, Bukarest. ix. Jahrgang, 1900.

42. Judd, J. W.—"On some simple Massive Minerals (Crystalline Rocks) from India and Australia." Mineralogical Magazine, 1895, p.63.

43. Bell, J. M., Marshall, P., and Clarke, E. DeC.—"The Geology of the Dun Mountain Subdivision." Bull. Geol. Surv. of New Zealand, No.12, 1911, pp.31-35.

44. Marshall, P.—"Note on the Gabbro of Dun Mountain." Trans. N.Z. Inst. ——, pp.320-322. Also, "The Geology of the Dun Mountain Subdivision." Bull. Geol. Survey of New Zealand, No.12, 1911, pp.31-35.

46. Card, G. W.—"An Eclogite-bearing Breccia from the Bingara Diamond Fields." Rec. Geol. Surv. N. S. Wales, Vol. vii., p.39.

46. Jevons, Jensen, Sussmilch, and Taylor.—"Geology and Petrology of the Prospect Intrusion." Journ. Proc. Roy. Soc. N. S. Wales, 1911, pp.445-553.

47. Carne, J. E.—"The Copper Mining Industry." Geol. Surv. N. S. Wales. Mineral Resources, No. 6, pp.322-6.

48. White, H. P.—"Chemical Notes on Glaucophane Schists from Australia and New Caledonia." Rec. Geol. Surv. N. S. Wales, Vol. vii., p.47.

49. Ransome, F. L.—"The Geology of Angel Island." Bull. Dept. Geol., Univ. of California, Vol. i., No.7, pp.198-224(1894).

EXPLANATION OF PLATES XXVII.-XXIX.

Plate xxvii. *Photomicrographs.*

Fig.1.—Spilite [N.T., 415]; Frenchman's Spur, Nundle (×20).

Fig.2.—Spilite, rapidly chilled [N.T., 31]; Moonlight Hill, Nundle (×100).

Fig.3.—Dolerite with primary labradorite, and abundant ilmenite [N.T., 501]; Red Rock, Munro's Creek, Bowling Alley Point (×12).

Fig.4.—Albitised dolerite, with spongy felspar [N.T., 327]; Hanging Rock, Nundle (×22) [polarised light].

Fig.5.—Flow-structure in lava [M.B.,233]; Jerry's Creek, Crow Mountain.

Fig.6.—Spherulitic rhyolite, with flow-structure [M.B., 1]; pebble in conglomerates, Rocky Creek (×20) [polarised light].

Plate xxviii. *Photomicrographs.*

Fig. 7.—Bastite in schistose serpentine, with chrysotile-veins; "North of Tamworth" (× 12) [polarised light].

Fig. 8.—Antigorite commencing to form in normal mesh-serpentine [N.T., 258]; Bowling Alley Point (× 22) [polarised light].

Fig. 9.—Antigorite completely replacing normal serpentine, and commencing to form in bastite [N.T., 383]; Bowling Alley Point (× 10) [polarised light].

Fig. 10.—Tremolite-antigorite-chromite rocks [M.B., 319]; Hall's Creek, 15 miles south of Bingara (× 12) [polarised light].

Fig. 11.—Multiply twinned clinozoisite in saussurite-gabbros [M.B., 181]; 3 miles W.S.W. of Gulf Creek (× 10) [polarised light].

Fig. 12.—Amphibolite passing into antigorite, showing multiple twinning of the hornblende [M.B., 186]; Paling Yard, Barraba (× 20) [polarised light].

Plate xxix. *Photomicrographs.*

Fig. 13.—Intrusion of plagioclase-porphyry (left) into spilite (right) [N.T., 89]; Bowling Alley Point (× 12).

Fig. 14.—Vosgesite [M.B., 144]; 6 miles north of Attunga (× 22).

Fig. 15.—Camptonite [M.B., 228]; near Crow Mountain (× 21).

Fig. 16.—Prehnite and garnet in contact-altered limestone [M.B., 163]; Attunga (× 11) [polarised light].

Fig. 17.—Radiolarian mudstone [N.T., 410]; Nundle (× 20).

Fig. 18.—Radiolarian mudstone with felspathic (tuffaceous ?) bands [M.B., 71]; Barraba (× 22).

CORRIGENDA.

P.662, line 5—*for* Plates xxv.-xxvii., *read* Plates xxvii.-xxix.

Pp.664, 666, 667, 669, in the references to figs.1-6—*for* Pl. xxv., *read* Pl. xxvii.

Pp.673, 674, 675, 681, 689, in the references to figs.7-11—*for* Pl. xxvi., *read* Pl. xxviii.

Pp.694, 697, 699, in the references to figs.13-15—*for* Pl. xxvii., *read* Pl. xxix.

CONTRIBUTIONS TO OUR KNOWLEDGE OF SOIL-FERTILITY. Nos. vii. to xi.

By R. Greig-Smith, D.Sc., Macleay Bacteriologist to the Society.

vii. *The Combined Action of Disinfectants and Heat upon Soils.*

In previous researches, I have shown that the action of a moderate heat upon soil, differs from that of the volatile disinfectants, so far as the subsequent growth of bacteria is concerned. According to certain authors, the results should be similar, because both bring about the same result, namely, the destruction of the phagocytic protozoa. If the result is the same, it should be immaterial, in cases where the soil has been treated both with disinfectant and heat, whether the one is applied before the other or *vice-versa*. A preliminary test, with a garden-soil, showed a considerable difference in this respect, and led to further work upon the matter.

At first, an alluvial soil was used. The heating consisted of exposing it to 60°-65° for 30 minutes, and, where necessary, it was treated with 5% chloroform overnight. The tests were moistened with sterile water to bring the moisture to 16% and the temperature of incubation was that of the room, viz., 15°, which gradually rose to 20° as the season advanced.

Experiment i.

Alluvial soil.	Bacteria in millions per gram of air-dried soil.				
	Start.	7	15	43	64 days.
Untreated	1·2	4·8	5·3	2·1	1·5
Heated only	1·1	3·0	7·3	4·6	5·1
Heated, then chloroformed ..	1·0	4·8	6·1	5·4	6·9
Chloroformed only	...	3·1	7·2	6·2	6·8
Chloroformed, then heated ...	...	3·4	6·8	6·0	7·3

As the differences were less than had been expected, a second experiment was made, in which the moisture was brought to 19% with sterile water. This was equivalent to half-saturation.

EXPERIMENT ii.

Alluvial soil.	Bacteria in millions per gram of air-dry soil.				
	5	11	18	32	61 days.
Untreated	2·9	2·5	1·6	1·7	1·8
Heated only	4·0	2·9	1·7	2·3	2·5
Heated, then chloroformed .	5·1	6·7	5·0	6·9	5·6
Chloroformed	5·6	9·7	9·8	9·4	7·6
Chloroformed, then heated ..	5·8	7·1	6·8	8·6	7·1

These experiments show that there is only a slight difference effected by the different treatments, the small difference, however, being in favour of the preliminary treatment with chloroform. As, according to my view, the differences produced by the antiseptic treatment are caused largely by the native agricere, I continued the experiments with a soil richer in this substance than the alluvial soil which had been used.

An air-dried garden-soil was heated for 45 minutes at 62°-68°, or treated overnight with 5% chloroform. In the first experiment, No. iii., the soils were moistened with a soil-suspension containing an equivalent of 1% of raw soil, while, in the second, sterile water was employed. The chloroformed soils were difficult to moisten, and accordingly were thoroughly stirred and gently pressed flat.

EXPERIMENT iii.

Garden-soil.	Bacteria in millions per gram of air-dry soil.		
	5	11	75 days.
Control	4·2	5·6	1·5
Heated only	4·2	8·4	1·8
Heated, then chloroformed ...	36	48	8·4
Chloroformed only	78	47	17·2
Chloroformed, then heated ...	80	67	16·4

EXPERIMENT iv.

Garden-soil.	Bacteria in millions per gram of air-dry soil.			
	6	12	16	37 days.
Control	3·6	...	2·4	1·1
Heated only	3·6	...	3·6	2·2
Heated, then chloroformed ...	21	18	10·6	10·6
Chloroformed only	37	32	31·5	32·2
Chloroformed, then heated ..	33	33	32·5	32·2

The experiments show decided differences between the sets according to the order of treatment. The effect of heat is small compared with that of chloroform, and in the tests receiving the double treatment, the differences between heat then chloroform, and chloroform then heat, are marked; and it is fair to conclude that the order of treatment is not immaterial, when a soil is heated and treated with a volatile disinfectant. Why this should be so, is not clear.

The great differences in the counts of the soils treated with heat alone, and chloroform alone, especially when the soils are fairly rich in organic matter, show that the volatile disinfectant makes more nutriment available for the bacteria. The study of the nutritive effects of extracts of soils before, and after chloroform-treatment, frequently shows this in a marked manner. (Posted p. 733.)

After treatment with a volatile antiseptic, the particles of soil are undoubtedly altered physically, for such soils are difficult to wet. This has been shown by Egorow, and is confirmed by the following observations upon the capillary rise of water.

CAPILLARY POWER.

	2	20	50	73	145 hours.
Normal garden-soil ..	11·3	17	21	23	29 cm.
Chloroformed garden-soil.	0·9	2·5	2·7	3	3 cm.

Once the soil is thoroughly wetted, water probably passes as freely through it as through an untreated soil. At any rate, experiments upon the comparative rate of evaporation of water, in soils, bore this out. The trouble is in getting the treated soil thoroughly moistened, for unless this is done, the evaporation, as compared with that of an untreated soil, is slower or faster, according to whether the soil is wetted from below or from above. A thoroughly wetted and chloroformed soil lost slightly more during the first three days, but afterwards kept pace with the untreated soil.

viii. *The Toxins of Soils.*

In former papers of this series, I have shown that there are, in soils, substances which act as toxins towards bacteria. Their effect is not so clearly shown in soils themselves as in extracts obtained from them. The toxic extract, obtained by digesting soils with water and filtering through porcelain, showed its activity by either reducing the numbers of a sensitive bacterium, such as *Bac. prodigiosus,* or by retarding the speed of multiplication of the ordinary soil-bacteria. The sensitive *Bac. prodigiosus* was used, because it is typical of a class of soil-bacteria; it can be readily counted when grown upon plates, it can be evenly distributed in water, and it grows well in fluid and solid media.

The growth of bacteria, in soil-extracts, depends upon at least two factors, the nutriment in the extract, and the toxins. The former acts as an accelerant, increasing the number; while the latter behaves as a depressant, either destroying or hindering growth. In all extracts, these two play their respective parts, so that the final result will depend upon the relative preponderance of the one or the other. So far as is known, the nutrients are stable, and their effect is, therefore, constant. The toxins, on the other hand, are unstable, and according to the temperature, decay with greater or less rapidly. They are destroyed by heat and by sunlight.

As further information regarding the behaviour of the toxins should be interesting, and possibly useful, it was decided to determine the effect of extracting the soil with water under varying conditions; and, if possible, of devising a method for measuring the toxicity of soils.

The method of extracting the toxins consists in taking a quantity of the soil, and shaking it with water, 50 times every five minutes for an hour. With a very toxic soil, this is unnecessary, but with soils in which the toxicity is masked by the nutrients, the full shaking is required.

EXPERIMENT i.

	10 bacteria became	
	Stored soil.	Raw soil.
Shaken 600 times in one hour, then filtered .	125	13
Shaken 20 times in an hour, then filtered ..	290	...
Shaken 10 times, and filtered at once	...	55

The extract is then filtered through paper on the filter-pump, the first turbid runnings being returned, and the clear filtrate is filtered through a Pasteur-Chamberland F. candle. The first 20-30 c.c., are thrown away. Ten c.c. of the filtrate are pipetted into a Freudenreich flask, and seeded with 1 c.c. of a suspension of *Bac. prodigiosus,* containing a suitable number of cells.* The Freudenreich flasks are incubated overnight, and counts made by the plate-method; one-fortieth c.c. of several dilutions are smeared on set agar-plates, dried at 37°, and incubated at 28°.

In the following experiment, an air-dried garden-soil, which had been stored in the laboratory for three weeks, was extracted with distilled water.

EXPERIMENT ii.

	100 grams of dry garden-soil shaken with distilled water.	1,000 bacteria after 20 hours at 28° became
1.	75 c.c.	420
2.	100 c.c.	0
3.	150 c.c.	123
4.	200 c.c.	202
5.	250 c.c.	5,580
6.	Water-control	14

* A heaped 2 mm. loop of a 20 hours' agar-culture distributed in 10 c.c. of water by blowing, is centrifugalised until the clumps are sedimented; one c.c. of the supernatant suspension is shaken with 100 c.c. of water, and one to two c.c. of this are shaken with 100 c.c. One c.c. of this last dilution, when added to 10 c.c., and one-fortieth c.c. taken, gives a count of about 200 cells.

The graph of these numbers is interesting, but the water-control showed that distilled water had a destructive action upon the added bacteria; and as this was not desired, tap-water was subsequently employed.

In the next experiment, the soil had been air-dried for two days.

EXPERIMENT iii.

	100 grams of dry garden-soil with tap-water.	1,000 bacteria became
1.	75 c.c.	3
2.	100 c.c.	115
3.	150 c.c.	12
4.	200 c.c.	12
5.	250 c.c.	168
6.	Water-control	1,093

It is clear that the soil is toxic in all proportions used. In No. 2, the plates showed that the culture was impure, and this suggested that possibly extraneous bacteria might have an accelerating influence upon *Bac. prodigiosus.* This was tested in the following experiment, which was made nine days later, the soil having been stored for 11 days. In the second part, a drop of the unfiltered extract of No. 1 was added to each test.

EXPERIMENT iv.

100 grams air-dried garden soil, stored 11 days, with water.	1,000 bacteria in 20 hours, at 28°, became	in the presence of mixed soil-bacteria
1. 80 c.c.	125	7
2. 100 c.c. ...	70	33
3. 150 c.c.	1,900	1,600
4. 200 c.c.	16,200	16,500
5. Water-control ...	7,200	...

The soil furnished toxic extracts, although when compared with Experiment iii., the toxicity appears to be diminishing. The presence of the mixed soil-bacteria did not materially influence the growth of *Bac. prodigiosus.* Five days later, a further test of the toxicity was made.

Experiment v.

100 grams air-dried garden-soil stored 16 days, with water.	1,000 bacteria, in 20 hours, at 28°, became	
		extract diluted one-half with water.
1. 40 c.c.	200,000	...
2. 50 c.c.	1,400,000	1,200,000
3. 80 c.c.	140	380
4. 100 c.c.	12	136
5. 150 c.c.	250	980
6. 200 c.c.	230,000	...
7. 800 c.c.	180,000	...
8. Water-control ...	15,600	...

Later experiments, with this specimen of air-dried soil, showed that, upon the twenty-ninth day of storage, the toxicity had diminished considerably.

The effect of dilution upon a toxic soil-extract was studied, in order to find out, if possible, the point of dilution at which the added bacteria maintained their numbers, or, at any rate, equalled the control or water-increase. Previous experiments had shown that dilution so weakened the activity of toxin, that the nutrients caused an increase. If a balanced action could be demonstrated, a road might be found to estimate the toxicity of soils. The first experiment in this direction was upon the same soil used in the last experiment, but it had been stored for 29 days.

Experiment vi.

Equal parts of soil and water.	10 bacteria in 21 hours at 28° became
Undiluted	10,000
Diluted 1 : 1	16,400
Diluted 1 : 3	8,300
Diluted 1 : 7	4,000
Diluted 1 : 15	200
Water-control	100

The loss of toxicity, by this specimen of soil, is shown by the thousandfold increase in the undiluted extract; 13 days before, the toxicity had produced a hundredfold decrease.

At this time, the soil in the garden had been subjected to heavy rains, about 4 inches having fallen in four days, and it was not expected that it would be toxic. A trial bore this out.

Experiment vii.

Equal parts of raw soil and water.	10 bacteria, in 19 hours, at 28°, became
Undiluted	500
Diluted 4 : 1	750
Diluted 3 : 2	125
Diluted 2 : 3	13
Diluted 1 : 4	150
Water-control	25

The loss of toxicity of raw soils, being coincident with the occurrence of heavy rains, has been already noted.* That it returns again upon the cessation of the rain, and the prevalence of drying winds, is shown in the next experiment, the soil, for which, was taken after a three days' spell of cool, dry S.-W. winds.

Experiment viii.

Equal parts of raw soil and water.	10 bacteria, in 19 hours, at 28°, became
1. Undiluted	13
2. Diluted 1 : 1...	2,540
3. Diluted 1 : 3...	1,670
4. Undiluted	55
5. Second extraction of 1	1,460
6. Water-control	70

The return of the toxicity of this specimen of soil, taken 12 days after that of Experiment vii., is evident; and that it is toxic, is shown in test No. 4, which differed from No. 1, in having been shaken only ten times, and immediately filtered. The residual soil from No. 1 was extracted a second time with the same quantity of water, *viz.*, 200 c.c. to 200 grams, and the filtrate was nutritive (No. 5).

After a dry spell of five days, garden-soil was air-dried in the laboratory for three hours, and was found to contain 3·5 % moisture. It was treated with chloroform overnight, and the dis-

* These Proceedings, 1911, p.684.

infectant aired off in the morning. The same soil, without treatment, as well as raw soil taken upon the following morning, were also tested.

EXPERIMENT ix.

	100 bacteria became		
	Extract full strength.	half-strength.	quarter-strength.
Partly dried soil taken 4/6/13 ...	4	4,500	3,200
The same chloroformed	3,000	3,600	40,800
Raw soil taken 5/6/13	15	30	850

The toxicity of the soil is undoubted, and portions were used with varying quantities of water for extraction. The effect of chloroforming the soil is well seen.*

Having obtained a toxic soil, the extraction, with varying amounts of water, was continued.

EXPERIMENT x.

100 grams soil, seven days old, with water.	100 bacteria became
1. 40	85,000
2. 50	300
3. 66	5
4. 100	(2,030)
5. 133	30
6. 200	30,150
7. Water-control	290

Five (22°) and eight (28°) days later, the same sample of soil was used, as the employment of fresh soil was prevented by the prevalence of rain. The tests were incubated overnight at 22° and at 28°.

EXPERIMENT xi.

100 grams soil, with water.	10 bacteria became			
	at 22°		at 28°	
	a	b	a	b
1. 50	530	500	6,600	7,200
2. 75	600	690	6,300	7,900
3. 100	160	530	5,800	(12,000)
4. 150	(1,170)	70	3,100	3,900
5. 200	60	40	3,700	4,700
6. 250	230	220	2,500	2,300
7. Water-control ...	40	12	90	100

* Compare these Proceedings, 1910, 814.

In this and the preceding experiment, the bracketed numbers are probably excessive. It is frequently found, in a series of tests, that one is out of what appears to be the normal sequence. For this reason, the last experiment was made in duplicate, so that a discrepancy might be allowed for.

It is seen that the toxicity of the soil, manifest in Experiments ix., and x., has disappeared by the twelfth day of storage, but although now nutritive, there is some confirmation of the toxicity being most evident when about equal parts of soil and water are taken.

The return of the toxins to the soil, after dry weather, shows that, though they may be disguised by the soil-nutrients, they should be reckoned with, when considering the seasonal variation of bacteria in soils. The seasonal variation has been noted by many writers. Conn found that the numbers were high in February, and, rising in the summer, fell again in the autumn. Hiltner and Störmer showed that the bacteria did not tend to increase as the temperature rose, the August counts being no higher than those of February, and, in some cases, they were less. It is true that one cannot trace a direct relationship between the rainfall and the bacterial numbers of some investigations,* but the question may have to be determined in tropical or subtropical countries, where the rain falls during regular monthly or quarterly periods. The removal of toxin, by drainage-waters, is another question that deserves consideration.

From the irregularity of the results obtained by diluting the soil-extracts, it would appear that this method offers no means of determining the toxicity of soils. As the toxins are thermolabile, the action of heat might prove more successful; and, accordingly, experiments were made in this direction. Two years previously* it had been found that, in a certain soil-extract, 1,000 bacteria became reduced to 73; but when the extract had been raised to boil-

* As, for example, Engberding, Centrl. Bakt. 2te., 23, 569.

† These Proceedings, 1911, 815.

ing point, they were reduced only to 667; and, when boiled for an hour, they increased to three and one-quarter millions.

Extracts of the garden-soil at various depths were made, in order to see to what extent the toxins had been washed down by previous rains, and instead of subjecting the extracts to 100°, the lower temperature of 60° was employed. The top inch of the soil was removed, and the succeeding three-inch portions were taken. The two lower layers contained some clay, which had probably been put there when the sandy soil had been used as a garden, about twenty years ago.

Experiment xii.

Moist garden-soil.	Moisture %.	10 bacteria became		
		Extract not heated.	Heated at 60° for	
			20 minutes.	60 minutes.
First three inches	14·3	1,500	1,130	1,110
Second three inches .	10·3	1,060	810	1,060
Third three inches ...	11·1	160	65	56
Water-control	...	13	...	...

The first and second three inches, which, together, may be taken as representing the soil, have much the same nutritive power, and have much the same behaviour. The third three inches, which may be taken as the subsoil, is much less nutritive. The toxin is apparently different, for heat, at 60°, does not increase the nutritive effect. It does not appear that the soil-toxin has been retained by the subsoil, unless it is that the rain of the previous three days had been excessive. On the 28th, 29th, and 30th June, the soil received 3, 25, and 71, points of rain, respectively, that is, a total of, practically, an inch of rain upon the three days preceding that on which the soil was taken. The conditions were, therefore, against finding toxin in the soil. There appears to be an increase of toxicity upon heating the extracts of the subsoil at 60°, or, what may be the equivalent in this case, a diminution of nutritive effect, which does not occur in toxic soils. The portions of soil were cut out with a circular tin-cylinder of 3·5 inches diameter, and three inches deep. Each portion weighed approximately 400 grams. The inch of rain, which fell upon the surface-area, measured approximately 160 c.c. Each portion, therefore, held 57, 41, and 44 c.c. respectively, or 142 c.c. in all, so that the soil had been leached by the 160 c.c. of rain.

The experiment was repeated in a modified form, a week later, and during this time, no rain had fallen. A saline solution, containing 0·2 % of potassium sulphate, was used in making the extracts, as the flocculation of the clay-particles, by water, retarded the filtration of the soil-suspensions. Instead of heating the extracts at 60°, they were boiled in flasks fitted with aërial condensers. In this, and the previous experiment, 400 grams of moist soil were shaken with 400 c.c. of tap-water or saline for an hour.

EXPERIMENT xiii.

Depth of garden-soil.	Moisture.	10 bacteria became			Bacteria in 1 gram. of dry soil.
		Unboiled.	Boiled		
			15 min.	60 min.	
2 to 4 in. ...	9·7%	6	17	1,350	5,200,000
10 to 12 in. ...	10·3%	11	10	2	2,500,000
Saline-control ...	...	18	...	...	...

The soil is decidedly, though feebly, toxic, and, according to expectation, the toxins were destroyed by heat, allowing the nutrients to produce an increase of bacteria. The subsoil is also toxic, inasmuch as the unboiled extract produced fewer bacteria than the saline control. The action of heat, upon the subsoil-extract, is in contrast with the soil-extract, but is confirmatory of the previous experiment. Thus there appear to be two toxins in soil, one thermolabile, the other thermostable, unless it is that the latter is a product of the action of heat upon some soluble and filterable soil-constituent. Prolonged or excessive heat develops thermostable toxins in the soil itself, and the thermostability of the extracts of the subsoil, and, in some cases, of the soil, may be due to a similar phenomenon. As it is, we have to deal with a complex action.

Fifty days later, the soils were again tested. No rain had fallen for nearly a month, and the soil was consequently very dry.

EXPERIMENT xiv.

Depth of garden-soil.	Moisture.	10 bacteria became		
		Unboiled.	Boiled	
			15 min.	60 min.
$1\frac{1}{2}$ to $4\frac{1}{2}$ inches	4·6%	125	775	2,800
9 to 12 inches	7·1%	22	7	0
Saline-control	...	37	...	...

The soil was nutritive, but, as shown by the effect of heat, it contained thermolabile toxins. The subsoil was toxic, and the toxicity was increased by boiling the extracts. One expected to find the soil strongly toxic after the spell of dry weather, and the failure to realise this, shows that an accumulation of toxic substances does not occur in dry soils. The condition is similar to that which takes place in the laboratory, with soils that are air-dried and stored. They rapidly lose their toxicity and become nutritive. Inferentially, a certain percentage of moisture is necessary for the formation of toxins in soils.

From these experiments, it is seen that the demonstration of toxins in soils depends upon obtaining a soil in which the toxins preponderate over the nutrients, and in using an appropriate dilution in making the extracts. Equal parts of soil and water generally yield the most toxic extract. The toxins of the soil are thermolabile, while those of the subsoil used were thermostable. The existence of two kinds of soil-bacteriotoxins are thus indicated.

ix. *The Formation of Toxins in the Soil.*

The leaching out of the thermolabile toxins from soil by rain, the occurrence of thermostable toxins in the subsoil, and the reappearance of thermolabile toxins in the soil, make it appear probable that thermolabile toxins are produced entirely in the soil, and do not rise from below. The production may take place rapidly, as a sample taken after a rainfall of 4·75 inches, and stored in the laboratory for three days, showed the following:—

EXPERIMENT i.

	100 bacteria at 22° became
Raw extract, unboiled	3
Extract boiled ¼ hour	1
Extract boiled one hour	20
Saline-control	228

Again, a soil was extracted at once, and after storage in a bucket, in the laboratory, for seven days, during which, the moisture fell from 10% to 8%.

EXPERIMENT ii.

	100 bacteria at 22° became			
	Unboiled.	Boiled 15 min.	Boiled 60 min.	Control.
Raw soil	60	170	13,650	180
After seven days' storage ...	0	7	360	127

A soil, which was nutritive in the fresh condition, was incubated at 28° for 14 days. Unfortunately, the plug in the bottle permitted the soil to dry, and the moisture fell from 10% to 4·5%, so that the conditions for toxin-formation and preservation were not the most favourable. However, the soil became toxic, as the following shows:—

EXPERIMENT iii.

	10 bacteria became						
				Diluted.			Water-control.
	Undiluted.	4/5	3/5	2/5	1/5	1/10	
Fresh soil	187	107	124	210	73	38	18
The same incubated 14 days at 28° ...	106	4	13	970	14	41	164

The increase of toxicity is seen upon comparing the undiluted numbers with the water-controls. It is also seen in all dilutions, excepting the two-fifth. The effect of dilution is peculiar, but, beyond recording the counts, little can be said, at present, regarding the matter.

A spell of dry weather prevented the continuation of similar tests at the time, and, therefore, a quantity of soil was put into a Büchner porcelain-funnel, and treated, during one day, with a quantity of distilled water, equivalent to one inch of rain. On the following day, the drainage was filtered and tested, the soil mixed and divided into portions, each containing 200 grams of dry soil. These were stored in bottles at 22°, and tested from time to time.

Experiment iv.

	100 bacteria at 22° became			
	Unboiled.	boiled ¼ hr.	boiled 1 hr.	Control.
Soil-drainage...	270	510	3,640	100
Soil extracted at once ...	1,910	4,640	5,520	100
Soil extracted after 5 days ..	104	534	10,090	550
Soil extracted after 13 days.	380	875	23,600	600
Soil extracted after 33 days.	113	41,000	54,600	900
Soil extracted after 49 days.	56	2,400	23,000	194

A rich, brown, alluvial soil, from the Hawkesbury Agricultural College, had been stored in the laboratory for about a year. It contained 1·5% of moisture. Two hundred gram-portions were weighed out into 700 c.c. bottles, and moistened with 40 c.c. of a soil-suspension of the same soil, which had been growing maize-plants in the glasshouse. Ten grams of the soil were shaken with 500 c.c. of sterile water, to make the suspension. The bottles were corked, and divided into two sets, one being kept at 28°, the other at laboratory-temperature (15° to 20°). When required, each bottle received 160 c.c. of water containing 4 c.c of 10% potassium sulphate. The shaking and filtration were done in the usual manner.

Experiment v.

	100 bacteria became at 22°						
	Soil incubated at 15°-20°.			incubated at 28°.			Control.
	unboiled extract.	boiled 15 min.	boiled 66 min.	unboiled extract.	boiled 15 min.	boiled 60 min.	
At start ...	35,000	129,000	476,000	35,000	129,000	476,000	370
After 6 days..	9,000	34,000	78,000	1,500	12,000	43,000	390
After 30 days.	420	6,000	24,600	3,900	9,000	17,800	194

The experiment shows that a soil, from which the toxins had decayed during long storage, became less nutritive or more toxic upon being moistened. At a comparatively low temperature (15°-20°), the change was slower to develop than at a higher temperature (28°), but when formed, it was more persistent.

Observations made, during these investigations, show that soil has a variable, bacteriotoxic content. Rain washes the toxin out, and the soil becomes non-toxic. When the rain ceases, bacteriotoxins are again formed, and persist, if the soil remains moist. With continued dry weather, and consequent lowering of the soil-moisture, the toxins decay. Experiments in the laboratory confirmed these observations. A soil originally toxic, became non-toxic when washed with water, and, upon incubation, again became toxic. Another soil, originally nutritive, became very much less so upon incubation.

x. *The action of Chloroform upon Blood treated with Vaseline.*

When a soil is treated with a volatile disinfectant, it behaves as if more nourishment had been liberated for the growth of the surviving bacteria. The volatile disinfectants are also fat-solvents, and, after noting their visible action in the soil, I suggested that the effect, produced by the disinfectant, was by virtue of its removing the fat or agricere, and so facilitating the decay of the organic matter. Certain experiments* upon the growth of bacteria, in various layers of disinfected soil, bore out this suggestion. In endeavouring to confirm the hypothesis, I have made experiments with the ammoniacal fermentation of blood saturated either with paraffin or vaseline, and treated with chloroform. These, however, are rather against the hypothesis, and are here recorded as a contribution to the subject.

Dried blood was heated for a day, at 56°, with paraffin melting at 43°, and the excess removed. After being ground and sifted, two gram portions were weighed out, mixed with 50 grams of sand, and treated with chloroform. One hundred and thirty grams of dry soil were added, and 30 c.c. of soil-infusion. The tests were incubated at 22°, for 6 days; then water was added,

* These Proceedings, 1911, pp.696 *et seq.*

and the bottles shaken for a day, and the extract filtered off in the morning. The filtrates were distilled with magnesia, and the ammonia determined.

Experiment i.

	Milligrams of ammoniacal nitrogen.
Paraffined blood, untreated...	41
	43
	38
	—41
Paraffined blood, chloroformed	39
	43
	41
	—41

Experiment ii.

	Milligrams of ammoniacal nitrogen.
Vaselined blood, untreated	60
	60
	65
	—62
Vaselined blood, chloroformed ...	53
	53
	61
	— 56

The next experiment was made with vaselined blood and sand. No soil was used, and, as a fermenting agent, a suspension of *Bac. prodigiosus* was added. A tube containing a strip of paper, moistened with dilute sulphuric acid, was placed in the test-bottle, to prevent any possible loss of ammonia.

Experiment iii.

	Milligrams of ammoniacal nitrogen.
Vaselined blood, untreated	13·4
	12·3
	12·5
	13·7
	——13·0
Vaselined blood, chloroformed ...	13·4
	14·1
	11·9
	11·5
	——12·7

The experiments show that dried blood, saturated with paraffin or vaseline, and afterwards treated with chloroform, does not decay quicker on account of the chloroform-treatment.

xi. *The Action of Naphthalene in Soil.*

The action of certain chemicals, used as fungicides, in increasing the yield of crop, has been frequently noted. Of these, perhaps, the most conspicuous example is the effect of spraying potatoes with Bordeaux mixture. As a rule, the treatment shows that the mixture has a decided manurial effect. We do not know, however, whether it is the lime or the copper that produces the result, and, in a series of tests upon the growth of bacteria in soils, that I made with copper sulphate, lime, a mixture of these and with superphosphate, the results were negative; that is to say, the control-test showed a greater number of bacteria, from time to time, than any of the others.

Meanwhile, Mr. Hugh Dixson called my attention to the proposed use of sulphur and naphthalene in horticultural practice. Both are said to augment the crop in unsterilised soils, and I decided to test them, with regard to any action they might have upon the increase of bacteria. The sulphur was used as precipitated sulphur, and the naphthalene as "vapo-naphtha," generally used, in conjunction with lime, for destroying injurious insects. In a previous paper, I showed that sodium thiosulphate increased the growth of bacteria in soil-extracts, and, as the same might occur in soils, it was used with other salts in an experiment. The test was made upon soils contained in bottles closed with a cork furnished with a glass tube drawn out to an open capillary point, and were incubated at 22°.

Experiment i.

Garden-soil, with 16% moisture.	Bacteria at 22° in millions per gram of air-dried soil.				
	6days.	19dys.	28dys.	47dys.	123 dys.
Precipitated sulphur, 0·1%	4·8	2·4	2·2	1·2	0·6
Naphthalene, 0·1%	90·0	10·7	10·5	23·4	8·0
Sodium thiosulphate, 0·1%	9·8	15·8	16·8	15·0	2·2
Control	2·4	1·6	1·0	1·2	1·1
Calcium sulphate, 0·1%	3·4	0·9	0·2	0·8	0·7
Ferrous sulphate, 0·05%	0·4	0·6	1·0	0·8	0·6
Copper sulphate, 0·04%	0·6	0·5	0·7	0·7	0·7

As 0·1% is approximately equivalent to 27 cwts. per acre, the quantities added were excessive, but they have shown that naphthalene and thiosulphate have a decided effect upon the numbers of bacteria. In the case of the naphthalene, the amount used was about eighty times that recommended, assuming that it was thoroughly mixed with the soil. The sulphur was about ten times that used by Boullanger in his experiments. The prevailing bacterium, in the six days' naphthalene-test, was *Bact. putidum* (85 millions).

A second experiment was prepared, using varying quantities of naphthalene and thiosulphate. The soil was an alluvial, and received raw soil-extract equivalent to 1% of soil. The bottles were stored in the laboratory.

EXPERIMENT ii.

Alluvial soil.	Bacteria in millions per gram (18°-27°).				
	6 days.	12dys.	18dys.	28dys.	99 days.
Control	1·2	2·1	2·4	1·6	1·8
Sodium thiosulphate, 0·075%	1·7	2·9	2·6	2·5	2·8
Sodium thiosulphate, 0·15%	2·3	2·7	2·2	1·4	2·2
Naphthalene, 0·0187%	21·7	6·2	8·8	5·6	3·0
Naphthalene, 0·0375%	5·8	21·2	18·4	18·8	3·9
Naphthalene, 0·075%	5·6	32·1	23·0	30·2	4·7

In this soil, the thiosulphate does not show the difference over the control that it did in the previous experiment with garden-soil, while the behaviour with naphthalene is confirmed. The different action of thiosulphate, in the two kinds of soil, may possibly be explained by the greater agricere-content of the garden-soil, which is comparatively rich in this substance, while the alluvial soil is comparatively poor. Seymour Jones* says that sodium thiosulphate possesses the property of being able to remove grease from pelt or from leather, and it may have the same effect, therefore, upon the organic matter of the soil.

Naphthalene is used as an insecticide, and to disguise disagreeable odours, such as occur in urinals, etc. It is soluble in oils,

* Journ. Soc. Chem. Ind., 1912, 1130, abstract.

a solution in olive oil being used in cases of scabies. Molten naphthalene dissolves paraffin, grease-paint, unguentum resinæ, etc., and it acts, therefore, much as a volatile disinfectant. That its antiseptic value is exceedingly poor, is evident from the numbers of bacteria obtained in the experiments. This, however, applies only to the quantities taken; a larger quantity might show a disinfecting action. Small quantities of certain poisons, such as ether, carbon bisulphide, potassium bichromate, copper sulphate, etc., have a stimulating influence upon bacterial growth, while certain others have not;* and it is possible that the naphthalene, in the experiment, exerted an accelerating action.

The great multiplication of *Bact. putidum*, in the first experiment, points to the probability that naphthalene will induce an increased ammonification. To prove this, an experiment was made by adding two grms. of dried blood to 200 grms. of dried garden-soil, and adding a soil-suspension, made by shaking 100 grams of raw soil with a litre of water. With this, the moisture-content was made up to 19%. The bottles, containing the soil, stood upon the laboratory-bench for seven days, when they received two grms. of copper sulphate, and 500 c.c. of water. They were shaken 50 times, at hourly intervals, for a day, allowed to rest overnight, and the supernatant liquid filtered in the morning. The ammonia was determined, in the usual way, by distilling with magnesium oxide. The numbers are the average of three, and sometimes of four tests.

EXPERIMENT iii.

Milligrams of naphthalene added to 100 grams soil.	Ammoniacal nitrogen formed from 2 grams of dried blood in 7 days; milligrams.
None.	66
0·5	64
5	63
25	62
50	21

This unexpected lowering of the ammonification led to another experiment being made.

* Fred, Centrlbl. f. Bakt., 2te Abt., 31, 185.

EXPERIMENT iv.

Milligrams of naphthalene added to 100 grams soil.	Ammoniacal nitrogen formed from 2 grams of dried blood in 6 days; milligrams.
None.	60
1	60
10	58
50	35
250	23

It is clear, that when 1% of dried blood is contained in soil, naphthalene acts as a depressant, so far as ammonification is concerned. In the experiments with soil and naphthalene, the latter showed itself to be an accelerant of bacterial growth, and, inferentially, of the rapidity of decay. The sets of experiments are, therefore, at variance. In an endeavour to find the cause of the variance the following was obtained.

EXPERIMENT v.

Milligrams of naphthalene added to 100 grams soil.	Ammoniacal nitrogen formed from 2 grams dried blood in 4 days at 21°; milligrams.	Bacteria in millions per gram of dry soil.
None.	36	45
1	34	44
10	26	45

The result shows that, under the conditions of the experiment, there is no difference in the bacterial counts; and that, in the presence of dried blood, the stimulating action of naphthalene is not evident.

As it would be interesting to know what ammonification occurs when unmanured soil is used, a similar experiment, without the blood, was made. This extended over 14 days, and the result showed that no ammonia had been formed from the organic matter of the soil; that is to say, no ammonia was detected, upon distilling the soil-extracts with magnesium oxide. In spite of this, the bacterial counts showed a rise almost proportional to the amount of naphthalene added.

EXPERIMENT vi.

Milligrams of naphthalene added to 100 grams soil.	Bacteria in millions per gram, grown upon Lipman-Brown synthetic agar.				
	Total colonies.	True bacteria.			Cladothrix Moulds.
		Mixed types.	Translucent.	Gummy.	
None.	3·7	1·5	0·1	0	2·4
1	4·9	2·7	0·2	0·2	1·8
10	11·7	4·5	1·5	0	5·7
50	47·0	12·2	14·1	0	20·7
250	98·0	19·6	58·8	5·9	13·7

The great bulk of the translucent colonies consisted of a small, inert cocco-bacterium.

Some pot-experiments were made with oats and maize, in soil containing none, 0·001, and 0·005 per cent. of naphthalene; but although the plants started somewhat better in the naphthalened soils, the others soon overtook them, and ultimately there was no difference.

The conclusion arrived at, from these experiments, is that while naphthalene induces an increase in the number of bacteria in unmanured soils, there is no corresponding increase in the formation of ammonia from the organic matter originally present or added as dried blood.

A REVISION OF THE *CULICIDÆ* IN THE MACLEAY MUSEUM, SYDNEY.

By Frank H. Taylor, F.E.S., Entomologist to the Australian Institute of Tropical Medicine.

(Plate xxx.)

The following paper contains a description of Skuse's types in the above Museum, at the Sydney University.

It is proposed to refer *Anopheles stigmaticus* and *A. atratipes* to the genus *Pyretophorus*; *Culex flavifrons* and *C. vittiger* to *Culicada*, and to give a new name to *Grabhamia flavifrons* of Theobald; *Culex linealis* is placed in the genus *Culicelsa*. *Culex atripes* has been transferred to the genus *Scutomyia*, and shown to be distinct from *Stegomyia punctolateralis* Theob.

I wish to express my indebtedness to Professors W. A. Haswell and T. W. E. David, for their kindness in allowing me access to the collection, when recently in Sydney. I have also to thank Mr. Shewan, Acting Curator, for many courtesies.

Pyretophorus stigmaticus (Skuse).

Anopheles stigmaticus Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1758, 1888; Theobald, Mon. Culicid., i., p.207, 1901.

♀. Head yellowish-brown, clothed with yellowish, upright, forked scales, and brown hairs, with numerous yellowish ones overhanging the eyes from the centre; antennæ brown, basal lobe dusky brown, second segment pale at the base; palpi brown, clothed with dusky scales, shorter than the proboscis, which is brown.

Thorax brown, with three dusky patches, one anterior and two posterior, clothed with scanty, narrow-curved, golden-yellow scales; scutellum brown; metanotum dusky-brown; pleuræ blackish; prothoracic lobes prominent.

Legs brown, clothed with brown scales, changing to dusky-brown on the tarsi.

Wings with the costa black; veins clothed with light brown scales; fringe brown; first fork-cell longer and narrower than the second fork-cell, base of the former nearer the base of the wing than that of the latter; the stem of the first fork-cell about the length of its cell, stem of the second longer than the cell; supernumerary and posterior cross-veins parallel, the latter scarcely nearer the apex of the wing.

Abdomen dark brown, sparsely covered with golden hairs; venter brown.

♂. Very similar to female; antennæ yellowish-brown, shorter than proboscis, plumes brown, and very dense; palpi brown, shorter than proboscis, last segment spatulate, and clothed with short brown hairs; proboscis brown and slender; wings as in ♀; mid cross-vein slightly nearer the apex of the wing than the posterior cross-vein. Length, 4·5 to 5 mm.

Hab.—Blue Mountains, N. S. Wales.

Obs.—A very distinct species, belonging to the genus *Pyretophorus*, easily distinguished from other Australian Anophelines.

PYRETOPHORUS ATRATIPES (Skuse).

Anopheles atratipes Skuse, Proc. Linn. Soc. N. S. Wales, (2),iii., p.1755, 1888; Theobald, Mon. Culicid., i., p.208, 1901; v., p.43, 1910.

♀. Head dusky brown, clothed with white narrow-curves, and upright forked scales, border-bristles dark brown, with numerous long, white hairs overhanging the eyes from the centre; eyes black; antennæ brown, basal lobe dusky, second segment about twice the length of third; palpi dark brown, slightly shorter than the proboscis, apex creamy-yellow; proboscis black, fairly long, slender.

Thorax brown, with a moderately large, dusky patch on the anterior end, and two small ones towards the lateral edges in front of the wing-roots, and one, median, immediately in front of the scutellum, with three rows of narrow-curved, hair-like scales, and a few scattered dusky hairs, lateral border-bristles white, densest above the wing-roots; scutellum brown, with a few narrow-curved, white scales; metanotum dark brown; pleuræ dark brown.

Abdomen dark brown, clothed with golden-yellow hairs.

Wings with the costa, subcostal, and first longitudinal veins dark brown-scaled, remaining veins brown-scaled; there is a dark spot at the base of the third longitudinal vein, and at the bases of the branches of the fifth longitudinal vein, sixth long vein white-scaled, with the apical third brown-scaled; first fork-cell longer and narrower than the second, base of the former nearer the base of the wing than that of the latter; stem of the first fork-cell about as long as its cell, stem of the second longer than the cell; fringe at the apex of wing white, remainder brown; halteres brown.

Legs: coxæ and trochanters brown; femora brown, fore femora slightly club-shaped at the base, pale at the apex; tibiæ dark brown; tarsi dusky. Length, 6·5 mm.

Hab.—Berowra, N.S.W.

NYSSORHYNCHUS ANNULIPES Walker.

Walker, Ins. Saund., i., p.433, 1850; *Anopheles musivus* Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1754, 1888; *A. mastersi* Skuse, *ibid.*, p.1757; Theobald, Mon. Culicid., i., pp.164, 165, 1901.

This species was redescribed by Theobald, in his Monograph, rendering it unnecessary for me to do so.

A critical examination of the type of *A. mastersi*, has proved, beyond doubt, that it is the same as Skuse's *A. musivus*, in all essentials. At most, it can be regarded only as a variety of *N. annulipes*, which is somewhat given to variation It is possible to breed the two forms from the same batch of larvæ.

TOXORHYNCHITES SPECIOSA (Skuse).

Megarrhina speciosa Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1722, 1888; Theobald, Mon. Culicid, i., p.228, 1901; Bancroft, Ann. Queensland Mus., No.8, p.16, 1908; Taylor, Ann. Rept. Aust. Inst. Trop. Med., p.51 (1911), 1913.

This species has been fully described in the above publications. The type agrees, in all details, with that published by me.

Mucidus alternans Westwood.

Westwood, Ann. Soc. Ent. Fr., iv., p.681, and Trans. Ent. Soc. Lond , iii , p.384; *Culex hispidiosus* Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1726, 1888; Theobald, Mon. Culicid., i., p.269, 1901.

This species has already been fully described by Theobald, in his Monograph, rendering further description unnecessary.

Scutomyia atripes (Skuse).

Culex atripes Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1750, 1888; Theobald, Mon. Culicid., ii., pp.58, 256, 1901 ; *Theobaldia atripes* Neveu-Lemaire (*nec* Skuse), Arch. Parasitologie, vi., p.615, 1902; *Mimeteomyia atripes* (Skuse) Cleland, Second Rept Gov. Bureau Microbiology, Sydney, p.144, 1912.

♀. Head clothed with flat, dusky scales with violet reflections, and a small patch of narrow-curved ones in the mid-region, with a patch of flat, creamy, lateral ones ; border-bristles brown; antennæ black, verticillate hairs black, clothed with short whitish pile; palpi black; clypeus black; proboscis black; eyes violet-black.

Thorax clothed with thin, brown, narrow-curved scales; prothoracic lobes prominent, clothed with large, dense, flat, white scales and brown hairs; lateral border-bristles brown, densest above the wing-roots; scutellum brown, mid-lobe clothed with large, dusky, loosely applied, flat scales, lateral lobes with paler ones; pleuræ black, densely clothed with white, flat scales.

Abdomen black, scaled with white, lateral spots on segments 6 to 8; venter dark brown, clothed with small, white scales.

Wings with the costa, subcostal, and first long veins clothed with dusky scales, remaining veins clothed with brown scales, the lateral ones linear, the median small and flat; first fork-cell longer and narrower than the second, its base nearer the base of the wing than that of the latter; stem of the first fork-cell about one-third the length of the cell, that of the second about two-thirds as long as the cell; posterior cross-vein longer than, and about thrice its own length from the mid cross-vein; fringe brown. Halteres with the stems yellowish, knobs dusky.

Legs [the fore and mid wanting], hind dusky, the tarsi in some lights with a coppery tinge; ungues small, equal and simple.

♂. Similar to ♀. Palpi broken; antennæ with the nodes dark, plumes brown, about two-thirds the length of the proboscis. Wings as in ♀, but with the post cross-vein only about twice its length distant from the mid cross-vein.

Legs steel-black; femora white beneath, with a white apical spot above; apical tarsus of the fore-legs pale; fore and mid ungues unequal, the larger with a tooth, hind small, equal and simple. Length, 4 mm.

Hab.—Sydney, Blue Mountains, N.S.W.

Obs.—Edwards places this species in the genus *Mimeteomyia*, and Neveu-Lemaire in the genus *Theobaldia*; it clearly belongs to the genus *Scutomyia*; their determinations were based on a misconception of the species. Edwards also says that *Stegomyia punctolateralis* Theob., is a synonym of the above. They are quite distinct; a comparison of the two species shows that, *inter alia*, the abdominal spots and the ungues of the male differ considerably.

GRABHAMIA THEOBALDI, nom.nov.

Grabhamia flavifrons Theobald (*nec* Skuse), Mon. Culicid, iv., p.304, 1907.

Specimens of the above were sent to Theobald by Dr. T. L. Bancroft, from Southern Queensland. Theobald thought they were Skuse's species, on account of the yellowish appearance of the wings, mentioned by Skuse. A specimen in the Institute collection from Brisbane, when compared with the type, proved that they were distinct species, belonging to two different genera.

CULICADA FLAVIFRONS (Skuse).

Culex flavifrons Skuse (*nec* Theobald), Proc. Linn. Soc. N. S. Wales, (2), iii., p.1735, 1888; Theobald, Mon. Culicid., i., p.421, 1901; iv., p.304, 1907.

♂. Head dark brown, clothed with creamy-yellow, narrow-curved, and upright forked scales, with flat, creamy yellow ones on the sides; palpi four-jointed, brown, slightly longer than the proboscis, clothed with mixed brown and creamy scales, second segment the longest, with its apex and the last two segments densely clothed with yellowish-brown hairs; antennæ light brown, nodes dark brown, plumes light brown, last two segments long, densely covered with short pile; proboscis long, slender, brown; eyes black and silvery.

Thorax brown, clothed with golden-yellow, narrow-curved scales; prothoracic lobes prominent, brown, clothed with flat scales and golden hairs; prealar bristles yellow; scutellum brown, clothed with narrow-curved, light golden-yellow scales, posterior border-bristles yellow; pleuræ brown, clothed with patches of white, flat scales, and golden bristles.

Abdomen brown [denuded].

Legs brown; coxæ and trochanters dark brown; femora pale beneath; tibiæ and tarsi with white basal banding; ungues of forelegs very unequal, [mid wanting], hind equal.

Wings with the costa dark brown, vein-scales paler, with a few, scattered, yellow scales; first fork-cell longer and narrower than the second, the base of the latter nearer the base of the wing than that of the former; stem of the first fork-cell nearly the length of its cell; stem of the second longer than its cell; posterior cross-vein shorter than, and scarcely its own length distant from, the mid cross-vein; fringe pale. Halteres with the stems pale brown, knobs dark brown. Length, 6 mm.

♀. Very similar to ♂. Abdomen clothed with dark brown scales, with creamy basal banding, penultimate segment clothed with creamy scales. Wings with the stem of the first fork-cell about two-thirds the length of its cell, stem of the second not quite the length of the cell. Legs similar to ♂; ungues wanting. Length, 5 mm.

Hab.—Blue Mountains, N.S.W.; Brisbane, Queensland.

Obs.—The species described by Theobald as *Grabhamia flavifrons* Skuse, is quite distinct from the true *C. flavifrons* Skuse, the latter being much more robust, and having entirely different squamose characters on the wings, besides differing in numerous other details. I propose to rename the former, *Grabhamia theobaldi* (*antea*, p.751).

CULICADA VITTIGER (Skuse).

(Plate xxx., figs. 1-2.)

Culex vittiger Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1728, 1888; Theobald, Mon. Culicid., i., p.387, 1901; Giles, Handbk. Gnats, 2nd Ed., p.419, 1902.

♀ Head brown, clothed with long, loosely applied, creamy-white, narrow-curved scales, and pale yellowish upright forked ones, with creamy-white flat ones at the sides, a row of brown border-bristles round the eyes, with a few pale ones overhanging the eyes from the centre; eyes black, with silvery patches; antennæ brown, verticillate hairs dark brown, pubescence white, second segment yellowish-brown, basal lobes darker; palpi long, covered with ochraceous and dark brown scales, clothed beneath with ochraceous scales, except the apex, which is almost entirely clothed with dark scales.

Thorax deep blackish-brown, paler towards the edges and posteriorly, with four broad lines of browny-black, narrow-curved scales, the two centre ones the whole length of the thorax, the lateral ones not extending the full length of the thorax, the rest of the thorax clothed with creamy-white, narrow-curved scales and golden bristles, which are denser above the roots of the wings; scutellum brown, clothed with greyish-white, narrow-curved scales, mid-lobe with sixteen, golden border-bristles, seven to the lateral lobes; metanotum dark brown; pleuræ with the ground-colour mottled light and dark brown, and clothed with numerous, flat, white scales.

Abdomen brown, densely clothed with pale, creamy-white scales, segments 2 to 4 with the apical half brown-scaled, first segment clothed with a patch of white scales and pale creamy hairs; posterior border-bristles creamy; venter yellowish-brown, clothed with white scales.

Wings with the costa brown-scaled, with a few scattered white ones; subcostal and first longitudinal veins with scattered creamy-white scales, those on the latter basal; first fork-cell longer and narrower than the second, base of the latter nearer the base of the wing than that of the former; stem of the first fork-cell about two-thirds the length of the cell, stem of the second about as long as its cell; posterior cross-vein shorter than the mid, and not quite its own length distant from it. Halteres light brown.

Legs: coxæ and trochanters brown; femora light brown, brown-scaled above, white beneath, with a dark brown apical band; tibiæ white-scaled, with a brown, dorsal, longitudinal line, and a narrow, apical, brown band; first tarsals white, with deep brown apical banding, second to fourth brown-scaled, with a decreasing, white, basal banding, fifth brown; ungues stout, each with a small tooth. Length, 7·2 mm.

Hab.—Gosford (type), N.S.W.; Bowen and Wide Bay District, Queensland.

♂. Head as in ♀; antennæ densely plumose, the latter brown, nodes brown, internodes pale yellowish, basal lobes reddish-brown, penultimate and apical segments blackish; palpi pale yellowish-brown, the middle third of the first segment creamy-yellow, the apex of the first, second, and third segments with brown hairs; proboscis light yellow, with apical half brown.

Thorax and abdomen as in ♀.

Legs as in ♀; fore-legs with the fourth tarsals very short and broad, fifth with a large spur on the ventral surface at the base; ungues of the fore-legs unequal, uniserrate; ungues of the mid-legs very unequal, the larger with a large, blunt notch towards the base, the smaller with a moderately large tooth in the middle, hind-ungues equal, small, nearly straight.

Wings with the first fork-cell longer and narrower than the second, the base of the latter nearer the base of the wing; stem of the first fork-cell scarcely the length of its cell; posterior cross-vein shorter than the mid cross-vein, and slightly more than its own length from the latter. Length, 7·5 mm.

Hab.—Townsville, 9/3/13 (F. H. Taylor).

Obs.—This is the first time that the male has been met with, when a single specimen was taken, together with several females, amongst grass. Giles states that the female palpi are *distinctly* five-jointed, whereas they are only four-jointed. He also gives a very brief diagnosis of a male which shows some discrepancies when compared with the above description. He was probably dealing with another species.

Culicelsa lineалis (Skuse).

Culex linealis Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1747, 1888; Theobald, Mon. Culicid., ii., p.165, 1901.

♀. Head black, clothed with creamy-white, narrow-curved, and black, upright, forked scales, with flat, creamy-white ones on the sides; eyes violet-black and silver; palpi covered with dense, dark brown scales, and numerous brown bristles, the base with a few pale scales; proboscis dark brown.

Thorax dark brown, clothed with dark brown, narrow-curved scales, with four rows and the lateral borders of creamy-white ones; scutellum dark brown, clothed with creamy-white, narrow-curved scales; pleuræ blackish-brown, clothed with patches of white, flat scales.

Abdomen [damaged] clothed with black scales, banding not distinguishable; venter pale-scaled.

Legs dark brown; femora and tibiæ pale beneath; ungues equal and simple.

Wings with the veins clothed with brown scales; costa dark brown; first fork-cell longer and narrower than the second, its stem about one-half the length of its cell, stem of the second about two-thirds the length of the cell; base of the second fork-cell nearer the base of the wing than that of the first fork-cell.

♂. Head similar to ♀; palpi longer than the proboscis, dark brown, penultimate and apical segments brown, clothed with fairly long, brown hairs; antennæ pale brown, clothed with brown plumes, last two segments brown, moderately long.

Thorax similar to ♀; scutellum pale brown, clothed with narrow-curved, pale, creamy-white scales, mid-lobe with four, pale golden, posterior border-bristles, lateral lobes with three.

Abdomen clothed with dusky-brown scales, and white basal banding on segments 2 to 7, first segment clothed with brown scales, and long, pale brown hairs, eighth segment with a median patch of white scales; venter white-scaled, with narrow, brown, apical banding. Legs as in ♀; ungues wanting. Length, ♀ 5·5 mm.; ♂ 5 mm.

Hab.—Blue Mountains (type), and Wheeney Creek, N.S.W.

Obs.—A very distinct and handsome species. The male, though undescribed by Skuse, undoubtedly belongs to this species.

CULICELSA VIGILAX (Skuse).

Culex vigilax Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1731, 1888; *Culex marinus* Theobald, Mon. Culicid., i., pp.395, 396, 1901.

This species has been redescribed by Theobald, whose description agrees with the type in all details. The extent of the pale creamy scales, on the proboscis, is very variable. I have seen specimens in which the proboscis is almost entirely clothed with them, while, in others, they are all but absent.

CULICELSA ANNULIROSTRIS (Skuse).

Culex annulirostris Skuse, Proc. Linn. Soc. N. S. Wales (2), iii., p.1737, 1888; Theobald, Mon. Culicid., i., pp.365, 367, 1901; iii., p.162, 1903.

This species has been redescribed by Theobald, rendering further details unnecessary.

CULEX OCCIDENTALIS Skuse.

Proc. Linn. Soc. N. S. Wales, (2), iii., 1729, 1888; Theobald, Mon. Culicid , i., p.419, 1901; iii., p.179, 1903.

♀. Head dark brown, clothed with creamy-white, narrow-curved, and light brown, upright, forked scales in the centre, and reddish-brown, narrow-curved ones bordering the eyes, sides with alternate patches of white and brown, flat scales; border-bristles brown, with a few paler ones overhanging the eyes from the centre; eyes black and silvery; clypeus brown; palpi black-scaled, with a few, scattered, dark hairs, and a small patch of white scales on the apex of the penultimate segment, apex of the last segment white-scaled; antennæ dark brown, pubescence greyish, verticillate hairs brown, basal lobes brown, basal half of second segment creamy-yellow; proboscis dark brown at the base.

Thorax reddish-brown, clothed with pale creamy, narrow-curved scales, and bronzy brown ones; scutellum brown, clothed with pale, narrow-curved scales; prothoracic lobes fairly prominent, brown, clothed with pale, narrow-curved scales and yellowish hairs; metanotum brown; pleuræ brown, clothed with patches of creamy-white, flat scales.

Abdomen brown, clothed with brown scales, segments with white basal banding; venter white-scaled, with narrow, apical, brown banding.

Wings with the costa black, veins clothed with dark brown scales; first fork-cell longer and narrower than the second, their bases about level; stem of the first fork-cell about one-half the length of the cell, stem of the second about two-thirds the length of the cell; posterior cross-vein shorter than, and a little more more than its own length distant from it; second incrassation well marked. Halteres creamy, with black knobs.

Legs clothed with dark brown scales; first three tarsals of the fore and mid legs with white basal banding; [hind legs damaged]; fore and mid ungues equal, stout, each with a small tooth. Length, 5·5 mm.

Hab.—King George's Sound, W.A. (type unique).

Obs.—This is a very distinct species, not to be confused with other Australian species. Dr. Cleland kindly presented specimens to the Institute collection, which he informed me had been so named, for him, by Mr. F. W. Edwards; and which, on comparison with the type, proved to be quite distinct, and corresponded with Strickland's description of *Culicada vandema.* The two species are not to be confused, as the latter is much more robust, and has a large, brown spot on the wings, which the former lacks, besides other differences.

Culex procax Skuse.

Proc. Linn. Soc. N. S. Wales, (2), iii., p.1742, 1888; Theobald, Mon. Culicid., i., p.415, 1901.

♀. Head brown, clothed with white, narrow-curved scales, and upright, forked ones, with flat, white ones on the sides; proboscis dark brown, pale at the base; palpi brown; antennæ brown, verticillate hairs deep brown, pubescence pale.

Thorax brown, with a median, dark stripe running the full length of the thorax, clothed with pale yellowish-brown and dark, narrow-curved scales; scutellum brown, clothed with pale scales; prothoracic lobes brown, clothed with brownish, narrow-curved scales and hairs; pleuræ brown, with patches of white, flat scales.

Abdomen deep brown, clothed with dark brown scales, segments with white basal banding, with traces of white, lateral spots, border-bristles yellow; venter brown, apparently clothed with white scales.

Wings with the costa black, vein-scales brown, first fork-cell longer and narrower than the second, its base nearer the base of the wing than that of the latter; stem of the first fork-cell about two-thirds the length of its cell, stem of the second about as long as the cell; posterior cross-vein shorter than, and about its own length distant from the mid cross-vein. Halteres creamy-white.

Legs [in the type, the fore and mid are wanting], brown-scaled; femora pale beneath, knee-spots white; first three tarsals of fore and midlegs with white basal banding, fourth and fifth unbanded, all the tarsi of the hind-legs with white, basal banding; ungues equal and simple. Length, 4 mm.

Hab.—Gosford (type), Clifton, Illawarra District, N.S.W.

Obs.—The type is in very poor condition. The head and abdomen are almost dennded, and the fore and mid legs are wanting.

Culex sagax Skuse.

Proc. Linn. Soc. N. S. Wales, (2), iii., p.1744, 1888; Theobald, Mon. Culicid., ii., p.87, 1901; iii., p.205, 1903.

♀. Head brown, clothed with narrow-curved, pale golden scales, and yellowish and black, upright, forked ones, with white, flat ones on the sides; antennæ black; proboscis black; clypeus black; palpi black-scaled, with a few pale ones at the apex.

Thorax dark brown, with brown and a few pale narrow-curved scales; scutellum clothed with pale narrow-curved scales; metanotum brown; pleuræ brown, clothed with patches of flat, white scales.

Abdomen black-scaled, with basal creamy banding to the segments; venter clothed with yellowish scales, with apparently darker median spots.

Legs deep brown, unbanded; femora pale beneath; ungues of fore and mid legs equal, and uniserrate, hind equal and simple.

Wings clothed with brown scales; first fork-cell longer and narrower than the second, its base nearer the base of the wing than that of the latter; stem of the first fork-cell about one-third the length of the cell, stem of the second about two-thirds the length of its cell; posterior cross-vein longer, and about its own length distant from the mid cross-vein. Halteres deep yellow. Length, 5·5 mm.

Hab.—Murrumbidgee District, N.S.W.

Culex macleayi Skuse.

Proc. Linn. Soc. N. S. Wales, (2), iii., p.1746, 1888; Theobald, Mon. Culicid., ii., p.162, 1901.

This is an abraded *C. fatigans* Wied. The thorax of the specimens is distinctly abraded. Large numbers of specimens have been examined, and, occasionally, forms have been found to correspond to Skuse's description, but, in each case, the thorax has been somewhat denuded. The name *C. macleayi* must, therefore, sink as a synonym of *C. fatigans* Wied.

Culex sp., Skuse.

Proc. Linn. Soc. N. S. Wales, (2), iii., p.1748, 1888; Theobald, Mon. Culicid., ii., p.162, 1901; *Culex fatigans* Wied., var. *Skusi* Giles, Handbook Gnats, 2nd Ed., p.441, 1902.

Skuse thought that this was probably a variety of *C. ciliaris* Linn. An examination of his specimens, contained in the Macleay Museum, has proved, beyond doubt, that they are abraded specimens of *C. fatigans* Wied., and consequently Giles' name must sink as a synonym of *C. fatigans* Wied.

ÆDEOMYIA VENUSTIPES (Skuse).

(Plate xxx , fig.3.)

Ædes venustipes Skuse, Proc. Linn. Soc. N. S. Wales, (2), iii., p.1761, 1898; Theobald, Mon. Culicid., ii., p.223, 1901; v., pp.469, 477, 1910; Taylor, Bull. Northern Territory, No. i., p. 62, 1912; Ann. Rept. Aust. Inst. Trop. Med., p.59, (1911) 1913.

This species has been fully described by me, and specimens from Queensland, when compared with the type, were seen not to differ from it.

EXPLANATION OF PLATE XXX

Fig.1.—*Culicada vittiger* (Skuse) ♀ ; head.
Fig.2.—*Culicada vittiger* (Skuse) ♀ ; wing.
Fig.3.—*Ædeomyia venustipes* (Skuse) ♀ ; wing.

Figures approximately × 13.

NOTE ON THE OCCURRENCE OF STRYCHNICINE.

By James M. Petrie, D.Sc., F.I.C., Linnean Macleay Fellow of the Society in Biochemistry.

(From the Physiological Laboratory of the University of Sydney.)

Strychnos psilosperma is a small tree, endemic in northern New South Wales, and Queensland. Its leaves possess a bitter taste, and are found to contain the little-known alkaloid strychnicine, accompanying strychnine and brucine.

Occurrence.—Strychnicine was discovered by Dr. van Boorsma, in 1902.* He isolated this alkaloid from the leaves of *Strychnos nux-vomica*, detecting it even in their earliest stages. He also found it in the pulp of the ripe fruit, in the hard shell, and in the thin orange-coloured skin of the fruit. The seeds contained a trace, and sometimes none. It was also identified in the leaves of *Strychnos tieuté* of Java; and was shown to be absent from the bark and wood of both these species. In the former it is associated, in the leaves, with both strychnine and brucine, while in the latter species with strychnine only.

Van Boorsma likewise tested *Strychnos laurina* and *S. monosperma* (E. Indies), leaves and branches, both young and old, but found no strychnicine.

Since its discovery, in 1902, this alkaloid has apparently been entirely neglected. The original paper, occurring in a botanical journal, published in the Dutch East Indies, has probably not been available to all workers; and perhaps for this reason, the *Strychnos* species which have been examined, other than those mentioned, have not been tested for strychnicine.

Separation of Strychnicine.—The leaves of *Strychnos psilosperma* were extracted with alcohol, the solvent distilled off *in*

---

* Bull. de l'instit. bot. de Buitenzorg, xiv., 1902, 3.

vacuo, and the residue dissolved in acidulated water. From this solution, containing alkaloids, the colouring matter was removed with ether and chloroform; then, on adding a slight excess of sodium hydroxide, the alkaloids were precipitated, and extracted with chloroform. The extract was shaken with acidulated water, and back into chloroform, a number of times in succession. Finally, the chloroform was distilled off, and the residue converted into sulphates, which were then dissolved in hot water and crystallised. The alkaloids readily separated in this way, and left in the mother-liquor a small amount of brucine, and most of the glucoside loganin, which imparted to the solution its characteristic purple tint.

The sulphates of the combined alkaloids were recrystallised from water and alcohol, and this left a peculiar green fluid, which gradually changed to brown on long standing. This point was observed also by Hooper* in his examination of *S. nux-vomica* leaves, and stated by him to be due to an acid resin.

The white crystallised sulphates were next dissolved in the minimum quantity of water, and precipitated by a considerable excess of sodium hydroxide. Van Boorsma states that the strychnicine redissolves under these conditions. The precipitate which was separated by the centrifuge, consisted of strychnine, and the supernatant fluid was examined for strychnicine. On the addition of more alkali to this fluid, further deposition took place of a bulky precipitate, first white, then turning to pink, brown, and dark brown. This precipitate appeared also to be easily soluble on adding a very little water, and was removed by shaking out with chloroform. The remaining aqueous solution, and from which nothing more could be removed by chloroform, still gave a Mayer reaction when tested, and became fluorescent when acidulated; it, however, did not taste bitter. The chloroform-extract then contained that portion of the alkaloids which was not permanently precipitated by sodium hydroxide. After removal of the chloroform, and dissolving in dilute sulphuric acid, to the solution, potas-

* Pharm. Journ. xxi., 1890, 493.

sium ferrocyanide was added, in order to separate any strychnine. This ferrocyanide precipitate and filtrate were separately examined.

Results.—The small ferrocyanide precipitate, when extracted with ammonia and chloroform, and the latter distilled off, left a residue, which—(1) gave all the general reactions for alkaloids, (2) with sulphuric acid and bichromate did not give the characteristic colour-reaction for strychnine, (3) gave no red colouration with nitric acid. This ferrocyanide precipitate, therefore, contained an alkaloid, which was not strychnine, and not brucine.

The filtrate from the ferrocyanide was also shaken out with alkali-chloroform, the solvent removed by distillation and the residue tested: (1) It gave all the general alkaloidal reactions, (2) it did not give the strychnine colour-test with sulphuric acid and bichromate, but (3) gave a faint positive reaction with nitric acid for brucine. The ferrocyanide filtrate, therefore, also contained an alkaloid, which was not strychnine, and in which only a trace of brucine was detected.

The alkaloid in both ferrocyanide precipitate and filtrate, when dissolved in a little dilute acid, gave precipitations with Wagner and Mayer solutions, picric, phosphotungstic, phosphomolybdic, tannic acids. When treated with excess of sodium hydroxide and filtered, the solution gave with hydrochloric acid the purple colour due to strychnicine, a reaction which the discoverer states to be characteristic of this new alkaloid. Barium hydroxide in excess and the solution then acidified with hydrochloric acid, also gives the characteristic purple reaction.

References.—It is noteworthy that, in the literature on the Strychnos species, before van Boorsma's discovery, there are definite indications of a probable new alkaloid; for example, Shenstone (Journ. Chem. Soc. 37, 1880, 235) states, that the igasurine of Desnoix is a mixture of strychnine and brucine, with a trace of some persistent impurity. Koefoed (Chem. Zeit., Mar. 16, 1889, 78; thro. Pharm. Journ. xix., 864) shows evidence which led him to conclude, that commercial strychnine and brucine each contain two alkaloids. Fractional crystallisation of the platinum salts gave two different compounds containing different amounts of Pt.; the molecular difference represented CH_2, and the author distinguished the new compound by the prefix "homo." Hooper (Pharm. Journ. xxi., 1890, 493) in his investigation of the constituents of the leaves of *S. nux-vomica,* found that potassium ferrocyanide gave only a small precipitate, but that this did not possess the properties of strychnine; it did not give the sulphuric-bichromate reaction.

Summary.—The alkaloid discovered by van Boorsma in 1902, in the leaves of *Strychnos nux-vomica,* and named by him, strychnicine, is identified in the leaves of the Australian endemic species, *Strychnos psilosperma.* This strychnicine is found in the mother-liquor, after separating strychnine and brucine by sodium hydroxide and crystallisation. It is only partially precipitated by ferrocyanide, on long standing at a low temperature. It is recognised by its giving all the general alkaloid reactions, by giving a negative result for strychnine with sulphuric and bichromate, and a negative brucine result with nitric acid. Its solubility in sodium hydroxide, and its colour-reaction with barium or sodium hydroxide and hydrochloric acid are characteristic.

I am indebted to Mr. F. Turner, F.L.S., for the supply of material, which was sent to him by Dr. Bancroft, from North Queensland, and to both I take this opportunity of expressing my thanks. I have also to thank Professor Anderson Stuart for laboratory accommodation and facilities.

STUDY OF THE *ODONATA* OF TASMANIA IN RELATION TO THE BASSIAN ISTHMUS.

By R. J. Tillyard, M.A., F.E.S., Science Research Student in the University of Sydney.

Introduction.

The Bassian Isthmus is the name given to that portion of land, now sunk beneath the sea, which once connected Tasmania with the mainland of Australia. Although all scientists are agreed on the previous existence of such a connection, yet there is not, so far, sufficient evidence to enable us to say, definitely and precisely, when, where and how long it existed, and at what period of past time it broke down.

A short summary of the opinions expressed on the point will perhaps make the position clear.

Professor Baldwin Spencer* (1892), on the evidence afforded by the Mammalia, concluded that "at some period during Tertiary times, ... and comparatively early in the period, Tasmania began to be gradually separated off from the mainland. . . . When Tasmania became separated off, it contained a series of forms identical, so far as *genera* are concerned, with those of what is now Victoria, and in *species* almost identical with those of Southern Victoria." And again: "We must conclude from the mammalian fauna that there has been no absolute land-connection between South-East Australia and Tasmania since practically the end of the Tertiary Period or early in Pleistocene times, as otherwise it would be impossible to account for the absence, not only of the dingo, but also of the large and specialised Diprotodont fauna, of

* Report Aust. Assoc. Adv. Sc., Hobart, 1892, pp. 117, 118.

which the Pleistocene Period saw the rise and fall upon the mainland."

The late Mr. A. W. Howitt*, in an able discussion on the Tasmanian aborigines, states: "In early Tertiary, or even late pre-Tertiary times . . . the northern part of Tasmania was relatively higher above sea-level by at least 270 feet than it is now." Later, "a period of great basaltic extrusion covered and protected many of the Older Tertiary Sediments, and culminated in a widespread subsidence to some 1,000 feet on the west coast and 700 feet on the north coast of Tasmania. . . . Subsequently there was a re-elevation of the land during Pleiocene and more recent times. . . . The commencement of this later connection of Tasmania and Victoria may be provisionally placed in the Pleiocene epoch." He also gives a map showing the 50 and 100 fathom lines for the depth of the sea over the area in question, from which it can be seen that the elevation of 270 feet mentioned, would be quite sufficient to lay bare nearly all that portion now known as Bass Straits.

Mr. C. Hedley† (1903), in a very interesting paper, shows that the marine Molluscan fauna of the southern coast-line of Australia is not continuous from east to west, but can be subdivided into two very distinct faunas, the "Adelaidean" westwards and the "Peronian" eastwards, each distinguished by the possession of many special forms. Further, though the fauna of the east coast to Cape Howe is Peronian, the fauna of Hobson's Bay and Westernport is shown to be Adelaidean. The striking conclusion is drawn, that the Bassian Isthmus must, therefore, have lasted much later, as a narrow connection between Wilson's Promontory and the North-East of Tasmania, than it did as a connection with the north-west of the island. Mr. Hedley wisely does not attempt to fix dates, but points out that the fact of these two marine faunas not yet having had time to intermingle, places the submergence of the Isthmus necessarily at a very late and, probably, post-Tertiary period.

---

* Report Aust. Assoc. Adv. Sc., Sydney, 1898, p.740.
† These Proceedings, 1903, p.876.

Dr. Fritz Noetling* (1910) argues ably, from his knowledge of the very low state of civilisation of the Tasmanian aboriginals, that they could not possibly have reached the island in canoes, but must have crossed over on dry land. The date of submergence of the Isthmus must, therefore, have been recent enough to allow of the passage of man across it beforehand, though the crossing of later arrivals (the Australian aboriginals and the dingo) was prevented. He gives the following approximate dates, which can be only regarded as purely hypothetical:—

Last Glacial Epoch.—60,000 years ago.

Post-Glacial Epoch.—Existence of a broad Isthmus 50,000 years ago. Submergence began 10,000 years ago, about the time that the gigantic Marsupials disappeared.

Prehistoric Epoch.—Submergence still going on, 7,000 years ago; Tasmanian aborigines arrived. Formation of Bass Straits completed about 5,000 years ago; the dingo reached Australia.

The discovery of the remains of the giant Diprotodon in Tasmania, and the strong evidence in favour of the dingo having been brought to Australia in a semidomestic condition by the Australian aborigines, make it evident that Professor Baldwin Spencer was placing the limit too far back, when he argued for the complete isolation of Tasmania since the close of the Tertiary period. On the other hand, recent discoveries of prehistoric man in Europe make it appear extremely probable that the time of man's past existence on the earth can be considerably lengthened. And since the Tasmanian aborigines are recognised as having been as low in the scale of civilisation, as any of the recently discovered prehistoric men in Europe, there is no need to accept such exceedingly close limits as Dr. Noetling would place on the time of final submergence of the Isthmus. The Diprotodon, too, was almost certainly pre-Glacial, and its existence in Tasmania does not, therefore, offer any evidence in support of Dr. Noetling's dates.

For the purposes of this paper, it will not be necessary to fix the geologic time at which the change took place. I propose simply

---

* Papers and Proc. Roy. Soc. Tasmania, 1910, p.261.

to divide the era under discussion into three parts, which I shall name and define as follows:—

A. Pre-Isthmian.—All that period of time, including the early Tertiary period of elevation (Howitt), the period of submergence, and the final re-elevation, up to the formation of a broad land-connection, with running rivers, between Tasmania and the mainland.

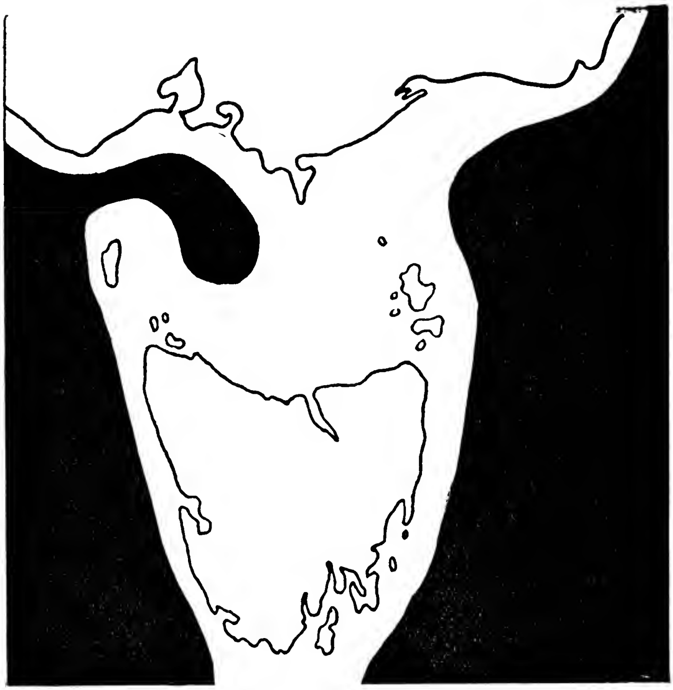


Fig. 1.—Pre-Isthmian.

Fig. 1 gives a hypothetical sketch of the coast-line towards the close of this period.

B. Isthmian.—The period during which a gradual narrowing of the connection took place, resulting in the formation of the narrow Isthmus on the east side, as suggested by Hedley (Fig. 2), and up to its final submergence.

C. POST-ISTHMIAN.—The period from the final submergence of the Isthmus to the present day (Fig. 3).

In the summer of 1908-9, I spent a month collecting Odonata in Tasmania, and obtained fairly comprehensive collections from many localities in the north, north-east, centre and south of the

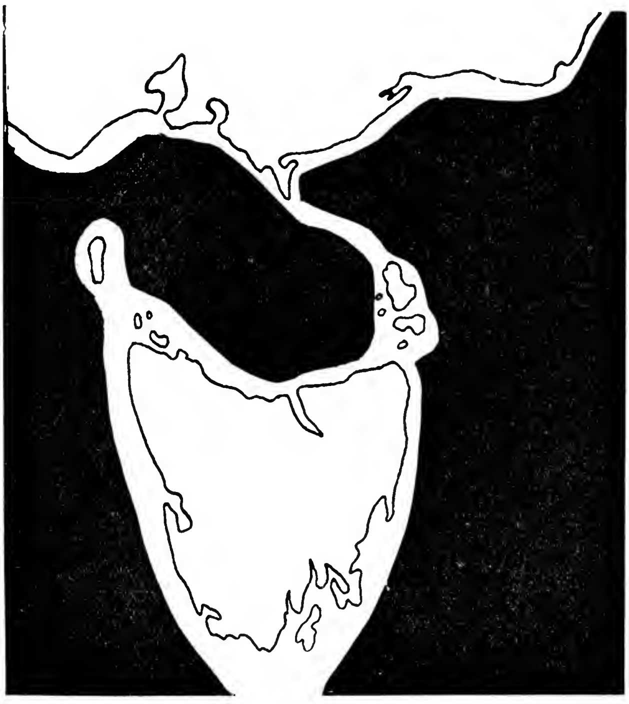


Fig. 2.—ISTHMIAN.

island. Though dragonflies were fairly numerous, the number of species obtained (nineteen) was surprisingly small.

Since then, I have received small collections from the west coast and from Ben Lomond, also a very complete collection from Mr. F. M. Littler, taken in various localities around Launceston and along the north-western line. These have not added any new species to the list.

An examination of the material in the Hobart Museum enabled me to add further localities to my list, and also to note the occurrence of a new species in the Hobart district. The total number of species, therefore, now stands at twenty.

Though it is probable that further careful collecting may result in the addition of a few more species, yet the list, as it stands, must be by now fairly complete. As it presents some very extraordinary features which seem to me to offer very decisive evidence concerning the nature and extent of the land-connection (Bassian Isthmus), known to have existed formerly between Tasmania and the mainland, I have thought it advisable to put the facts on record.

Two facts strike one, at once, as being very remarkable in the case of the Tasmanian Odonata:—

(1) Although the island is richly watered almost everywhere by permanently running rivers, very few *Odonata* occur on them; whereas the *Odonate* fauna of the lagoons and lakes is astonishingly abundant.

(2) Many of the very commonest species, to be found all over Southern Victoria, are completely absent from Tasmania.

It occurred to me that the nature and extent of the Bassian Isthmus must have played a very considerable part in this distribution. If the Isthmus was, for a very long time, too broken or narrow to possess any permanent running water, it would follow that only those *Odonata* that were capable of breeding in stagnant water (small lagoons, pools or waterholes), would be able to cross into Tasmania, while all those species, whose larvæ require running water, would be shut out. I, therefore, made a list of the dragonflies of Southern Victoria (for which the records are very complete) and divided them into two portions.

A.—Those that have never been known to breed in still water.

B.—Those that habitually breed in still water.

This list comprises forty-two species, including all the known Victorian *Odonata* except a few exceedingly rare species only recorded from North Gippsland (Alexandra), which do not approach close enough, in their distribution, to the southern coast of that State to be taken into consideration.

Fig.3.—Post Isthmian (present day).

To these, I have added the, as yet, undescribed species from Hobart (*Austroæschna* sp.), making a total of forty-three. Dividing these into lists A and B, and including in both A and B the species *Austrogomphus guérini*, which, although habitually breeding in slowly running water, has occasionally been observed to breed in still water, we find that list A contains twenty-four species, and list B twenty. In list B, however, we have the two geminate species, or rather subspecies, *Synthemis eustalacta* Burm., (occurring only on the mainland) and *S. tasmanica* Tillyard (occurring only in Tasmania). From the point of view of this paper, *S. tasmanica* must clearly be reckoned as the Tasmanian portion of *S. eustalacta*. Counting, therefore, these two forms as two races of one species, list B will contain nineteen species.

I propose to give these two lists in full, and then to draw what appear to be very obvious conclusions from them :—

List A.—Species which have never been known to breed in still water (except *Austrogomphus guérini* occasionally). * present, – absent.

Name.	Victoria.	Tasmania.
Diphlebia lestoïdes Selys	*	–
Argiolestes icteromelas Selys	*	–
Argiolestes griseus Selys	*	–
Synlestes weyersi Selys	*	–
Austrolestes cingulatus Burm.	*	–
Nososticta solida Selys	*	–
Isosticta simplex Martin	*	–
Austrogomphus guérini Ramb.... ...	*	*
Austrogomphus ochraceus Selys ...	*	–
Austrogomphus heteroclitus Selys ...	*	–
Austroæschna, n.sp.	–	*
Austroæschna longissima Martin ...	*	*
Austroæschna unicornis Martin ...	*	–
Austroæschna tripunctata Martin ...	*	–
Austroæschna sagittata Martin... ...	*	–
Austroæschna parvistigma Selys ..	–	*
Austroæschna multipunctata Martin ...	*	–
Austroæschna atrata Martin	*	–
Æschna brevistyla Ramb.	*	*
Metathemis guttata Selys	*	–
Metathemis brevistyla Selys	*	–
Metathemis virgula Selys	*	–
Hemicordulia australiæ Ramb. ..	*	–
Diplacodes hæmatodes Burm.	*	–

Total present in Southern Victoria 22
Total present in Tasmania 5
Total common to both 3
Percentage of Tasmanian to S. Victorian forms, 22·7%.

List B.– Species which habitually breed in still water (except *Austrogomphus guérini*, which does so *occasionally*).

Name.	Victoria.	Tasmania.
Austrolestes leda Selys	*	*
Austrolestes psyche Selys	*	*
Austrolestes annulosus Selys	*	*
Austrolestes analis Ramb.	*	*
Agrion lyelli Tillyard	*	*
Ischnura heterosticta Burm.	*	*
Ischnura aurora Br.	*	*
Austroagrion cyane	*	*
Austrogomphus guérini Ramb.... ...	*	*
Anax papuensis Burm.	*	—
{*Synthemis eustalacta eustalacta* Burm.	*	
{*S. eustalacta tasmanica* Tillyard ...		*
S. macrostigma orientalis Tillyard ...	*	*
Procordulia jacksoniensis Selys ...	*	*
Hemicordulia tau Selys...	*	*
Nannophya dalei Tillyard	*	*
Austrothemis nigrescens Martin ...	*	*
Diplacodes bipunctata Br.	*	—
Diplacodes melanopsis Martin	*	—
Orthetrum caledonicum Br.	*	—

Total present in Southern Victoria 19
Total present in Tasmania 15
Total common to both 14
Percentage of Tasmanian to S. Victorian forms, 78·9%.

The contrast between the results given in these two lists is most striking and calls for some definite explanation. How is it that so few running-water forms, of the many found in Southern Victoria, also occur in Tasmania? How is it, on the other hand, that the great majority of those still-water forms found in Southern Victoria, also occur in Tasmania? How is it, in particular, that *of species in the same genus,* equally common and widespread in Southern Victoria, only the still-water species occur in Tasmania, while the running-water species do not? For instance out of five species of *Austrolestes,* only one, *A. cingulatus,* and that the most abundant of all in Southern Victoria, does not occur in Tasmania;

exactly that one species, be it noted, that is unable to breed in still water. Again, out of three species of *Austrogomphus,* only *A. guérini,* which habitually prefers slowly running water, and occasionally breeds in still water, occurs in Tasmania. And again, out of two species of *Hemicordulia,* that one (*H. tau*), which breeds in still water is present in Tasmania, while the equally common *H. australiæ,* which breeds only in running water, is absent.

The evidence, afforded by the above facts, seems to me to point conclusively to *the existence, for a very considerable period, of a Bassian Isthmus so narrow or incomplete, that only still-water species were able to pass across it into Tasmania.* No permanent, running streams could have been present during the time that these migrations were in progress, or, at the best, they must have been very few and far apart.

Next let us examine the exceptions to the general rule as presented above.

Firstly, the species of the genus *Austroæschna* are all running, water forms, yet three occur in Tasmania, and one of these is peculiar to the island. Coupled with this, is the fact that the running-water species, *Æschna brevistyla,* is also abundant there.

The answer to this anomaly, lies in the admittedly great antiquity of the *Æschninæ.* As these genera occur on both sides of the present barrier quite abundantly, and their larvæ cannot breed in still water (that of *Æschna brevistyla* prefers *slowly* running water, but all the species of *Austroæschna* require fairly fast, running water), it seems fair to argue, that their appearance on the scene took place at an earlier period than that of the other groups in question, at a time when the Bassian Isthmus was large and well-supplied with running streams. The fact that Tasmania also possesses, in the undescribed species of *Austroæschna,** its only truly autochthonous species, points to the greater antiquity of this genus, compared with those whose species have remained undifferentiated.

I am of opinion that both *Austroæschna* and *Æschna* arose from a common Mesozoic ancestor, which, first of all, differentiated into

* The description of this species will shortly be published.

two main types, represented at the present day by the two main divisions of the *Æschnine* stem, viz., the *Brachytronini* (to which *Austroæschna* belongs) and the *Æschnini*. Of these, the *Æschnini* soon became dominant in all the regions of the earth except the *Australian*, while the *Brachytronini* decreased rapidly everywhere except in Australia, where (like the Marsupials) they enjoyed an uninterrupted development, and increased to form the large genus *Austroæschna* and its allies. Somewhat later, the *Æschninæ*, spreading rapidly through the Neotropic Region, sent out a few vigorous species down into Archiplata, and reached across into a temperate Antarctica. Finally, a single species, *Æschna brevistyla*, found its way into New Zealand, and also into Tasmania, and crossed the Bassian Isthmus, while it was still large and supplied with running streams. The fact that *Æschna brevistyla* is so abundant in Tasmania, and becomes rapidly rarer as we go northwards, finally failing to reach the extreme north of the continent, is a strong argument in favour of this supposition, and against the theory, held by Dr. Ris, of the origin of *Æschna brevistyla* from a common parent with the tropical *Anaciæschna jaspidea*.

Next, let us turn to the very extraordinary distribution of the *Libellulinæ* of the region under survey. In Southern Victoria, the only really common species are the three species of *Diplacodes*, which are abundant everywhere along the coast and inland also. *Orthetrum caledonicum* is abundant in the warmer parts, but gets rare along the colder southern coast. *Nannophya dalei* and *Austrothemis nigrescens* are distinctly *rare*. Yet, of all these species, which breed equally freely in still water, only the two rarest occur in Tasmania. We can only conclude that the commoner *Diplacodes* and *Orthetrum*, both known to be offshoots from tropical genera, *did not reach their present southern limit until after the disappearance of the Bassian Isthmus*. It would follow, that *Nannophya* and *Austrothemis* are much older genera, which were present in Tasmania before the Isthmus disappeared. *Nannophya* is known to be an archaic genus, with a somewhat discontinuous distribution. *Austrothemis* is a puzzle, having no very close allies, and only one species, confined to the southern parts of Australia. There seems very little doubt that it, too, must be a remnant of some ancient Libelluline group now almost extinct.

Not less extraordinary than the case of *Diplacodes,* is the failure of the strong-flying and very abundant still-water species, *Anax papuensis,* to appear in Tasmania. This species may often be seen flying in the streets of the city of Melbourne, and it seems that it can only be a matter of time before it must establish itself in Launceston, considering the frequent communication between the two ports. The fact that it has failed, so far, to negotiate 200 miles of sea, with islands *en route,* shows how very seldom *Odonata* are dispersed across even narrow straits. Apart from a strong tendency to migrate, exhibited by a few *Libellulid* genera, there seems no reason to suppose that dragonflies are ever carried far from their breeding grounds. When storm or wind arises, they immediately seek shelter; indeed, they do so usually some time before the disturbance breaks upon them.

Argiolestes icteromelas and *Hemicordulia australiæ* are both very abundant in Southern Victoria; but, as they breed in running water, their inability to cross over is explainable on the hypothesis already offered.

The case of *Hemicordulia tau* has some special features. This species is exceedingly abundant in Victoria, but quite rare in Tasmania. It is only in occupation of occasional pools and water-holes, and, in particular, of artificially constructed dams. It is the only southern Australian species which has developed a migratory tendency. Particularly in the autumn, when a second brood appears, it is recorded at intervals of a few years apart, as appearing in thousands over large areas, and travelling for many miles. I am strongly of opinion that *Hemicordulia tau* is the most recent addition to the *Odonate* fauna of Tasmania, and that the scanty colonisation of the island, by this species, has been brought about by the successful passage of Bass Straits by portion of one of these migratory swarms, probably within the last few years. The fact that it has not yet colonised the large swamps and lagoons, is a strong argument for this view.

Let us next consider the case of the *Synthemina,* of which the two still-water species, *S. eustalacta* and *S. macrostigma,* are represented in Tasmania, while the running-water species of the genus *Metathemis* do not occur there. The typical form of *S. tasmanica* discovered by me at St. Patrick's River, differs very considerably, both in size and colouration, from *S. eustalacta.* But I also found, at Launceston, breeding in still-water, a form whose colouration was almost exactly that of *S. eustalacta,* and whose size was intermediate between the latter and typical *S. tasmanica.* We see, therefore, that *S. eustalacta* crossed over as a still-water form, but that it is now developing into a running-water species on the island, and is assuming, with the change of habit, the darker and duller colouration already attained by *Metathemis* on the mainland. *S. macrostigma,* on the other hand, still keeps to the swamps, and shows no variation from the mainland form.

The *Synthemina* are admittedly the most archaic of the *Corduliinæ.* There can be little doubt that they attained their present group-characters at least as early as the beginning of the Tertiary period. It seems probable, therefore, that they may have crossed to Tasmania during the very earliest part of the Pre-Isthmian period (the period of Howitt's "first elevation"). Such a supposition is in keeping with their comparative rarity on the island, if we see in all the other still-water *Libellulidae* a more recently arrived band of competitors.

Metathemis is a specialised offshoot of *Synthemis,* and only breeds in running water. The fact that this genus keeps to the high lands, and only approaches the coast where it is very hilly, prevents us from using it as an argument for the absence of running water on the land-connection during Howitt's "first elevation" period.

Summing up, we now have the following facts:—

(1) Of the running-water forms, only 22% have succeeded in passing from Victoria to Tasmania. These consist of the most archaic forms found in the island (*Austroæschna, Æschna*). Hence only during the earliest period of the land-connection (Pre-Isthmian) was there sufficient running water for the passage of such forms.

(2) Of the still-water forms, 79% have passed over. These include all except the most cænogenetic genus of the *Æschninæ* (*Anax*), and the more recent genera of the *Libellulidæ* (*Diplacodes*, *Orthetrum*, *Hemicordulia*). Hence, for a very long period of time, probably during the whole of the Isthmian period, there was not sufficient running water on the isthmus to allow of the passage of running-water forms; but there was a good supply of still water, by means of which an abundant migration of still-water forms flourished. This conclusion will be seen to support, very strongly, Mr. Hedley's contention for a narrow Eastern Isthmus.

Let us now invert the problem, and classify our genera on the evidence before us. We may divide them into three groups:—

(1) *Pre-Isthmian genera.*

(*a*) Running-water forms that passed over in Pre-Isthmian times:—*Austroæschna*, *Æschna brevistyla* (this latter most probably passed *from* Tasmania *into* Victoria).

(*b*) Still-water forms that passed over during the period of "first elevation":—*Synthemis*.

(2) *Isthmian genera.*

(*a*) Running-water forms that failed to get across:—*Diphlebia*, *Argiolestes, Synlestes, Austrolestes cingulatus, Nososticta, Isosticta*, *Austrogomphus* (except *A. guérini*), *Metathemis*(?), *Hemicordulia australiæ*.

(*b*) Still-water forms that succeeded in crossing:—*Austrolestes* (*A. leda, A. annulosus, A. psyche, A. analis*), *Agrion, Ischnura, Austroagrion*, *Austrogomphus guérini*, *Procordulia*, *Nannophya*, *Austrothemis*.

3. *Post-Isthmian genera.*

Still-water forms that have failed to cross:—*Anax papuensis Hemicordulia tau* (very recent migration only), *Diplacodes, Orthetrum*.

The above classification, though it fails to give us any exact geological age in which to place the arrivals of the various genera into the area in question, is still of great value in exhibiting the *comparative* ages of the different groups, as shown by their arrivals at their southern limits of distribution.

DONATIONS AND EXCHANGES.

Received during the period November 28th, 1912, to November 26th, 1913.

(*From the respective Societies, etc., unless otherwise mentioned.*)

Adelaide.

Department of Mines: Geological Survey of South Australia—

Annual Report, 1912(1913).

Bulletin, Nos.1-2(1912-13).

Review of Mining Operations in the State of South Australia during the Half-years ended December 31st, 1912, and June 30th, 1913, Nos.17-18(1913).

Report No. ii. The Mount Grainger Goldfield. By R. L. Jack(1913).

Public Library, Museum, etc., of South Australia—

Report of the Board of Governors for 1911-12(1912).

Royal Society of South Australia—

Memoirs. ii., 3-4(1911-12).

Transactions and Proceedings, and Report. xxxvi.(1912).

Woods and Forests Department of South Australia—

Annual Progress Report upon State Forest Administration for the year 1911-12(1912). By W. Gill, F.L.S., F.R.H.S., Conservator of Forests.

Albany, N.Y.

New York State Library—

Sixty-fourth Annual Report of the New York State Museum, 1910 (2 vols.; 1912).

Amsterdam.

Koninklijke Akademie van Wetenschappen—

Jaarboek, 1911(1912).

Proceedings of the Section of Sciences. xiv.(1911-12).

Verhandelingen. xvii. 1(1912).
Verslag van de Gewone Vergaderingen. xx.(1911-12).

Ann Arbor.

University of Michigan—
University Bulletin N.S. xiv., 16(1913).

Antwerp.

Societe Royale de Geographie d'Anvers—
Bulletin. xxxv., xxxvi., 1-4(1912-13).

Baltimore.

Johns Hopkins University—
Hospital Bulletin. xxiii., 261-262; xxiv., 263-272(1912-13).
University Circulars. 1912, 2-10; 1913, 1-6(1912-13).

Basle.

Naturforschende Gesellschaft in Basel—
Verhandlungen. xxiii.(1912).

Batavia.

Konink. Natuurkundige Vereeniging in Nederl. Indie
Natuurkundig Tijdschrift. lxx.-lxxii.(1911-13).

Berkeley, Cal.

University of California—
Library: Contents-Index. Vol. i.(1889-90).
Publications. Botany, iv., 16-19; v., 1-5(1912-13).
Geology. Bulletin. vii., 6-19(1912-13).
Pathology. ii., 9-13(1912-13).
Physiology. iv., 17-18(1912-13).
Zoology. x., 9; xi., 1-8(1912-13).

Separates: (*a*) "Experimental Study of Poison-Oak," by E. von Adelung [Arch. Internal Med., ii., 1913]; (*b*) Classification of the Streptothrices," &c., by E. J. Claypole [Journ. Exp. Med., xvii., 1913]; (*c-e*) "Agglutination of encapsulated Bacteria," "Relative frequency of *B. coli communior* in contaminated Water," and "Entwicklung und gegenwärtiger Stand der Immunitätsforschung in America," by J. G. Fitzgerald [Proc. Soc. Exp. Biol. and Med., x., 1912; Jahresber. ueber die Ergebnisse der Immunit. 1911]; "A Method of correlated Teaching of

Pathology and Bacteriology," etc., by F. P. Gay [Johns Hopkins Hosp. Bull., xxiii., 1912); (*g-h*) "Induced Variations in the Agglutin-Ability of *Bacillus typhosus*," and "Specific and Extreme Hyperleucocytosis," &c., by F. P. Gay, and E. J. Claypole [Journ. Amer. Med. Assoc., lx., 1913]; (*i-l*) "Antigenic Properties of Split Products of Casein," "Antigenic Properties of a Protein compounded with Casein," "Antigenic Properties of Globin Caseinate," "Comparison of Paranuclein split from Casein," &c., by F. P. Gay and T. B. Robertson [Journ. Exp. Med., xvi.-xvii., 1912-13; Journ. Biol. Chem., xii., 1912]; (*m*) "Studies on the Locus of Antibody-Formation," by F. P. Gay and G. Y. Rusk [Trans. Fifteenth Internat. Congress on Hygiene, &c., 1912]; (*n*) "A Constant Temperature Oven for Paraffin-imbedding" [Zeitschr. f. wissenschaftl. Microscopie, &c., xxix., 1912].

Berlin.

Deutsche Entomologische Gesellschaft zu Berlin—
Deutsche Entomologische Zeitschrift, 1912, 6; 1913, 1-5 (1912-13).

Entomologischer Verein zu Berlin—
Berliner Entomologische Zeitschrift, lvii., 1-2; lviii., 1-2 (1912-13).

Gesellschaft f. Erdkunde zu Berlin—
Zeitschrift. 1912, 8-10; 1913, 1-7 (1912-13).

Berne.

Naturforschende Gesellschaft in Bern—
Mitteilungen aus dem Jahre 1912 (1913).

Societe Helvetique des Sciences Naturelles—
Actes, 95me.Session, 1912 (2 vols.: ?1913).

Birmingham.

Birmingham Natural History and Philosophical Society—
List, 1913; Annual Report for 1912(1913).
Pamphlet: "Introduction to the Fauna of the Midland Plateau." By P. E. Martineau(1913).
Proceedings, xiii., 1(1913).

Bonn.

Naturhistorischer Verein in Bonn—

Sitzungsberichte. 1911, 2; 1912, 1(1912-13).

Verhandlungen. lxviii., 2; lxix., 1(1912-13).

Boston.

American Academy of Arts and Sciences—

Proceedings, xlvii., 16-22; xlviii., 2-20; xlix., 1-2(1912-13).

Bremen.

Naturwissenschaftlicher Verein—

Abhandlungen. xxi., 2; xxii., 1(1913).

Brisbane.

Colonial Botanist's Department—

Botany Bulletin No. xvii.(1913).

Comprehensive Catalogue of Queensland Plants, both Indigenous and Naturalised. By F. M. Bailey, C.M.G., F.L.S.(8vo Brisbane, 1912?).

Descriptive List of Queensland Grasses on exhibition at the Office of the Department of Agriculture and Stock, Brisbane. By F. M. Bailey, C.M.G., F.L.S.

Fourteen Separates: "Contributions to the Flora of Queensland" [Queensland Agricultural Journal, 1912-13].

One Separate: "Botanic Notes, No. ii.", by C. T. White [" Queensland Naturalist," February, 1913].

Department of Agriculture and Stock—

Queensland Agricultural Journal, xxix., 6; xxx., 1-6; xxxi., 1-5(1912-13).

Geological Survey of Queensland—

Publications. Nos.238-239(1913).

Queensland Museum—

Annals, No.10(1911)—Memoirs, i.(1912).

Royal Geographical Society of Australasia: Queensland Branch—

Proceedings and Transactions, xxvi.-xxvii.(in one) [1912].

Royal Society of Queensland—

Proceedings. xxiv.(1913)

Brussels.

ACADEMIE ROYALE DE BELGIQUE—

Annuaire. 79me. Année(1913).

Bulletin de la Classe des Sciences. 1912, 8-12; 1913, 1-6 (1912-13).

SOCIETE ENTOMOLOGIQUE DE BELGIQUE—

Annales. lvi.(1912).

Mémoires. xx.-xxi.(1912).

SOCIETE ROYALE BOTANIQUE DE BELGIQUE—

Bulletin. xlix., l.(Vol. Jubilaire) [1912-13].

Budapest.

MUSEUM NATIONALE HUNGARICUM—

Annales. x., 2; xi., 1(1912-13).

Buenos Aires.

MUSEO NACIONAL DE BUENOS AIRES—

Anales. Tomo xxiii.(1912).

Buffalo, U.S.A.

BUFFALO SOCIETY OF NATURAL SCIENCES—

Bulletin. x., 2(1912).

Calcutta.

GEOLOGICAL SURVEY OF INDIA—

Memoirs. xli.(1913).

Records. xliii., 1-2(1913).

INDIAN MUSEUM—

Annual Report, 1911-12, Parts i.-ii.(1912).

Crinoids of the Indian Ocean. By A. H. Clark(4to.1912).

"Indian Fish of proved utility as Mosquito-Destroyers," by R. B. Sewell, and B. L. Chauduri(1912).

Memoirs. iii., 3(1913).

Records. iv., 10; vii., 1-5; viii., 1-2; ix., 1-2(1912-13).

SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA—

Description of the Imperial Bacteriological Laboratory, Muktesar: its Work and Products. By J. D. E. Holmes (Calcutta, 1913).

Cambridge, England.

Cambridge Philosophical Society—

Proceedings. xvii., 1-3(1913).

Transactions. xxii., 2(1913).

Cambridge, Mass.

Museum of Comparative Zoology at Harvard College—

Annual Report of the Curator for 1911-12(1912).

Bulletin. liv., 16-18; lv., 2; lvi., 1; lvii., 1(1912-13).

Cape Town.

Department of Mines, Cape of Good Hope—

Four Palæontological Separates [Ann. S. African Mus. vii., No.5, 1912].

Sixteenth Annual Report of the Geological Commission, 1911 (1912).

Royal Society of South Africa—

Transactions. ii., 5; iii., 1-2(1912-13).

South African Museum—

Annals. vii., 6; x., 4-6; xi., 3-5; xii., 1; xiii., 1(1912-13).

Report for the years 1910, 1911, 1912 (in one) [1913].

Cherbourg.

Societe Nationale des Sciences Naturelles, &c.—

Mémoires. xxxviii.(1911-12).

Chicago.

Field Museum of Natural History—

Botanical Series. ii., 8(1912).

Geological Series. iv., 2(1912).

Report Series. iv., 3(1913).

Christchurch, N.Z.

Canterbury College (University of New Zealand)—

Records of the Canterbury Museum. i., 4(1912).

Philosophical Institute of Canterbury—

Jubilee Celebration: Presidential Address, and Annual Report, 1912(1912).

Transactions and Proceedings of the New Zealand Institute, xlv., 1912(1913).

Christiania.

VIDENSKAB-SELSKABET I CHRISTIANIA—

Forhandlinger, 1911, 1912(1912-13).

Skrifter i. Math-naturvid. Klasse, 1911, 1912(1912-13).

Cincinnati, Ohio.

CINCINNATI SOCIETY OF NATURAL HISTORY—

Journal. xxi., 3(1912).

LLOYD LIBRARY—

Bibliographical Contributions. Nos. 7-10 (1912-13).

Colombo, Ceylon.

COLOMBO MUSEUM—

Spolia Zeylanica. viii., 31-32; ix., 33-34 (1912-13).

Columbus, Ohio.

BIOLOGICAL CLUB OF THE OHIO STATE UNIVERSITY—

Ohio Naturalist. xiii., 1-8(1912-13).

OHIO STATE UNIVERSITY

University Bulletin. xvi., 2(1911).

Copenhagen.

ACADEMIE ROYALE DES SCIENCES ET DES LETTRES DE DANEMARK—

Bulletin. 1912, 4-6; 1913, 1-2(1912-13).

KJOBENHAVNS UNIVERSITETS ZOOLOGISKE MUSEUM—

Danmark-Ekspeditionen til Grönlands Nordöstkyst, 1906-08. Bind iii., 15(1913).

"The Danish Ingolf-Expedition." ii., 5; iii., 3; v., 3(1912-13).

Decatur, Ill.

AMERICAN MICROSCOPICAL SOCIETY—

Transactions. xxxi., 2-4; xxxii., 1(1912-13).

Dublin.

ROYAL DUBLIN SOCIETY—

Economic Proceedings. ii., 5(1912).

Scientific Proceedings. New Series. xiii., 24-37(1912-13).

Royal Irish Academy—
Proceedings. Section B., xxx., 3-5; xxxi., 3, 15, 25, 32-34, 45, 48-50, 55, 61, 62; xxxii., 1-2(1912-13).

Durham.

University of Durham Philosophical Society—
Proceedings. iv., 5(1912).

Edinburgh.

Royal Physical Society of Edinburgh—
Proceedings. xviii., 4; xix., 1-3(1912-13).

Royal Society of Edinburgh—
Proceedings. xxxii., 4-5; xxxiii., 1-3(1912-13).
Transactions. xlviii., 2-4; xlix., 1(1912-13).

Scottish Microscopical Society—
Proceedings. vi., 1909-12(1912).

Florence.

Societa Entomologica Italiana—
Bulletino. xliii., 1911(1912).

Frankfurt am Main.

Senckenbergische Naturforschende Gesellschaft—
Abhandlungen. xxxi., 2-3; xxxiv., 3(1912).
Bericht, 43, 1912, 1-4(1912).

Freiburg i. Br.

Naturforschende Gesellschaft zu Freiburg i. Br.—
Berichte, xx., 1 (1913).

Garrison, N.Y.

American Naturalist. xlvi., Nos. 551-552; xlvii., Nos. 553-562(1912-13).

Geneva.

Societe de Physique et d'Histoire Naturelle de Geneve—
Compte Rendu, xxix., 1912(8vo., 1913).

Genoa.

Museo Civico di Storia Naturale di Genova—
Annali. Serie 3ª. v.(1911-13).

Grahamstown, S. Africa.

Albany Museum—

Records. ii., 5-6(1913).

Haarlem.

Societe Hollandaise des Sciences—

Archives Néerlandaises. Série iii., B. i., 3-4(1912).

Hague.

Nederlandsche Entomologische Vereeniging—

Entomologische Berichten. Deel iii., 67-72, T.p., etc.(1909-13)

Tijdschrift voor Entomologie. lv., 4; lvi., 1-2(1913).

Halifax.

Nova Scotian Institute of Science—

Proceedings and Transactions. xiii., 2(1912).

Halle.

Kaiserlich. Leopoldinisch-Carol. Deutsche Akademie der Naturforscher—

Leopoldina. xlvii.-xlviii., 1911-12(1911-12).

Hamburg.

Naturwissenschaftlicher Verein—

Abhandlungen. xx., 1(1912).

Verhandlungen, 1911. Dritte Folge, xix.(1912).

Hamilton, Canada.

Hamilton Association—

Journal and Proceedings, No. xxvii., 1911-12(1912).

Helder.

Nederlandsche Dierkundige Vereeniging—

Aanwinsten der Bibliotheek, 1910-11.

Tijdschrift. 2de. Serie. xii., 3(1912).

Helsingfors.

Societas pro Fauna et Flora Fennica—

Acta. xxxvi.(1912).

Meddelanden. xxxviii.(1911-12).

SOCIETAS SCIENTIARUM FENNICA—

Acta. xxxviii.(Otto Donner Muistopuhe, 1913), xl., 5; xli., 1, 8; xlii., 1-3, Minnestal(1912-13).

Bidrag till Kännedom, 71(3), 72(1), 75(1), 76(1)[1913]

Meteorologisches Jahrbüch für Finlande. vii.; viii., 1; ix., 1, 1907-09(1912).

Oefersigt. liv., 1911-12, Afd. A, B, C(1912-13).

Schnee- und Eisverhältnisse in Finland im Winter, 1898-99, Von W. W. Korhonen(1912).

Hobart.

DEPARTMENT OF MINES—

Progress of the Mineral Industry of Tasmania for the Quarters ending 30th September and 31st December, 1912; 31st March and 30th June, 1913(1912-13).

Geological Survey Bulletins. Nos. 10-12(1911-12).

Report of the Secretary of Mines for the Year, 1912(1913).

ROYAL SOCIETY OF TASMANIA—

Papers and Proceedings, 1912(1913).

Honolulu, T.H.

BERNICE PAUAHI BISHOP MUSEUM—

Fauna Hawaiiensis, i., 6, T.p., etc.(1913).

Occasional Papers. v., 3-4(1913).

Indianopolis, Ind.

INDIANA ACADEMY OF SCIENCE—

Proceedings. 1911(1912).

Jena.

MEDICINISCH-NATURWISSENSCHAFTLICHE GESELLSCHAFT—

Jenaische Zeitschrift. xlviii., 4; xlix., 1-4; l., 1-3(1912-13).

La Plata.

MUSEO DE LA PLATA—

Revista. xviii.(1911-12).

Leipsic.

ZOOLOGISCHER ANZEIGER. xl.,12-13; xli.; xlii.,1-12 (1912-13). *From the Publishers.*

Leyden.

RIJKS HERBARIUM—

Mededeelingen, Nos. 8-14 (in one) [1912].

Liege.

SOCIETE GEOLOGIQUE DE BELGIQUE—

Annales. xxxviii., 4; xxxix., 1-4; xl., 1-2 (1912-13)—Annexes au T. xxxviii.-xl. [Publications relatives au Congo Belge, 5 Nos.].

Mémoires, 1911-12, 1-2, T.p.&c. (1912).

SOCIETE ROYALE DES SCIENCES DE LIEGE—

Mémoires. 3e Série. ix. (1912).

London.

BOARD OF AGRICULTURE AND FISHERIES—

Journal of the Board of Agriculture, xix., 8-12; xx., 1-7 and Supplement Nos. 10-11 (1912-13).

Leaflets: Nos. 79, 197, 220, 228, 264-266, 268-274 (1912-13).

BRITISH MUSEUM (NATURAL HISTORY)—

Catalogues: (*a*) Chætopoda, A. Polychæta. Part i., Arenicolidæ. By J. H. Ashworth (1912); (*b*) Chiroptera. Second Edition. By K. Andersen. Vol. i., Megachiroptera (1912); (*c*) Heads and Horns of Indian Big Game bequeathed by A. O. Hume. By R. Lydekker (1913); (*d*) Lepidoptera Phalænæ. By Sir G. Hampson, Bart. Vols. xi. (Text and Plates), xii. (Text) [1912-13]; (*e*) Mammals of Western Europe (exclusive of Russia). By G. S. Miller (1912); (*f*) Marine Reptiles of the Oxford Clay. By C. W. Andrews. Part ii. (4to. 1913).—Economic Series. No. 1. By E. E. Austen (1913).—General Index to Hand-List of the Genera and Species of Birds, Vols. i.-iv., (1912).—Guide to the Exhibition of Animals, Plants, and Minerals mentioned in the Bible (Second Edition; 1911).—Monograph of the Mycetozoa: Descriptive Catalogue of the Species in the Herbarium of the B.M. By A. Lister; Second Edition, revised by G. Lister (1911).—Revision of the Ichneumonidæ. By C. Morley. Parts i.-ii (1912-13).

Entomological Society—

Transactions. 1912, 1-5; 1913, 1-2(1912-13).

Geological Society—

Geological Literature added to the Society's Library during the year ended December 31st, 1911(1912).

List, April, 1913(1913).

Quarterly Journal. lxviii., 4; lxix., 1-2(1912-13).

Linnean Society—

Journal. *Botany.* xli., 280-283 (1912-13). *Zoology.* xxxii., 214-215(1912-13).

List of the Society. 1912-13(1912).

Proceedings, 124th Session, 1911-12(1912).

Transactions. Second Series. *Botany.* vii., 19-20; viii., 1-2 (1912-13). *Zoology.* xi., 11-12; xv., 2-4; xvi., 1(1912-13).

Royal Botanic Gardens, Kew—

Bulletin of Miscellaneous Information, 1912(1912).

Hooker's Icones Plantarum. Fourth Series. x., 4 (1913) *From the Bentham Trustees.*

Royal Microscopical Society—

Journal. 1912, 5-6; 1913, 1-5(1912-13).

Royal Society—

Philosophical Transactions. Series B. cciii., 296-302; cciv., 303-306(1912-13).

Proceedings. Series B. lxxxv., 583; lxxxvi., 584-591; lxxxvii., 592-593(1912-13).

Zoological Society—

Abstract of Proceedings. Nos. 112-123(1912-13).

List of Fellows, May, 1913(1913).

Proceedings. 1912, 4; 1913, 1-3(1912-13). Index, 1901-10 (1912).

Transactions. xx., 3-4 (1913).

Lyons.

Societe Botanique de Lyon—

Nouveau Bulletin. i., 1-3(1913).

Madrid.

Real Sociedad Espanola de Historia Natural—
Boletin. xii., 9-10; xiii., 1-5(1912-13).
Memorias. vii., 4-7(1912-13).

Manchester.

Manchester Literary and Philosophical Society—
Memoirs and Proceedings. lvi., 3; lvii., 1-2(1912-13).

University of Manchester: Manchester Museum—
Publications of the Manchester Museum. No. 73 (1912).

Manila, P.I.

Bureau of Forestry: Dept. of the Interior—
Annual Report of the Director for year ended June 30th, 1912 (1912).

Bureau of Science of the Government of the Philippine Islands—
Eleventh Annual Report of the Bureau of Science, 1911-12 (1913).
Philippine Journal of Science. Section A, vii., 3-6; viii., 1-2—Section B., vii., 3-6; viii., 1-4—Section C., vii., 5-6; viii., 1-4—Section D., vii., 4-6; viii., 1-3(1912-13).

Melbourne.

Australasian Journal of Pharmacy—
Vols. xxvii., 323-324; xxviii., 325-334(1912-13). *From the Publisher.*

Commonwealth Bureau of Census and Statistics—
Official Year-Book of the Commonwealth of Australia. No. 6, 1901-12(1913).

Commonwealth of Australia: Department of External Affairs—
Bulletin of the Northern Territory. Nos.1, 1*a* (1912).—Bulletin of the Territory of Papua. No.1(1913).

Department of Agriculture of Victoria—
Journal. x., 12; xi., 1-11(1912-13).

Field Naturalists' Club of Victoria—
Victorian Naturalist. xxix., 8-12; xxx., 1-5, 7(1912-13).

Public Library, Museums, &c., of Victoria—
Report of the Trustees for 1912(1913).

Royal Australasian Ornithologists' Union—
"The Emu," xii., 3-4 and Supplement; xiii., 1-2(1913).

Royal Geographical Society of Australasia: Victorian Branch.
Victorian Geographical Journal. xxix.(1912).

Royal Society of Victoria—
Proceedings. New Series. xxv., 2; xxvi., 1(1913).

University of Melbourne—
Calendar. 1913(1912).

Mexico.

Instituto Geologico de Mexico—
Boletin. Num. 29(Text and Atlas)[1912].
Parergones. iv., 1(1912).

Modena.

La Nuova Notarisia—*From the Editor, Dr. G.B.De Toni*.
Serie xxiv. Aprile, Luglio, Ottobre, 1913(1913).

Monaco.

Musee Oceanographique de Monaco—
Bulletin. ix., 247-252, T.p.etc.; x., 253-271(1912-13).

Montreal.

Royal Society of Canada—
Proceedings and Transactions Third Series. vi.,(1912-13).

Moscow.

Societe Imperiale des Naturalistes—
Bulletin. Année 1911,4; 1912(1913).

Munich.

Konigliche Bayerische Akademie der Wissenschaften—
Abhandlungen der Math.-physikal. Classe. xxv.,9-10; xxvi., 1-2(1911-13).—Supplement Band ii., 8-9(1912).

Sitzungsberichte der Math.-physikal. Classe. 1912,2-3(1912).
Pamphlet: "Physik und Technik auf dem Wege zum absoluten Nellpunkte der Temperatur." Von Dr. C. v. Linde (1912).

Nantes.

Societe des Sciences Naturelles de l'Ouest de la France—
Bulletin. 3me Série. ii., 1-2(1912).

Naples.

Zoologische Station zu Neapel—
Mittheilungen. xxi., 1-5(1913).

New Haven, Conn.

Connecticut Academy—
Transactions. xvii., pp.213-361, 363-538; xviii., pp.1-137 (1912-13).

New York.

American Geographical Society—
Bulletin. xliv, 10-12; xlv., 1-10(1912-13).

American Museum of Natural History—
Annual Report [Forty-fourth] for the Year 1912(1913).
Bulletin. xxxi.(1912).
Memoirs. N.S. i., 1-4(1912-13).

New York Academy of Sciences—
Annals. xxii.(1912-13).

Ottawa.

Geological Survey of Canada—
Publications: Memoirs, Nos. 13, 17E, 21, 33, 35 [Nos. 1121, 1160, 1175, 1242, 1186](1912-13)—Summary Report for 1911 [No.1218](1912).

Oxford.

Radcliffe Library, Oxford University Museum—
Catalogue of Books added during 1912(1913).

Palo Alto, Cal.

Leland Stanford Junior University—
Publications. University Series. Nos. 9, 11, 12(1912-13).

Paris.

Journal de Conchyliologie. lx.,2-4; lxi.,1(1912-13).—Pamphlet: "En faveur de la Loi de Priorité." Par E. Hartert(n.d.).

Museum d'Histoire Naturelle—
Bulletin. Année 1911, 7; 1912, 1-2(1911-12).
Catalogue de la Coll. de Lepidoptères, Pt. i., Papilionidæ (1912).

Societe Entomologique de France—
Annales. lxxxi., 2-4; lxxxii., 1-3(1912-13).
Bulletin, 1912, Nos.15-21; 1913, 1-14(1912-13).

Societe Zoologique de France—
Mémoires. xxix.(1911).

Perth, W.A.

Geological Survey of West Australia—
Annual Progress Report for the Year 1912(1913).
Bulletin, Nos.42, 43, 45, 46, 47, 50(1912-13).

Government Statistician, West Australia—
Monthly Statistical Abstract. 1912, Nos. 149-151; 1913, Nos.152-161(1912-13).

Philadelphia.

Academy of Natural Sciences—
Proceedings. lxiv., 3; lxv., 1(1913).

American Philosophical Society—
Proceedings. li., 203 and 205-207; lii., 208-209(1912-13).—General Index to Vols. i.-l., 1838-1911(1912).
List of Members, August, 1912(1912).
Transactions. N.S. xxii., 2(1912).

University of Pennsylvania—
Contributions from the Botanical Laboratory. iv., 1(1911).

Zoological Society of Philadelphia—
Forty-first Annual Report of the Board of Directors, April, 1913(1913).

Plymouth.

Marine Biological Association of the United Kingdom—
Journal. N.S. ix., 4(1913).

Prague.

Koeniglich-Boehmische Gesellschaft der Wiss., in Prag—
Jahresbericht, 1911, 1912(1912-13).
Sitzungsberichte, Math.-Naturwiss. Cl., 1911, 1912(1912-13).

Societas Entomologica Bohemiæ—
Acta. ix., 3-4; x., 1-2(1912-13).

Pusa, India.

Agricultural Research Institute—
Bulletin, No.32(1912).
Memoirs of the Department of Agriculture in India. *Botanical Series.* v., 1-5; vi., 1 and 3(1912-13). *Entomological Series,* iv., 4-5(1912-13)—Report of the Agricultural Research Institute, 1911-12(1913)—Report on the Progress of Agriculture in India for 1911-12(1913).

Richmond, N.S.W.

Hawkesbury Agricultural College—
H. A. C. Journal. ix., 4, 12; x., 1-7, 9-11(1912-13).
Nature-Studies: Suggestions for Teachers. By C. T. Musson, W. M. Carne, C. Potts, and M. S. Benjamin(1913).

Rochester, N.Y.

Rochester Academy of Science—
Proceedings. v. pp. 39-58(1912).

St. Louis.

Missouri Botanical Garden—
Twenty-third Annual Report, 1912(1912).

St. Petersburg.

Academie Imperiale des Sciences—
Annuaire du Musée Zoologique. 1911, xvi., 4; 1912, xvii., 1-4(1911-13).
Bulletin. 6e Série. 1912, 14-15, 17-18; 1913, 1-5, 7-8, 10, 12-13 (1912-13).

Faune de la Russie et des Pays Limitrophes —Hydroidea ii., 1(1912); Marsipobranchii et Pisces, iii., 1(1912).

COMITE GEOLOGIQUE (INSTITUT DES MINES)—

Bulletins. xxx., 6 10; xxxi., 1-8(1911-12).

Mémoires. Nouvelle Série. Livraisons 58, 62-65, 69, 72, 74-76, 78-79, 81, 86(1911-13).

RUSSISCH-KAISERLICHE MINERALOGISCHE GESELLSCHAFT—

Materialen zur Geologie Russlands. xxv.(1912).

Verhandlungen. Zweite Serie. xlviii.(1912).

SOCIETAS ENTOMOLOGICA ROSSICA—

Horæ Entomologicæ. xl., 3-6(1912-13).

Revue Russe d'Entomologie. xii., 2-4; xiii., 1(1912-13).

San Francisco

CALIFORNIA ACADEMY OF NATURAL SCIENCES—

Proceedings. Fourth Series. i., pp. 431-446; iii., pp. 187-264(1912).

Sendai, Japan.

TOHOKU IMPERIAL UNIVERSITY—

Science Reports. i., 2-3(1913).

Stockholm

ENTOMOLOGISKA FORENINGEN I STOCKHOLM—

Entomologisk Tidskrift. xxxiii., 1-4(1912).

KONGL. SVENSKA VETENSKAPS-AKADEMIE—

Arkiv f. *Botanik.* xi., 1-4; xii., 1-2(1912).—*Kemi.* iv., 3-5(1912).—*Mathematik, Astronomi och Fysik.* vii., 3-4; viii., 1-2(1912).—*Zoologi.* vii., 2-4(1912-13).

Arsbok, 1912(1912).

Handlingar, N.F. xlvii., 2-11, T.p.&c.; xlviii., 1-7, T.p.&c.; xlix., 1-10 (et "Aurivillius, C.", Förteckning öfver Skrifter, utgifna af Prof. G. Retzius), T.p&c.; l., 1 (1911-13).

Lefnadsteckningar, iv., 5(1912).

Les Prix Nobel en 1911(1912).

Meddelanden från K. Vetenskapsakademiens Nobelinstitut. ii., 2(1912).

Skrifter af Carl von Linné. v.[Iter Lapponicum](1913).

Sydney, N.S.W.

AUSTRALIAN MUSEUM—

Annual Report, 1911-12(1913).

Memoir iv., 17(1913).

Miscellaneous Series. No. viii.,(1913).

Records. viii., 4; ix., 2-4; x., 1-6(1913).

Special Catalogue No. i. iv., 1-3(1913).

AUSTRALASIAN MEDICAL CONGRESS—

Transactions of the Ninth Session, Sydney, September, 1911 (2 vols.; 1913).

BOTANIC GARDENS AND DOMAINS, SYDNEY—

Annual Report for 1911(1912).

Critical Revision of the Genus *Eucalyptus*. ii., 7-8(1912-13). By J. H. Maiden, Government Botanist, &c.

BUREAU OF STATISTICS—

Official Year Book of New South Wales, 1912(1912-13).

DEPARTMENT OF AGRICULTURE, N.S.W.—

Agricultural Gazette of New South Wales. xxiii., 12; xxiv., 1-11(1912-13).

Science Bulletin. Nos. 6, 7(1912).

DEPARTMENT OF AGRICULTURE, FOREST BRANCH, N.S.W.—

Forest Flora of New South Wales. By J. H. Maiden, Government Botanist, &c. v., 10(1912).

Report of the Forestry Branch for the Year ended 30th June, 1912(1912).

DEPARTMENT OF MINES—

Annual Report of the Department of Mines for 1912 (1913).

Mineral Resources. Nos. 7(2nd ed.), and 17(1913).

DEPARTMENT OF PUBLIC INSTRUCTION—

Public Instruction Gazette of New South Wales, vi., 11-12; vii., 1-11 and two Supplements(1912-13).

Department of Public Instruction: Teachers' College—
Records of the Education Society. Nos. 7, 14-17(1913).
Teachers' College Calendar, 1913(1913).

Department of Public Instruction: Technical Education Branch—
Annual Report, 1911(1912).
Technical Education Series. No. 18, Cabinet Timbers (1913).
Technical Gazette of New South Wales, iii., 1-2(1913).

Harrington's Photographic Journal. xxi.,247; xxii., 248-257(1912-13).

Institution of Surveyors, N.S.W.—
"The Surveyor." xxv., 11-12; xxvi., 1-10(1912-13).

New South Wales Naturalists' Club—
"Australian Naturalist." ii., 13-16(1913).

Public Library of New South Wales—
Annual Report, 1911(1912).

Royal Anthropological Society of Australasia—
"Science of Man" N.S. xiv., 1-2(1912-13).

Royal Society of New South Wales—
Journal and Proceedings. xlvi., 1-2; xlvii., 1(1912-13).

University of Sydney—
Calendar, 1913(1913).
Reprints of Reports from the Science Laboratories, B.1908-09 to 1910-11(1912).

Tokyo.

College of Science, Imperial University of Tokyo—
Journal. xxxii., 8-10; xxxiii., 1(1912-13).

Tokyo Zoological Society—
Annotationes Zoologicæ Japonenses. viii., 2(1913).

Toronto.

Canadian Institute—
Transactions. ix., 3(1912).

Townsville.

Australian Institute of Tropical Medicine—

Report for Years 1910, 1911(1911-12).

Tunis.

Institut Pasteur de Tunis—

Archives. 1912, 4; 1913, 1-2(1912-13).

Turin.

Museo di Zoologica,&c.,della R.Universita di Torino—

Bolletino xxvii., Nos.645-664(1912).

Upsal.

Kongl. Universitets-Bibliotheket i Upsal—

Akademisk Afhandling af H. Nelson ["Om Randdeltan och Randäsar i Mellersta och Södra Sverige."] (8vo., 1910)—Akademisk Afhandling af Sten de Geer ["Klarälfvens Serpentinlopp och Flodplan."] (1911)—Inbjudningsskrift till Ahörande af der Offentliga Föreläsning," &c., af H. Schück. Häft 1-2(Upsala, 1911)—Schedulæ ad S. J. Enandri Salices Scandinaviæ Exsiccatas, Fascs. i.-ii.(1911)—Svensk Flora: Beskrifning öfver Sveriges Fanerogamer och Ormbunkar, af N. C. Kindberg (12mo., n.d.)—Zoologiska Bidrag fran Uppsala. Band i.(1912).

Vienna.

K. K. Naturhistorisches Hofmuseum in Wien—

Annalen. xxvi., 3-4; xxvii., 1-2(1912-13).

K. K. Zoologisch-botanische Gesellschaft—

Verhandlungen. lxii., 5-10; lxiii., 1-8(1912-13).

Washington, D.C.

Bureau of American Ethnology—

Annual Report, xxvii., 1906-07(1912).

Bulletin. Nos.47, 52, 54(1912-13).

Carnegie Institute of Washington—

Department of Experimental Evolution: Annual Report of the Director, 1912[Reprint from Year Book, No.xi.](1912).

Smithsonian Institution—

Annual Report of the Board of Regents for the Year ending June 30th, 1911(1912).

U. S. Department of Agriculture—

Bulletin. Nos.5 and 8(1913).

Bureau of Entomology : Bulletin, T.p.&c. of Nos.82 and 90, 91, 95 Part vii., T.p.&c., 96 Pt. vi., 99 Pt. ii., 109 Pt. vii., 111, 113, 115 Pts. ii.-iii., 116 Pts. ii.-v., 117-122, 127 Pts. i.-ii. (1912-13).—Circular, Nos. 162-173 (1912-13).—Technical Series, T.p.&c. of No.12, No.16 Pts. v.-vii., 20 Pt. vi., 27 Pt. i.(1912-13).

Farmers' Bulletin, No.512(1912).

Year-Book, 1912(1913).

U. S. Geological Survey—

Bulletin. Nos.448, 466, 470, 471, 484, 485, 491-494, 496-521, 523, 524(1911-12).

Mineral Resources, 1910, 1911, Parts i.-ii.(1911-12).

Monograph. li.,(Text and Atlas; 1912).

Professional Papers. Nos.69, 71, 74, 77(1912).

Publications of the U.S.G.S. (not including Topographic Maps). N.S. No.2(1912).

Thirty-second and Thirty-third Annual Reports, 1911-12 (1911-12).

Water Supply and Irrigation Papers. Nos.259, 271, 278-291, 293, 294, 296-301, 304, 310, 311, 313, 316(1911-13).

U. S. National Museum—

Annual Report for the Year ending June 30th, 1912(1913).

Bulletin. Nos.79, 81(1912-13).

Contributions from the U. S. National Herbarium. xvi., 2-9 and 12; xvii., 1-3(1912-13).

Proceedings. xli., xlii , xliii.(1912-13).

Wellington, N.Z.

New Zealand Institute—

Transactions and Proceedings. xliv.-xlv., 1911-12(1912-13).

PRIVATE DONORS.

Bonnesen, F. P., Boggild, O. B., og Ravn, J. P. J., Copenhagen —Pamphlet: "Carlsbergfondets Dybdeboring, i Gröndals eng ved Kjöbenhavn 1894-1907, og dens Nidenskabelige Resultater(4to., Copenhagen, 1913).

Cheel, E., Sydney - One Separate: "Vegetations-Charakter der Samoa-Inseln," von E. Betche [Monatsschr. Ver. zur Beförderung des Gartenbaues in den K. preuss. Staaten, 1881].

Janet, C., Voisinlieu près Beauvais (Oise).—Two Pamphlets and two Separates: (*a*) "Constitution Morphologique de l'Insecte," (*b*) "Le Sporophyte et le Gamétophyte du Vegetal: le Soma at le Germen de l'insecte [F.29-30: Limoges, 1911-12]—(*c*) Organes sensitifs de la mandibule de l'Abeille, Apis mellifera L." (*d*) "Sur l'existence d'un organe chordotonal et d'une vésicule pulsatile antennaires chez l'Abeille, et sur la morphologie de la tête de cette espèce [21-21: CR. cli.-clii., 1910-11]—List of Papers in the "Comptes Rendus des Séances de l'Académie des Sciences."

McAlpine, D., Melbourne—Handbook of Fungus Diseases of the Potato in Australia, and their Treatment. By D. McAlpine (8vo., Melbourne, 1911).–Bitter Pit Investigation: the Past History and Present Position of the Bitter Pit Question. By D. McAlpine, First Progress Report, 1911-12(4to., Melbourne, 1913).

Oliver, W. R. B., Auckland, N.Z.—Separate: "Geographic Relationships of the Birds of Lord Howe, Norfolk, and the Kermadec Islands" [Trans. N.Z. Institute, xliv.(1912)].

Shirley, J., D.Sc, Brisbane—Pamphlet: "A List of the known Lichens of Tasmania" (1912).—Separate: "The Flora of the Basaltic Tablelands of S.E. Queensland" [Rept. Austr. Assoc. Adv. Science, xiii.,(1912)].

Smith, E. A., I.S.O., London—(*a*) Two Separates: "Description of a new Species of *Acmæa* from Bombay, &c.," and "On the generic name to be applied to the *Venus Islandica* Linn."

[Proc. Malacol. Soc. ix., x.(1911-12)].—(*b*) Four Separates: "Note on *Helix rufescens* of Pennant," and "On the Pennant Collection of British Shells" [Journ. of Conch., Feb.-March, 1913]; "Note on *Murex mancinella* Linn." [Proc. Malacol. Soc., x., 1913]; "Note on *Helix rufescens* of Pennant" [Ann. Mag. Nat. Hist. (8), xi., 1913].—One Separate: "On the Survival of a Miocene Oyster in Recent Seas." By E. B. Newton, and E. A. Smith [Rec. Geol. Surv. India, xlii., 1912].

SMITH, R. GREIG-, Sydney—Report of the Dove Marine Laboratory, Cullercoats, Northumberland, for Years ending 30th June, 1912, 30th June, 1913(1912-13).—Three Abstracts of Bacteriological Papers [Centralbl. f. Bakt. xxxiv., 1912].

STEEL, T., F.L.S., Sydney—Pamphlet: "Notes on the Cane-Borer" (issued by the Colonial Sugar Refining Co., Ltd., 1911).

SYMMONDS, R. S, Sydney—Pamphlet: "Our Artesian Waters: Observations in the Laboratory and in the Field" (8vo., Sydney, 1912).

TURNER, F., F.L.S., Sydney—Pamphlet: "A Census of the Grasses of New South Wales." Issued by direction of the Minister for Mines and Agriculture (8vo., Sydney, 1890).

WATERS, A. W., F.L.S., Bournemouth, Eng.—Two Separates: (*a*) "A Structure in *Adeonella (Laminopora) contorta* (Michelin), and some other Bryozoa, together with Remarks on the *Adeonidæ* [Ann. Mag. Nat. Hist. (8) ix., 1612[; (*b*) "The Marine Fauna of British East Africa and Zanzibar, &c. Bryozoa: Cheilostomata [Proc. Zool. Soc., 1913].

[Printed off, 17th March, 1914.]

INDEX.

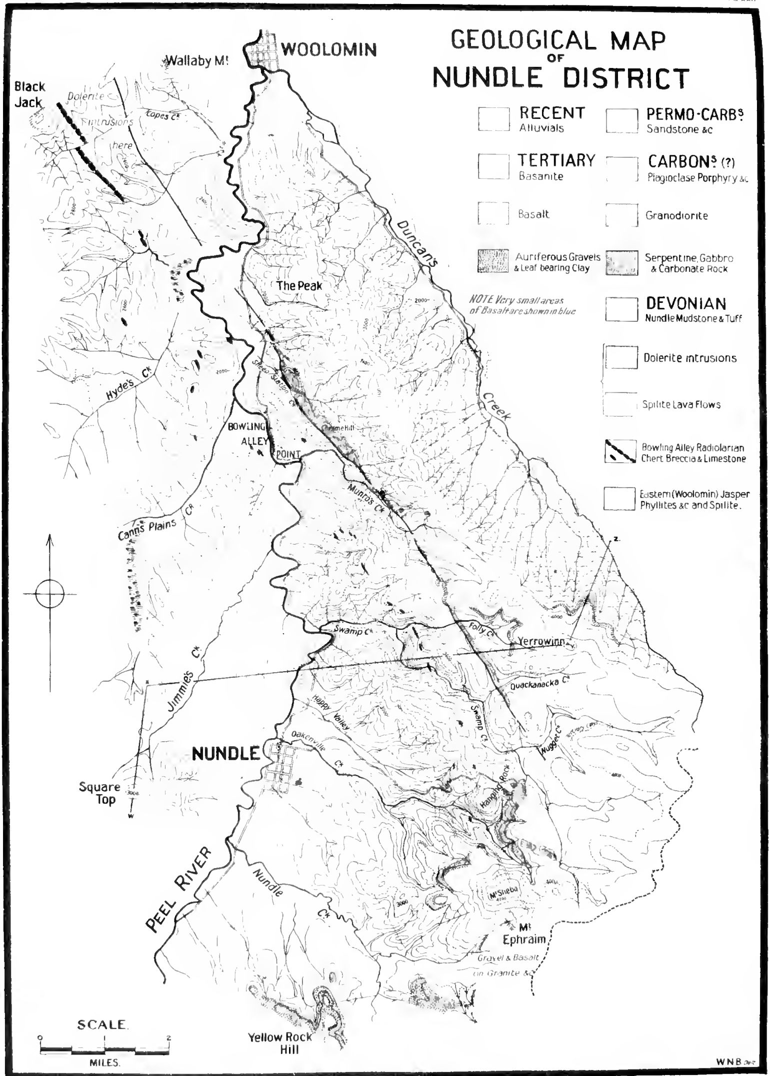
(1913.)

(*a*) GENERAL INDEX.

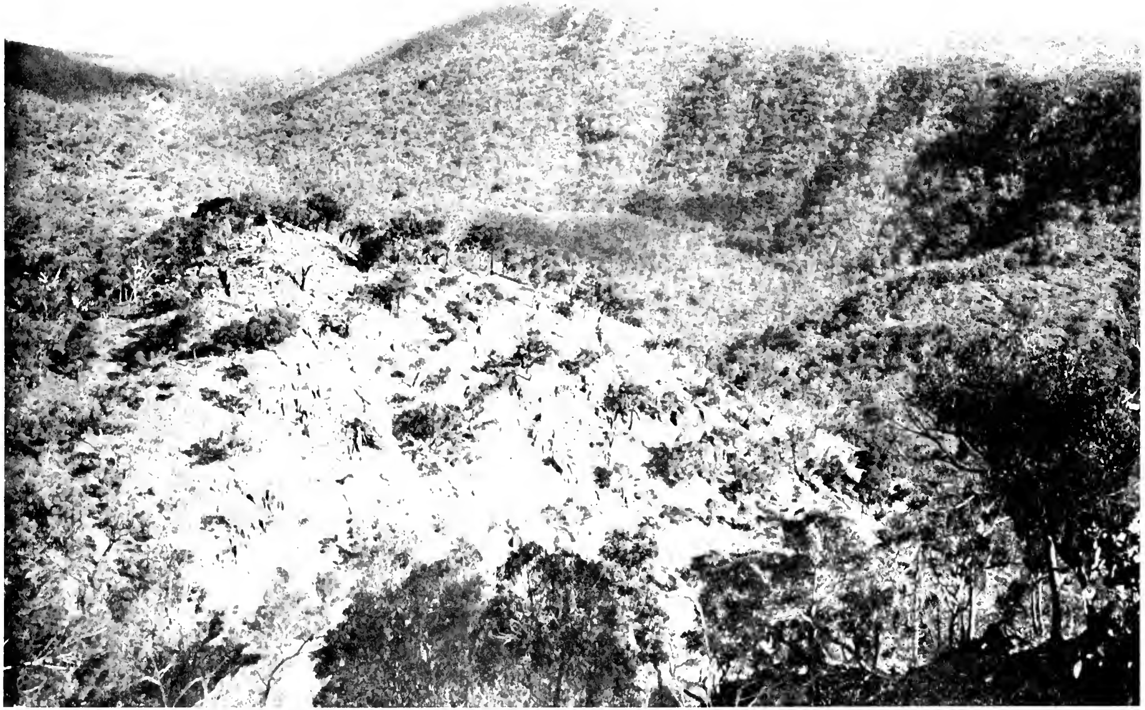
(*b*) BIOLOGICAL INDEX.

Names in italics are synonyms.

0



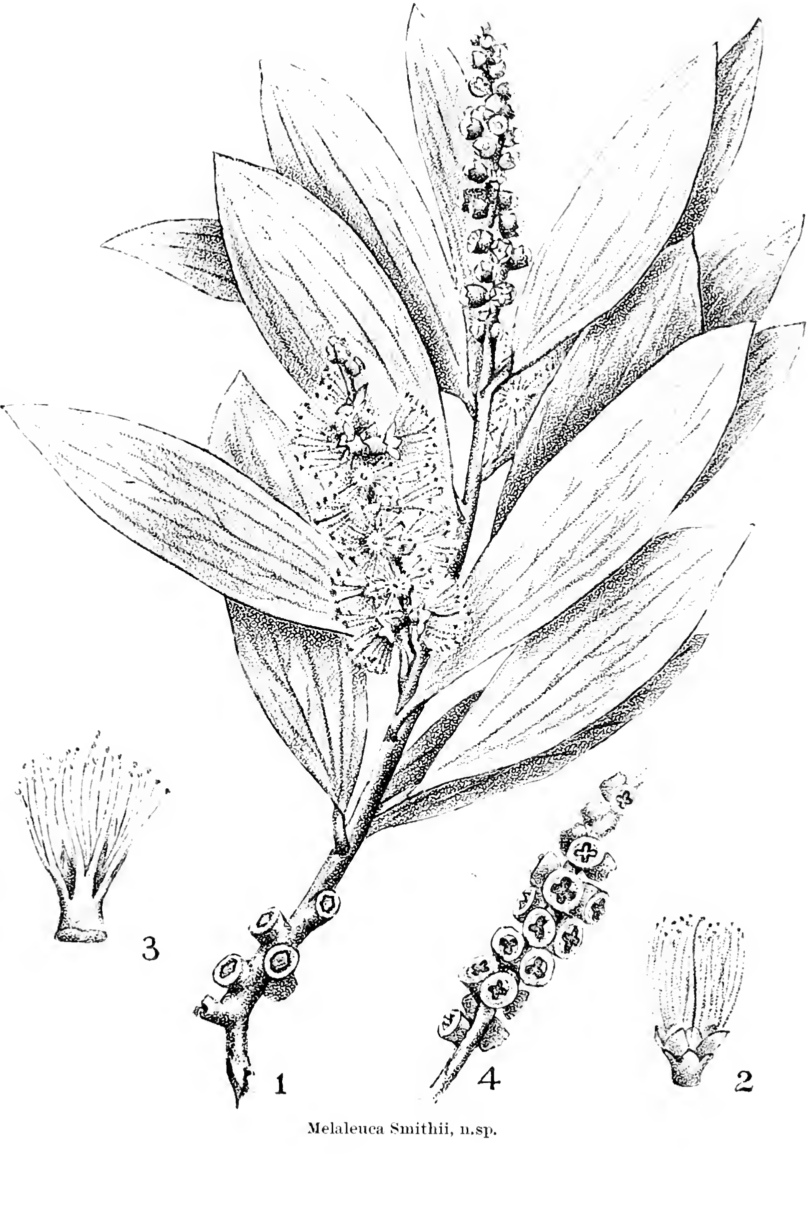
H. E. C. Robinson, Lith. 221-223 George St. Sydney.



View looking up Munro's Creek: the serpentine-belt to the left, cliffs of spilite in the centre, dolerite-cliffs to the right.

Swamp Creek Falls, dropping behind a shutter-like mass of spilite.

Melaleuca Maideni, n.sp.

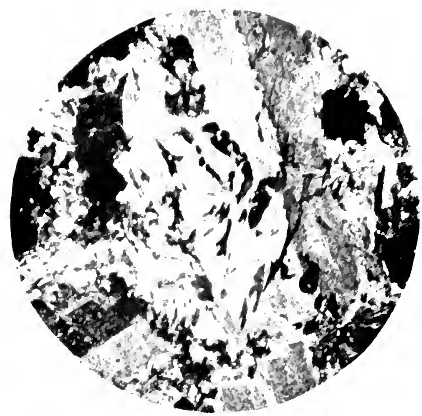


Melaleuca Smithii, n.sp.

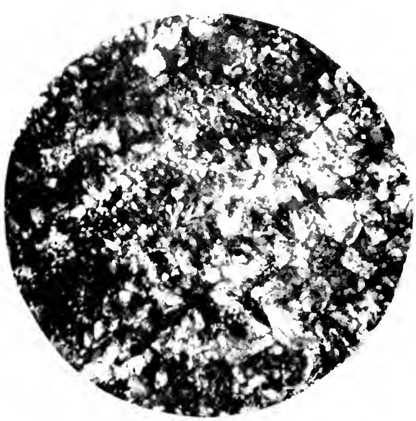
1

2

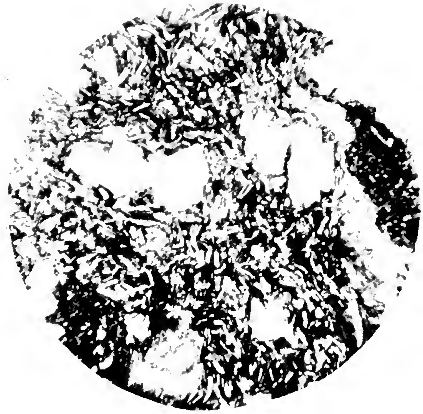
3



4



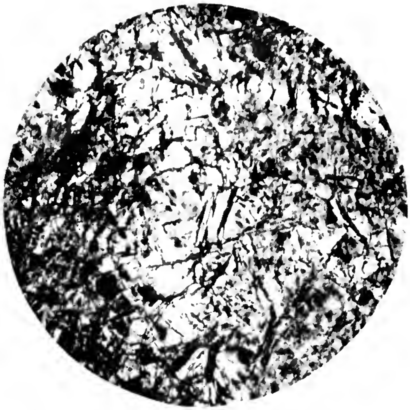
5



6

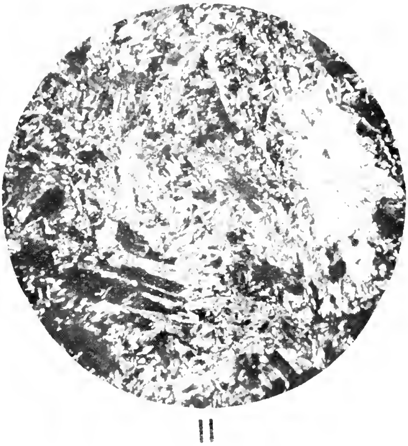
Petrology of the Great Serpentine Belt of New South Wales.

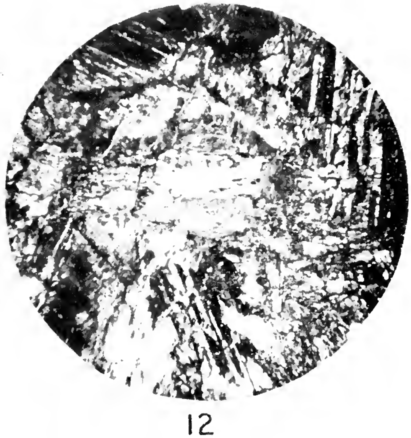

7


8

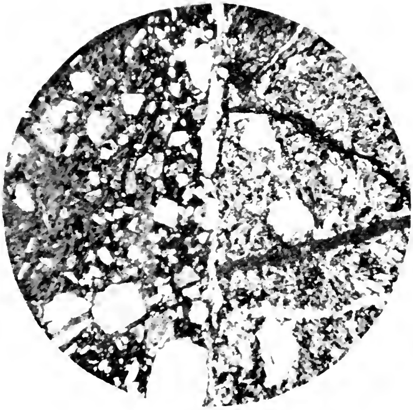

9


10

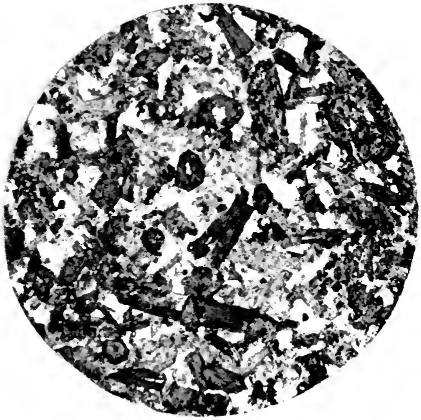

11


12

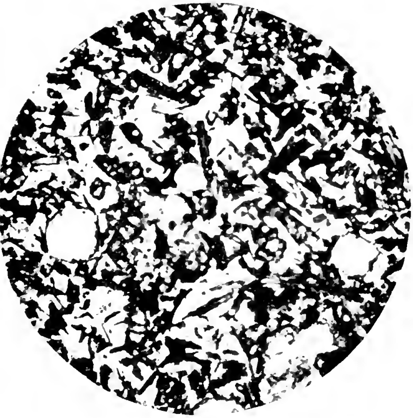
Petrology of the Great Serpentine Belt of New South Wales.



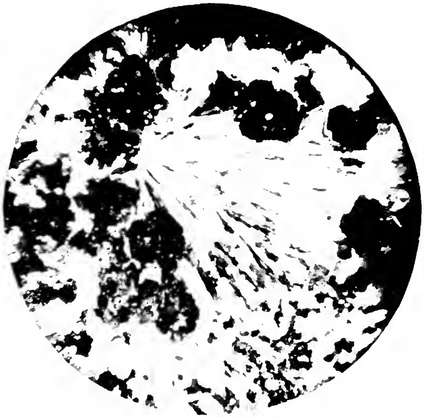
13



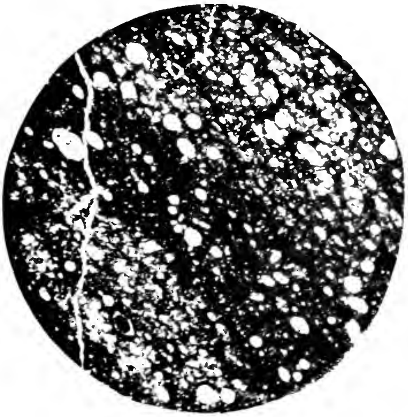
14



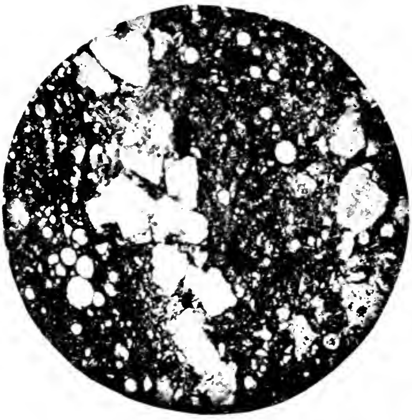
15



16

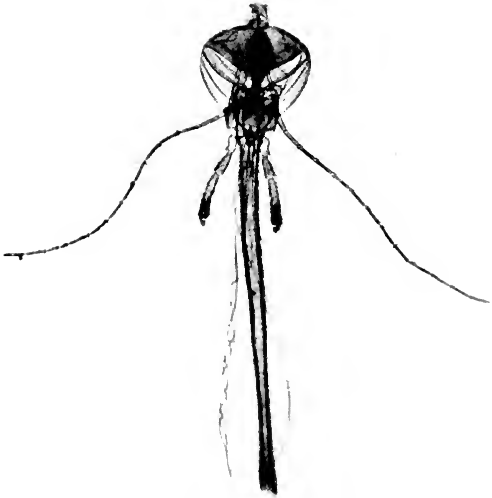


17



18

Petrology of the Great Serpentine Belt of New South Wales.

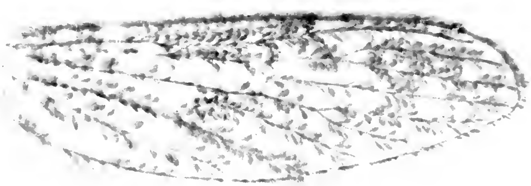


1

Figs. 1-2.
Culicada vittiger
(Skuse).

Fig. 3.
Ædeomyia venustipes
(Skuse).

2



3

Issued 17th September, 1913

Vol. XXXVIII.
Part 1.

No. 149

THE PROCEEDINGS OF THE LINNEAN SOCIETY OF NEW SOUTH WALES

FOR THE YEAR

1913

PART I. (pp. 1-228.)

Containing Papers read in

MARCH-MAY (in part)

WITH FOURTEEN PLATES.

(Plates i.-xiv.)

SYDNEY:

PRINTED AND PUBLISHED FOR THE SOCIETY
BY
W. A. PEPPERDAY & CO., 119A PITT STREET
AND
SOLD BY THE SOCIETY

NOTICE.

With the exception of Volumes I.-VI. of the Proceedings—of which the Society's stock was totally destroyed in the Garden Palace Fire—the Publications of the Linnean Society of N.S.W. may be obtained at the Society's Hall, Ithaca Road, Elizabeth Bay, Sydney, from Dulau & Co., 37 Soho Square, London, W., or R. Friedländer & Sohn, Carlstrasse 11, Berlin, N.W., at the following prices:—

First Series.

Proceedings for 1882, Vol. VII.—Part 1, 7s. 6d.; Part 2, 10s.; Part 3, 5s.; Part 4, 10s.

Proceedings for 1883, Vol. VIII.—Part 1, 10s.; Part 2, 5s.; Part 3, 7s.; Part 4, 8s.

Proceedings for 1884, Vol. IX.—Part 1, 8s.; Part 2, 12s.; Part 3, £1 5s.; Part 4, £1 5s.

Proceedings for 1885, Vol. X.—Part 1, 12s.; Part 2, 7s. 6d.; Part 3, 15s.; Part 4, 17s. 6d.

Second Series.

Proceedings for 1886, Vol. I.—Part 1, 10s. 6d.; Part 2, 12s.; Part 3, 13s.; Part 4, 12s. 6d.

Proceedings for 1887, Vol. II.—Part 1, 7s.; Part 2, 8s.; Part 3, 12s.; Part 4, £1 7s.

Proceedings for 1888, Vol. III.—Part 1, 15s.; Part 2, £1 4s.; Part 3, £1; Part 4, 18s.

Proceedings for 1889, Vol. IV.—Part 1, 11s.; Part 2, 16s.; Part 3, 19s.; Part 4, 11s.

Proceedings for 1890, Vol. V.—Part 1, 11s.; Part 2, 9s.; Part 3, 9s.; Part 4, 9s.

Proceedings for 1891, Vol. VI.—Part 1, 10s.; Part 2, 9s. 6d.; Part 3, 17s.; Part 4, 7s. 6d.

Proceedings for 1892, Vol. VII.—Part 1, 6s. 6d.; Part 2, 4s. 6d.; Part 3, 8s.; Part 4, 8s.

Proceedings for 1893, Vol. VIII.—Part 1, 5s.; Part 2, 11s.; Part 3, 6s.; Part 4, 9s.

Proceedings for 1894.—Vol. IX.—Part 1, 12s.; Part 2, 12s.; Part 3, 13s.; Part 4, 8s.

Proceedings for 1895, Vol. V.—Part 1, 15s.; Part 2, 8s. 6d.; Part 3, 10s., Supplement, 1s. 6d.; Part 4, 12s.

Proceedings for 1896.—Part 1, 9s., Supplement, 2s. 6d.; Part 2, 6s. 6d.; Part 3, 7s. 6d.; Part 4, £1 7s. 6d.

Proceedings for 1897.—Part 1, 10s.; Part 2, 8s. 6d.; Part 3, 9s.; Part 4, 12s. 6d.

Proceedings for 1898.—Part 1, 3s.; Part 2, 6s.; Part 3, 12s.; Part 4, 14s.

Proceedings for 1899.—Part 1, 12s. 6d.; Part 2, 12s.; Part 3, 10s.; Part 4, 10s. 6d.

Proceedings for 1900.—Part 1, 8s.; Part 2, 10s. 6d.; Part 3, 10s. 6d.; Part 4, 17s. 6d.

Proceedings for 1901.—Part 1, 10s.; Part 2, 9s.; Part 3, 5s.; Part 4, 17s. 6d.

Proceedings for 1902.—Part 1, 7s.; Part 2, 7s. 6d.; Part 3, 7s. 6d., Supplement, 3s.; Part 4, 15s.

Proceedings for 1903.—Part 1, 9s.; Part 2, 12s. 6d.; Part 3, 14s.; Part 4, 15s.

Proceedings for 1904.—Part 1, 10s.; Part 2, 7s. 6d.; Part 3, 9s.; Part 4, 10s.

Proceedings for 1905.—Part 1, with Supplement, 7s.; Part 2, 10s.; Part 3, 12s. 6d.; Part 4, with Supplement, 10s. 6d.

Proceedings for 1906.—Part 1, 12s. 6d.; Part 2, 12s. 6d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1907.—Part 1, 8s.; Part 2, 8s. 6d.; Part 3, 15s.; Part 4, 18s.

Proceedings for 1908.—Part 1, 7s.; Part 2, 9s.; Part 3, 14s.; Part 4, 12s. 6d

Proceedings for 1909.—Part 1, 12s.; Part 2, 17s.; Part 3, 14s.; Part 4, 16s. 6d.

Proceedings for 1910.—Part 1, 11s.; Part 2, 11s.; Part 3, 7s.; Part 4, 12s. 6d.

Proceedings for 1911—Part 1, 9s. 6d.; Part 2, 9s. 6d.; Part 3, 9s. 6d.; Part 4, 10s.

Proceedings for 1912—Part 1, 8s. 6d.; Part 2, 25s. 0d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1913—Part 1, 14s.

The Macleay Memorial Volume [issued October 13th, 1893]. Royal 4to., li. and 308 pages, with Portrait, and forty-two plates. Price £3 3.

Descriptive Catalogue of Australian Fishes. By William Macleay, F.L.S. [1881]. A few copies only. Price £1, net.

The Transactions of the Entomological Society of New South Wales, 2 vols., 8vo [Vol. i. five Parts, 1863-66; Vol. ii. five Parts, 1869-73; all published], price £2, net, are also obtainable, but neither the Parts nor the Volumes are sold separately.

PROCEEDINGS, 1913, PART 1.

CONTENTS.

Issued 5th November, 1913

Vol. XXXVIII.
Part 2.

No. 150

THE

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES

FOR THE YEAR

1913

PART II. (pp. 229-400.)

Containing Papers read in

MAY (in part)-JUNE

WITH FIVE PLATES.

(Plates xv.-xix.)

SYDNEY:

PRINTED AND PUBLISHED FOR THE SOCIETY

BY

W. A. PEPPERDAY & CO., 119A PITT STREET

AND

SOLD BY THE SOCIETY

PRICE - 7/6.

AGENTS IN EUROPE:

Messrs. DULAU & Co., 37 Soho Square, London, W.
Messrs. R. FRIEDLÆNDER & SOHN, Carlstrasse 11, Berlin, N.W.

NOTICE.

With the exception of Volumes I.-VI. of the Proceedings—of which the Society's stock was totally destroyed in the Garden Palace Fire—the Publications of the Linnean Society of N.S.W. may be obtained at the Society's Hall, Ithaca Road, Elizabeth Bay, Sydney, from Dulau & Co., 37 Soho Square, London, W., or R. Friedländer & Sohn, Carlstrasse 11, Berlin, N.W., at the following prices :—

First Series.

Proceedings for 1882, Vol. VII.—Part 1, 7s. 6d.; Part 2, 10s.; Part 3, 5s.; Part 4, 10s.

Proceedings for 1883, Vol. VIII.—Part 1, 10s.; Part 2, 5s.; Part 3, 7s.; Part 4, 8s.

Proceedings for 1884, Vol. IX.—Part 1, 8s.; Part 2, 12s.; Part 3, £1 5s.; Part 4, £1 5s.

Proceedings for 1885, Vol. X.—Part 1, 12s.; Part 2, 7s. 6d.; Part 3, 15s.; Part 4, 17s. 6d.

Second Series.

Proceedings for 1886, Vol. I.—Part 1, 10s. 6d.; Part 2, 12s.; Part 3, 13s.; Part 4, 12s. 6d.

Proceedings for 1887, Vol. II.—Part 1, 7s.; Part 2, 8s.; Part 3, 12s.; Part 4, £1 7s.

Proceedings for 1888, Vol. III.—Part 1, 15s.; Part 2, £1 4s.; Part 3, £1; Part 4, 18s.

Proceedings for 1889, Vol. IV.—Part 1, 11s.; Part 2, 16s.; Part 3, 19s.; Part 4, 11s.

Proceedings for 1890, Vol. V.—Part 1, 11s.; Part 2, 9s.; Part 3, 9s.; Part 4, 9s.

Proceedings for 1891, Vol. VI.—Part 1, 10s.; Part 2, 9s. 6d.; Part 3, 17s.; Part 4, 7s. 6d.

Proceedings for 1892, Vol. VII.—Part 1, 6s. 6d.; Part 2, 4s. 6d.; Part 3, 8s.; Part 4, 8s.

Proceedings for 1893, Vol. VIII.—Part 1, 5s.; Part 2, 11s.; Part 3, 6s.; Part 4, 9s.

Proceedings for 1894.—Vol. IX.—Part 1, 12s.; Part 2, 12s.; Part 3, 13s.; Part 4, 8s,

Proceedings for 1895, Vol. V.—Part 1, 15s.; Part 2, 8s. 6d.; Part 3, 10s., Supplement, 1s. 6d.; Part 4, 12s.

Proceedings for 1896.—Part 1, 9s., Supplement, 2s. 6d.; Part 2, 6s. 6d.; Part 3, 7s. 6d.; Part 4, £1 7s. 6d.

Proceedings for 1897.—Part 1, 10s.; Part 2, 8s. 6d.; Part 3, 9s.; Part 4, 12s. 6d.

Proceedings for 1898.—Part 1, 3s.; Part 2, 6s.; Part 3, 12s.; Part 4, 14s.

Proceedings for 1899.—Part 1, 12s. 6d.; Part 2, 12s.; Part 3, 10s.; Part 4, 10s. 6d.

Proceedings for 1900.—Part 1, 8s.; Part 2, 10s. 6d.; Part 3, 10s. 6d.; Part 4, 17s. 6d.

Proceedings for 1901.—Part 1, 10s.; Part 2, 9s.; Part 3, 5s.; Part 4, 17s. 6d.

Proceedings for 1902.—Part 1, 7s.; Part 2, 7s. 6d.; Part 3, 7s. 6d., Supplement, 3s.; Part 4, 15s.

Proceedings for 1903.—Part 1, 9s.; Part 2, 12s. 6d.; Part 3, 14s.; Part 4, 15s.

Proceedings for 1904.—Part 1, 10s.; Part 2, 7s. 6d.; Part 3, 9s.; Part 4, 10s.

Proceedings for 1905.—Part 1, with Supplement, 7s.; Part 2, 10s.; Part 3, 12s. 6d.; Part 4, with Supplement, 10s. 6d.

Proceedings for 1906.—Part 1, 12s. 6d.; Part 2, 12s. 6d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1907.—Part 1, 8s.; Part 2, 8s. 6d.; Part 3, 15s.; Part 4, 18s.

Proceedings for 1908.—Part 1, 7s.; Part 2, 9s.; Part 3, 14s.; Part 4, 12s. 6d.

Proceedings for 1909.—Part 1, 12s.; Part 2, 17s.; Part 3, 14s.; Part 4, 16s. 6d.

Proceedings for 1910.—Part 1, 11s.; Part 2, 11s.; Part 3, 7s.; Part 4, 12s. 6d.

Proceedings for 1911—Part 1, 9s. 6d.; Part 2. 9s. 6d.; Part 3, 9s. 6d.; Part 4, 10s.

Proceedings for 1912—Part 1, 8s. 6d.; Part 2, 25s. 0d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1913—Part 1, 14s.; Part 2, 7s. 6d.

The Macleay Memorial Volume [issued October 13th, 1893]. Royal 4to., li. and 308 pages, with Portrait, and forty-two plates. Price £3 3.

Descriptive Catalogue of Australian Fishes. By William Macleay, F.L.S. [1881]. A few copies only. Price £1, net.

The Transactions of the Entomological Society of New South Wales, 2 vols., 8vo [Vol. i. five Parts, 1863-66; Vol. ii. five Parts, 1869-73; all published], price £2, net, are also obtainable, but neither the Parts nor the Volumes are sold separately.

PROCEEDINGS, 1913, PART 2.

CONTENTS.

Issued 19th December, 1913.

Vol. XXXVIII.
Part 3.

No. 151

THE PROCEEDINGS OF THE LINNEAN SOCIETY OF NEW SOUTH WALES

FOR THE YEAR

1913

PART III. (pp. 401-568.)

Containing Papers read in

JULY, AUGUST, and SEPTEMBER (in part).

WITH TWO PLATES.

(Plates xx.-xxi.)

SYDNEY:

PRINTED AND PUBLISHED FOR THE SOCIETY
BY
W. A. PEPPERDAY & CO., 119A PITT STREET
AND
SOLD BY THE SOCIETY

PRICE - 6/-.

AGENTS IN EUROPE:

Messrs. DULAU & Co., 37 Soho Square, London, W.
Messrs. R. FRIEDLÆNDER & SOHN, Carlstrasse 11, Berlin, N.W.

NOTICE.

With the exception of Volumes I.-VI. of the Proceedings—of which the Society's stock was totally destroyed in the Garden Palace Fire—the Publications of the Linnean Society of N.S.W. may be obtained at the Society's Hall, Ithaca Road, Elizabeth Bay, Sydney, from Dulau & Co., 37 Soho Square, London, W., or R. Friedländer & Sohn, Carlstrasse 11, Berlin, N.W., at the following prices :—

First Series.

Proceedings for 1882, Vol. VII.—Part 1, 7s. 6d.; Part 2, 10s.; Part 3, 5s.; Part 4, 10s.

Proceedings for 1883, Vol. VIII.—Part 1, 10s.; Part 2, 5s.; Part 3, 7s.; Part 4, 8s.

Proceedings for 1884, Vol. IX.—Part 1, 8s.; Part 2, 12s.; Part 3, £1 5s.; Part 4, £1 5s.

Proceedings for 1885, Vol. X.—Part 1, 12s.; Part 2, 7s. 6d.; Part 3, 15s.; Part 4, 17s. 6d.

Second Series.

Proceedings for 1886, Vol. I.—Part 1, 10s. 6d.; Part 2, 12s.; Part 3, 13s.; Part 4, 12s. 6d.

Proceedings for 1887, Vol. II.—Part 1, 7s.; Part 2, 8s.; Part 3, 12s.; Part 4, £1 7s.

Proceedings for 1888, Vol. III.—Part 1, 15s.; Part 2, £1 4s.; Part 3, £1; Part 4, 18s.

Proceedings for 1889, Vol. IV.—Part 1, 11s.; Part 2, 16s.; Part 3, 19s.; Part 4, 11s.

Proceedings for 1890, Vol. V.—Part 1, 11s.; Part 2, 9s.; Part 3, 9s.; Part 4, 9s.

Proceedings for 1891, Vol. VI.—Part 1, 10s.; Part 2, 9s. 6d.; Part 3, 17s.; Part 4, 7s. 6d.

Proceedings for 1892, Vol. VII.—Part 1, 6s. 6d.; Part 2, 4s. 6d.; Part 3, 8s.; Part 4, 8s.

Proceedings for 1893, Vol. VIII.—Part 1, 5s.; Part 2, 11s.; Part 3, 6s.; Part 4, 9s.

Proceedings for 1894.—Vol. IX.—Part 1, 12s.; Part 2, 12s.; Part 3, 13s.; Part 4, 8s.

Proceedings for 1895, Vol. V.—Part 1, 15s.; Part 2, 8s. 6d.; Part 3, 10s., Supplement, 1s. 6d.; Part 4, 12s.

Proceedings for 1896.—Part 1, 9s., Supplement, 2s. 6d.; Part 2, 6s. 6d.; Part 3, 7s. 6d.; Part 4, £1 7s. 6d.

Proceedings for 1897.—Part 1, 10s.; Part 2, 8s. 6d.; Part 3, 9s.; Part 4, 12s. 6d.

Proceedings for 1898.—Part 1, 3s.; Part 2, 6s.; Part 3, 12s.; Part 4, 14s.

Proceedings for 1899.—Part 1, 12s. 6d.; Part 2, 12s.; Part 3, 10s.; Part 4, 10s. 6d.

Proceedings for 1900.—Part 1, 8s.; Part 2, 10s. 6d.; Part 3, 10s. 6d.; Part 4, 17s. 6d.

Proceedings for 1901.—Part 1, 10s.; Part 2, 9s.; Part 3, 5s.; Part 4, 17s. 6d.

Proceedings for 1902.—Part 1, 7s.; Part 2, 7s. 6d.; Part 3, 7s. 6d., Supplement, 3s.; Part 4, 15s.

Proceedings for 1903.—Part 1, 9s.; Part 2, 12s. 6d.; Part 3, 14s.; Part 4, 15s.

Proceedings for 1904.—Part 1, 10s.; Part 2, 7s. 6d.; Part 3, 9s.; Part 4, 10s.

Proceedings for 1905.—Part 1, with Supplement, 7s.; Part 2, 10s.; Part 3, 12s. 6d.; Part 4, with Supplement, 10s. 6d.

Proceedings for 1906.—Part 1, 12s. 6d.; Part 2, 12s. 6d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1907.—Part 1, 8s.; Part 2, 8s. 6d.; Part 3, 15s.; Part 4, 18s.

Proceedings for 1908.—Part 1, 7s.; Part 2, 9s.; Part 3, 14s.; Part 4, 12s. 6d.

Proceedings for 1909.—Part 1, 12s.; Part 2, 17s.; Part 3, 14s.; Part 4, 16s. 6d.

Proceedings for 1910.—Part 1, 11s.; Part 2, 11s.; Part 3, 7s.; Part 4, 12s. 6d.

Proceedings for 1911—Part 1, 9s. 6d.; Part 2, 9s. 6d.; Part 3, 9s. 6d.; Part 4, 10s.

Proceedings for 1912—Part 1, 8s. 6d.; Part 2, 25s. 0d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1913—Part 1, 14s.; Part 2, 7s. 6d.; Part 3, 6s.

The Macleay Memorial Volume [issued October 13th, 1893]. Royal 4to., li. and 308 pages, with Portrait, and forty-two plates. Price £3 3.

Descriptive Catalogue of Australian Fishes. By William Macleay, F.L.S. [1881]. A few copies only. Price £1, net.

The Transactions of the Entomological Society of New South Wales, 2 vols., 8vo [Vol. i. five Parts, 1863-66; Vol. ii. five Parts, 1869-73; all published], price £2, net, are also obtainable, but neither the Parts nor the Volumes are sold separately.

PROCEEDINGS, 1913, PART 3.

CONTENTS.

Issued 23rd March, 1914.

Vol. XXXVIII.
Part 4.

No. 152

THE PROCEEDINGS OF THE LINNEAN SOCIETY OF NEW SOUTH WALES

FOR THE YEAR

1913

PART IV. (pp. 569-802, i.-xl.)

Containing Papers read in

SEPTEMBER, OCTOBER, and NOVEMBER.

WITH NINE PLATES.

(Plates xxii.-xxx.)

SYDNEY:

PRINTED AND PUBLISHED FOR THE SOCIETY

BY

W. A. PEPPERDAY & CO., 119A PITT STREET

AND

SOLD BY THE SOCIETY

PRICE - 13/-

AGENTS IN EUROPE:

Messrs. Dulau & Co., 37 Soho Square, London, W.
Messrs. R. Friedländer & Sohn, Carlstrasse 11, Berlin, N.W.

NOTICE.

With the exception of Volumes I.-VI. of the Proceedings—of which the Society's stock was totally destroyed in the Garden Palace Fire—the Publications of the Linnean Society of N.S.W. may be obtained at the Society's Hall, Ithaca Road, Elizabeth Bay, Sydney, from Dulau & Co., 37 Soho Square, London, W., or R. Friedländer & Sohn, Carlstrasse 11, Berlin, N.W., at the following prices :—

First Series.

Proceedings for 1882, Vol. VII.—Part 1, 7s. 6d.; Part 2, 10s.; Part 3, 5s.; Part 4, 10s.

Proceedings for 1883, Vol. VIII.—Part 1, 10s.; Part 2, 5s.; Part 3, 7s.; Part 4, 8s.

Proceedings for 1884, Vol. IX.—Part 1, 8s.; Part 2, 12s.; Part 3, £1 5s.; Part 4, £1 5s.

Proceedings for 1885, Vol. X.—Part 1, 12s.; Part 2, 7s. 6d.; Part 3, 15s.; Part 4, 17s. 6d.

Second Series.

Proceedings for 1886, Vol. I.—Part 1, 10s. 6d.; Part 2, 12s.; Part 3, 13s.; Part 4, 12s. 6d.

Proceedings for 1887, Vol. II.—Part 1, 7s.; Part 2, 8s.; Part 3, 12s.; Part 4, £1 7s.

Proceedings for 1888, Vol. III.—Part 1, 15s.; Part 2, £1 4s.; Part 3, £1; Part 4, 18s.

Proceedings for 1889, Vol. IV.—Part 1, 11s.; Part 2, 16s.; Part 3, 19s.; Part 4, 11s.

Proceedings for 1890, Vol. V.—Part 1, 11s.; Part 2, 9s.; Part 3, 9s.; Part 4, 9s.

Proceedings for 1891, Vol. VI.—Part 1, 10s.; Part 2, 9s. 6d.; Part 3, 17s.; Part 4, 7s. 6d.

Proceedings for 1892, Vol. VII.—Part 1, 6s. 6d.; Part 2, 4s. 6d.; Part 3, 8s.; Part 4, 8s.

Proceedings for 1893, Vol. VIII.—Part 1, 5s.; Part 2, 11s.; Part 3, 6s.; Part 4, 9s.

Proceedings for 1894.—Vol. IX.—Part 1, 12s.; Part 2, 12s.; Part 3, 13s.; Part 4, 8s.

Proceedings for 1895, Vol. V.—Part 1, 15s.; Part 2, 8s. 6d.; Part 3, 10s., Supplement, 1s. 6d.; Part 4, 12s.

Proceedings for 1896.—Part 1, 9s., Supplement, 2s. 6d.; Part 2, 6s. 6d.; Part 3, 7s. 6d.; Part 4, £1 7s. 6d.

Proceedings for 1897.—Part 1, 10s.; Part 2, 8s. 6d.; Part 3, 9s.; Part 4, 12s. 6d.

Proceedings for 1898.—Part 1, 3s.; Part 2, 6s.; Part 3, 12s.; Part 4, 14s.

Proceedings for 1899.—Part 1, 12s. 6d.; Part 2, 12s.; Part 3, 10s.; Part 4, 10s. 6d.

Proceedings for 1900.—Part 1, 8s.; Part 2, 10s. 6d.; Part 3, 10s. 6d.; Part 4, 17s. 6d.

Proceedings for 1901.—Part 1, 10s.; Part 2, 9s.; Part 3, 5s.; Part 4, 17s. 6d.

Proceedings for 1902.—Part 1, 7s.; Part 2, 7s. 6d.; Part 3, 7s. 6d., Supplement, 3s.; Part 4, 15s.

Proceedings for 1903.—Part 1, 9s.; Part 2, 12s. 6d.; Part 3, 14s.; Part 4, 15s.

Proceedings for 1904.—Part 1, 10s.; Part 2, 7s. 6d.; Part 3, 9s.; Part 4, 10s.

Proceedings for 1905.—Part 1, with Supplement, 7s.; Part 2, 10s.; Part 3, 12s. 6d.; Part 4, with Supplement, 10s. 6d.

Proceedings for 1906.—Part 1, 12s. 6d.; Part 2, 12s. 6d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1907.—Part 1, 8s.; Part 2, 8s. 6d.; Part 3, 15s.; Part 4, 18s.

Proceedings for 1908.—Part 1, 7s.; Part 2, 9s.; Part 3, 14s.; Part 4, 12s. 6d.

Proceedings for 1909.—Part 1, 12s.; Part 2, 17s.; Part 3, 14s.; Part 4, 16s. 6d.

Proceedings for 1910.—Part 1, 11s.; Part 2, 11s.; Part 3, 7s.; Part 4, 12s. 6d.

Proceedings for 1911—Part 1, 9s. 6d.; Part 2, 9s. 6d.; Part 3, 9s. 6d.; Part 4, 10s.

Proceedings for 1912—Part 1, 8s. 6d.; Part 2, 25s. 0d.; Part 3, 12s. 6d.; Part 4, 15s.

Proceedings for 1913—Part 1, 14s.; Part 2, 7s. 6d.; Part 3, 6s.; Part 4, 13s.

The Macleay Memorial Volume [issued October 13th, 1893]. Royal 4to., li. and 308 pages, with Portrait, and forty-two plates. Price £3 3.

Descriptive Catalogue of Australian Fishes. By William Macleay, F.L.S. [1881]. A few copies only. Price £1, net.

The Transactions of the Entomological Society of New South Wales, 2 vols., 8vo [Vol. i. five Parts, 1863-66; Vol. ii. five Parts, 1869-73; all published], price £2, net, are also obtainable, but neither the Parts nor the Volumes are sold separately.

PROCEEDINGS, 1913, PART 4.

CONTENTS.