TRANSACTIONS AND PROCEEDINGS

OF THE

ROYAL SOCIETY OF SOUTH AUSTRALIA

(INCORPORATED)

VOL. LVII.

[WITH PORTRAIT, TEN PLATES, AND THIRTY-TWO FIGURES IN THE TEXT]

EDITED BY PROFESSOR WALTER HOWCHIN, F.G.S.

[Each Author is responsible for the soundness of the opinions given, and for the accuracy of the statements made in his paper.]

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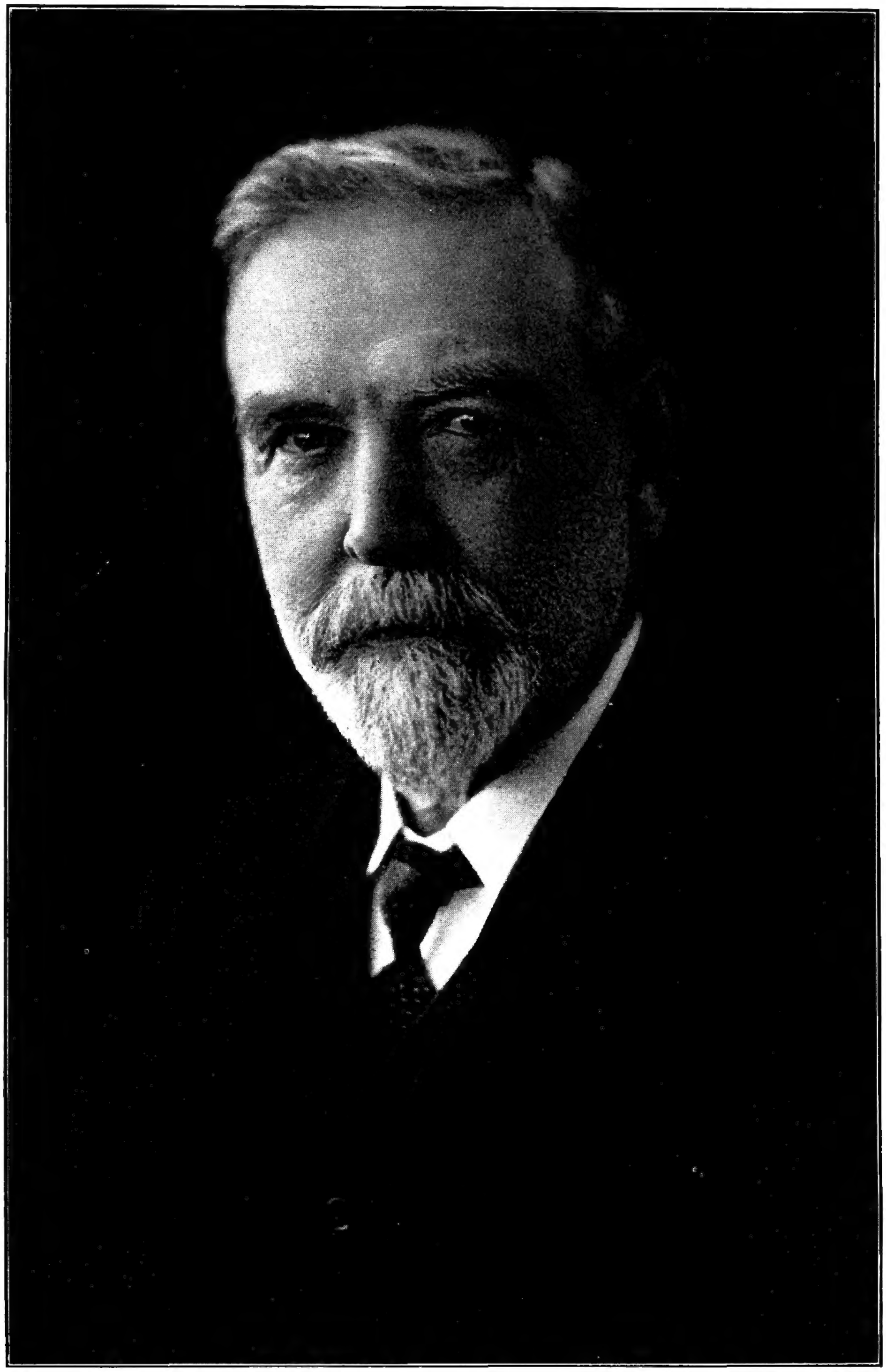

THE LATE SIR JOSEPH C. VERCO, M.D., F.R.C.S.

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ERRATUM

Page 142, for *crosus* Lam. read *crosus* Lam.

OBITUARY NOTICE.

SIR JOSEPH VERCO (1851-1933).

WITH PORTRAIT AS FRONTISPIECE.

Joseph Cooke Verco was born at Fullarton, S.A., on August 1, 1851. Both his parents were Cornish, as, it is interesting to note, were those of a great contemporary physician, Sir William Osler, Bart. (1849-1919), another colonial who was born and educated in Canada. Sir Joseph began his formal education at a well-known Adelaide school of last century conducted by John Lorenzo Young, an outstanding teacher and one of the foundation members of what later became the Royal Society. On leaving school, Sir Joseph spent twelve months in the service of the S.A. Railway Department, his ambition being to be able some day to write the mystic letters "C.E." after his name, but, as he learnt after a year's drudgery copying statistics in the office, the training he could get there was too primitive to lead to his success in the engineering profession, and he therefore decided to qualify for the medical profession. To brush up his classics, he attended St. Peter's College and, in 1869, won its coveted Young Exhibition, a valuable prize awarded to the best scholar of the year.

Early in 1870 he left Adelaide and began his medical studies in London. In 1875 he gained the M.B. degree at the University of London, and its two medals, one for his success in forensic medicine and the other in medicine; next year he secured its M.D. with the medal for proficiency in all subjects; and in 1877 its B.S. with medal. Some years ago Sir Joseph presented these four handsome gold medals to the Public Library. They are exhibited in the Coin Room, where they may be seen by any visitor interested in the academical triumphs won by an Australian student in the '70's of last century. In 1874 he gained the distinction of M.R.C.S. (Eng.), and three years later was advanced to its F.R.C.S. In 1875 he became L.R.C.P. (Lon.). His medical studies were made at St. Bartholomew's Hospital, and in 1876 he was appointed its House Physician, and in 1877 its Midwifery Assistant.

His connection with the venerable hospital occurred at a time of great importance in the history of surgical treatment; for when he entered it as a student, the cardinal discoveries that the genius of Lister had successfully applied at Edinburgh were condemned at "St. Bart's," but before he left it they were blessed. In 1923, its 800th anniversary was celebrated, and Sir Joseph Verco received a special invitation to join in the ceremonies. He, with Lady Verco, went to London, and after an absence of nearly half a century, he was able to revive his impressions of his old medical school.

In 1878 he returned to South Australia and began practising his profession in Adelaide. A few years later he was recognised as its leading physician, a distinction that he retained until his retirement in 1919. It is difficult to summarize his many medical and philanthropic activities during his half century of active life in Adelaide. For several years he was Hon. Physician to the Adelaide Children's Hospital and later became its Hon. Consulting Physician. For thirty years (1882-1912) he was Hon. Physician to the Adelaide Hospital, and on his retirement became its Hon. Consulting Physician. He took a great interest in the formation of the Medical School of the Adelaide University, and from 1887 to 1915 was its Lecturer on Medicine; was Dean of its Faculty of Medicine, 1919-21; and Dean of its Faculty of Dentistry in 1921. He was a member of the Council of the University from 1895-1902, and seventeen years later was again elected and remained on the Council until his death. In 1886-7 he became President of the branch of the British Medical Association in South Australia, and from 1914 to 1919 he filled the same distinguished position. On his retirement he was created a Knight Bachelor.

He was President of the first Intercolonial Medical Congress at its Adelaide meeting in 1887, when he delivered a striking address, widely reported in the Press of that day, dealing mainly with the reaction of the Australian environment on the descendants of Europeans. His medical publications include the important chapter "Hydatid Disease," contained in Allbutt & Rolleston's *System of Medicine* (vol. iv., 1907). In 1926 he presented to the University the sum of £5,000 for the purpose of publishing medical investigations in "The Australian Journal of Experimental Medicine and Medical Science."

"My interest in shells began when I was quite a lad and made a museum in the back yard of our home in Morphett Street, Adelaide. Shells, I thought, were more desirable to collect than insects, less liable to explode than birds' eggs and not quite so easily broken." These words are taken from a fragment of autobiography written by Sir Joseph to explain his interest in malacology, his favourite hobby, on which he spent much time and money and greatly advanced the knowledge of marine life along the Australian coasts. Fortunately, when as a lad he began his elementary studies, there was a collection of South Australian shells in the embryo S.A. Museum exhibited in a room above the Newspaper Room of the Public Library. These shells had been probably named by F. G. Waterhouse, the then Curator, and young Verco found them a useful guide in naming his own collection. His greatest treat, he wrote, was on school holidays to find his way to the Semaphore, then a row of uninhabited sandhills, and scour the beach for shells. But the schoolboy's passion for collecting was inhibited by the year he spent in the Railway Department, followed by another year at St. Peter's College, and then seven years in London medical schools; when he returned to begin practising his profession in Adelaide, the juvenile museum in the back yard had certainly, and the young man's interest in shells had apparently, vanished. About 1887 he suffered from an attack of enteric, and when he became convalescent his cousin, Dr. S. J. Magarey, invited him to stay for a few days at Glenelg. There Dr. Verco spent many hours walking along the sandy beach north of the Patawalonga Creek, and his interest in shells revived. To complete his convalescence he took a trip to New Zealand, and there gathered a large assortment of shells. They were brought back to South Australia and the more showy ones installed in a glass cabinet and exhibited in the Doctor's waiting room. The ailment that he once humorously described as "conchylophobia" now held him in thrall. His eldest brother, Mr. W. J. Verco, was a wheat merchant who owned several ketches that were used to bring wheat from the outports to Port Adelaide. For several consecutive years Dr. Verco had one of the ketches lent to him, and usually, with some of his nephews, he spent a week or more dredging for shells in the gulfs and bays of the State. Defects in the dredging apparatus were carefully noted and remedied for the next trip; not only were shells taken, but also corals, crabs, sea urchins, sponges, and other forms of marine life. The technique of preserving them was mastered, and they were forwarded to the experts in the various departments of the S.A. Museum and to collectors in other States. Space cannot be spared to give even a list of various dredging trips that became his regular form of recreation. He has left a manuscript account of these excursions, written at the time each was made, and containing a description of the hauls, as well as kindly and humorous comments on the events that occurred on board. If some day these are published, they will be found to be of scientific as well as general interest to many readers. Several times he hired a seaworthy tug and, with some co-workers interested in marine life, spent sometimes ten or twelve days dredging in the deeper waters covering the continental shelf off the Great Australian Bight. The expenses, wholly defrayed by Sir Joseph, were considerable, but the results were of great value to marine biology. His interest in the study of shells brought him into communication with similar workers in other parts of the Commonwealth; as time passed, some of these died and he purchased their collections and embodied them in his own. For many years he was Hon. Conchologist to the S.A. Museum, and his services in that capacity were invaluable. When in 1919 he released himself from the practice of his profession he spent many hours daily at the Museum; and when bodily weakness compelled him to relinquish this work of love, he presented to the Museum his valuable collection of shells and the cabinets containing them, as well as his conchological literature, comprising volumes in English, French, and German, some of them very rare and costly. His shells were catalogued with meticulous care; with each species was a sheet of specially made paper containing not only the technical descriptive matter but a summary of its distribution in space and time, and full references to literature and all important discussions of nomenclature and synonymy. It is a marvel of compression, and is capable of being added to when new information is available. It was a munificent gift, the value of the books alone being estimated at over £1,200.

Even a bald account of the services rendered by Sir Joseph to the Royal Society may seem to a reader unacquainted with its history to be unduly exaggerated. One, however, can truly assert that his influence, generosity, and powers of administration raised it from an obscure position to be among the most influential scientific bodies in the Commonwealth. He was elected a Fellow in 1878 when it was designated the Adelaide Philosophical Society, and at the time of his death, on July 29, 1933, was the doyen of the Society. In 1903, when he was first elected President, its fortunes soon brightened. He was elected President year by year until 1921, when he declined further nomination; but the Fellows were determined to keep him on the Council and during 1921-23 elected him one of the Vice-Presidents, and until the day of his death he remained a member of the Council. In the year Sir Joseph Verco became President our Royal Society was incorporated, thereby possessing the legal privilege of owning property and of being able to sue as well as of being sued in a court of law. One result of this was that the Society began building up a Research and Endowment Fund. Sir Joseph started it in 1908 by contributing £1,000, and the other principal donors, Mr. Thos. Scarfe (£1,000), Mr. R. Barr Smith (£1,005), Sir Edwin Smith (£200), and Mrs. Ellen Peterswald (£100), were each persuaded by Sir Joseph to bequeath their respective contributions to this valuable fund that for ages should radiate its beneficent energy in aid of scientific research in South Australia. Nor did the contribution to the Endowment Fund exhaust the financial aid that Sir Joseph gave: at one time the Society was confronted with the difficulty of properly displaying the large number of exchange publications that yearly poured into it, and, to provide extra shelving to display them, Sir Joseph's cheque came as a great aid; he presented also the handsome Presidential chair. Those who recall the methodical habits and great care that characterised Sir Joseph in all his work need not be reminded that his duties as President were ably carried out: he listened attentively to all papers and his comments on them were shrewd and kindly; his own papers on conchology were models of compression and clear in style; his rulings from the chair showed a knowledge of the Rules and Regulations laid down by the Society; and the influential position he had attained in South Australia was a powerful factor in successfully urging the claims of science to the consideration of its citizens.

Since his death it has been known that his benefactions to the Royal Society have not ended. His will, for which probate was recently granted, showed that he was a wealthy man. The income from the estate has been bequeathed to Lady Verco for life, and we all earnestly hope that she may long enjoy it; but when the inevitable happens, the whole estate is to be divided among many philanthropic, religious, and scientific bodies, among the last-named being the Royal Society. This bequest should substantially increase its Endowment Fund.

The Society has not been ungrateful to the memory of its greatest President. In 1928 it established the Sir Joseph Verco Medal, to be awarded for distinguished scientific investigations carried out by a member of the Royal Society of South Australia. The first recipient of the medal was Professor Howchin, who has won a distinguished name for the work he has done in proving the wide extent of glacial action in Australia. Sir Joseph attended the presentation ceremony and handed the medal to Prof. Howchin. It was Sir Joseph's last recorded attendance at the meeting of a Society on which, for a half century, he had lavished much devoted attention.

Addenda.—The "South Australian Naturalist" for August, 1933, contains the titles and references to all the malacological papers published by Sir Joseph Verco between the years 1895 and 1931. There are 26 papers recorded, the last two being in conjunction with Mr. Bernard C. Cotton, of the S.A. Museum.

The following list, kindly compiled by Prof. J. B. Cleland, M.D., gives the names of species of animals named in honour of Sir Joseph Verco by different naturalists, as well as a reference to the periodicals in which they first recorded them:—

I. MOLLUSCA.—(Gasteropoda) *Notocypraea verconis* Cotton and Godfrey, 1932, a cowry for S.A., W.A., and Tasmania (1, xiii., p. 41); *Prosimnia verconis* Cotton and Godfrey, 1932, S.A. (1, xiii., p. 46); *Nassarius verconis* Cotton and Godfrey, 1932, Verco's *Nassa*, S.A. (1, xiii., p. 95); *Alcithoe verconis* (Tate 1892 as *Voluta)*, S.A. (3, xv., p. 125, fig. 5); *Aethodoris (Albania) verconis* Basedow and Hedley, 1905 (3, xxix., p. 154); *Nembrotha verconis* Basedow and Hedley, 1905 (3, xxix., p. 158). (Pelecypoda) *Protonucula verconis* B. C. Cotton, 1930. Dredged by Sir Joseph at Eucla (2, iv., p. 223); *Scaeoleda verconis* Tate (as *Leda)*, 1891 (3, xiv., p. 264); *Corbula verconis* Finlay, 1927 (4, 57, p. 531). (Polyplacophora) *(Loricata) Ischnochiton verconis* Torr, 1911 (3, xxv. p. 102) = *Strigichiton verconis; Chiton verconis* Torr and Ashby, 1898 (3, xxii., pp. 215-216); *Acanthochiton verconis* Torr and Ashby, 1895 (3, xxii., pp. 217, 218).

II. CRUSTACEA.—*Leptostylis vercoi* Hale, 1928 (3, lii., p. 48). A Cumaceous Crustacean of Geographe Bay, W.A.

III. PISCES.—*Syngnathus vercoi* Waite and Hale, 1921 (2, i., p. 298). A Lophobranchiate fish dredged in St. Vincent Gulf by Sir Joseph.

References:—1. S.A. Naturalist; 2. Records of S.A. Museum; 3. Trans. Roy. Soc. S.A.; 4. Trans. N.Z. Inst.

B. S. R.

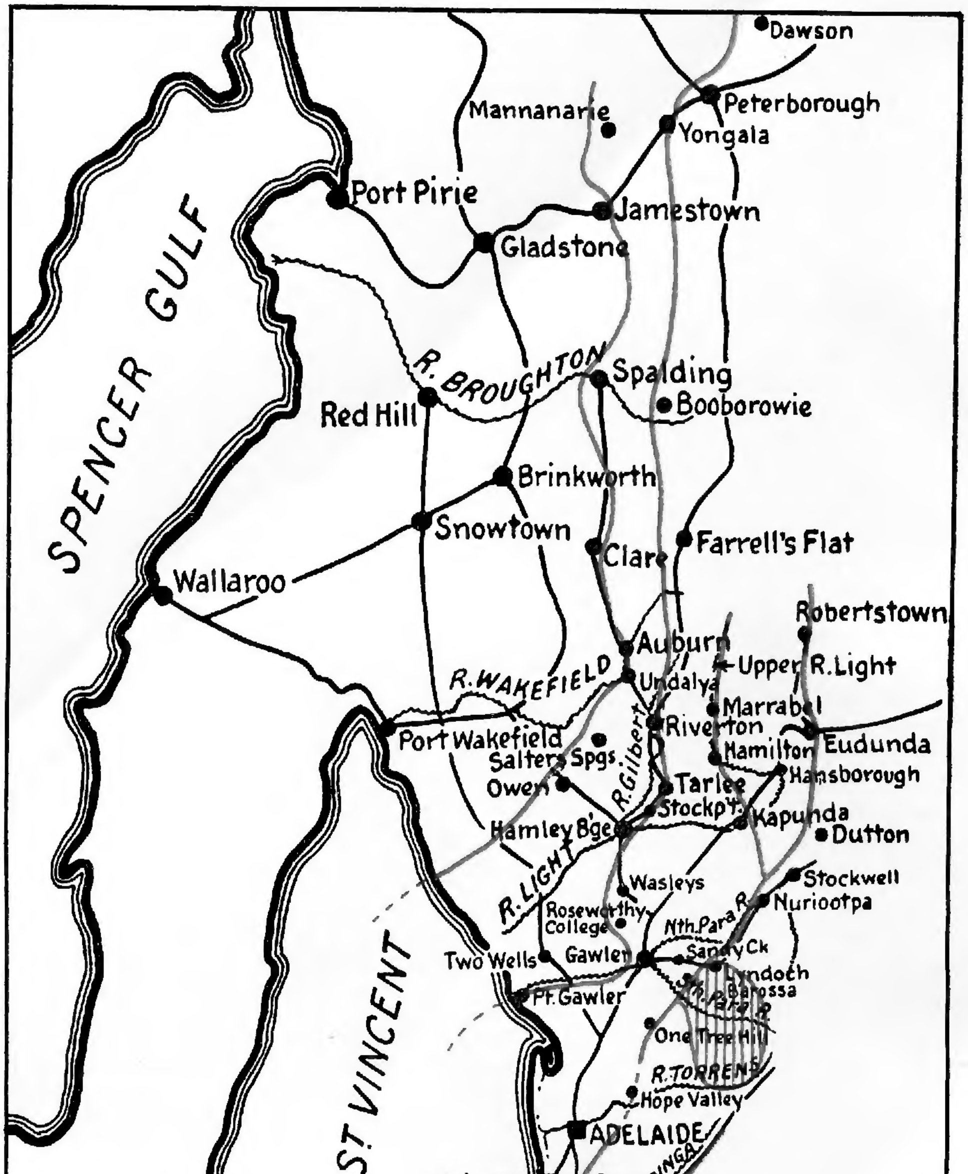

Fig. 1. Map of part of South Australia on which is shown, in red, the probable direction of some of the main river courses [the eastern group] before they were truncated.

THE DEAD RIVERS OF SOUTH AUSTRALIA, PART II – THE EASTERN GROUP WITH MAP

BY PROF. W. HOWCHIN, F.G.S.

Summary

Transactions

of

The Royal Society of South Australia (Incorporated)

VOL. LVII.

THE DEAD RIVERS OF SOUTH AUSTRALIA.

PART II.—THE EASTERN GROUP.

By Professor Walter Howchin, F.G.S.

[Read November 10, 1932.]

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In a previous paper [Trans. Roy. Soc. S. Austr., vol. lv., 1931, p. 113] it was explained that the original river systems of South Australia followed an inclined plane from Central Australia to the southern coast. The elevation of the Mount Lofty Ranges, at a comparatively late geological period, formed an east-west barrier to the central drainage by which these older rivers were truncated and formed numerous lakes on the northern side of the barrier. Although the rivers ceased to flow in their lower channels the physical features incidental to their former existence have persisted, somewhat modified, to the present time. Among these features the most remarkable are the extensive deposits of sands and gravels, in a consolidated (as well as unconsolidated) condition, which bear testimony to their former existence.

In the former paper, referred to above, the western occurrences of these extinct rivers were approximately defined as to their respective origins and the channels that they occupied. The most easterly member of this group was the river that had its source to the northward of Lake Frome and followed a southerly course by the way of Orroroo, Caltowie, Gulnare, and Rochester, finally uniting with another trunk river that formerly came down the Koolunga and Snowtown plain. Our present purpose is to follow up these investigations with respect to those extinct rivers that formerly drained the eastern portions of the Mount Lofty Ranges and had their outlet via the plain that is now drowned by the sea in Gulf St. Vincent. [See fig. 1.]

I. MANNANARIE, JAMESTOWN, SPALDING, CLARE, AND WAKEFIELD VALLEY CHANNEL.

(1) Mannanarie and Jamestown.

The township of Mannanarie, in the Hundred of the same name, is situated on a plain, four miles to five miles in width, with a northerly extension which connects it with the Black Rock Plain. The same valley extends, meridionally, in a southerly direction for about 70 miles. It is bounded on the westward, by the Mount Lock, the Bundaleer, and other ranges; and, on the eastern side, by the Browne's Hill Range, the Belalie Range, Camel's Hump, and other ranges, forming, respectively, the eastern and western boundaries of eight Hundreds in lineal succession.

In the neighbourhood of Mannanarie township, a flat, low median ridge divides the plain, longitudinally, into two parts, giving rise to two parallel, subordinate valleys, that follow the base of the ranges on either side to beyond Jamestown. By following the plateau (or middle road) from Jamestown, southwards, the valleys on the right and left are well seen. Eight miles from Jamestown the road, going south, comes to a dead end, facing Section 7 [Hd. Belalie], with steep roads going right and left down to the respective secondary valleys. These, originally, were united and formed a single main river channel. In the border districts of the Hundreds of Belalie and Reynolds a low, flat water-parting crosses the valley in an east and west direction, but the ancient valley passes over this slight rise and is continued to Clare, vía Spalding.

The last-named township is situated near to the River Broughton, which occupies the lowest position in a broad and shallow trough that forms a peculiar physiographical feature in the district, and needs explanation before proceeding further with the subject of the extinct river.

(2) The River Broughton Depression.

In the elevation of the Mount Lofty Ranges minor secondary movements of both elevation and depression took place which had important effects on the drainage. In the case now under consideration the ancient river channel under-went a transverse down-fold, or sag, having a north and south length of 45 miles. Jamestown, on the northern side, has an elevation of 1,495 feet above sea level; and Clare, on the southern side, an elevation of 1,305 feet; while Spalding, near the axis of the down-fold, has a height of only 945 feet, showing a depression between these marginal points of about 400 feet.

The River Broughton was brought into existence to carry off the drainage that became concentrated as a consequence of the sagging of the contours. The stratigraphical features are not affected by this depression, and the streams of the main valley have preserved their meridional courses—only, whilst those on the northern side have retained their southerly direction, those on the southern side have become reversed in their flow, as determined by the altered direction of the grade.

The River Broughton is the most typically defined as a transverse river in the existing river systems of South Australia. It takes its rise on the Booborowie plain, fed by numerous streams from the western flanks of the Bald Hill Range, where it is known as the Yakkalo Creek. After crossing the Booborowie plain, at right angles, it cuts through the Camel's Hump Range, crosses the Spalding plain, and, near the latter township, intersects the Bundaleer Range, where it has entrenched itself in the strong rocks of the Adelaide Series, excavating a deep and rough gorge that is continued to Yacka; which, in a straight line, would represent 12 miles, but is probably twice that distance in following the tortuous course of the river. It is, emphatically, a superimposed river discordantly developed on an older system that has become defunct, cutting transversely through four of these primordial channels in its passage to the sea.

(3) Spalding and Neighbourhood.

The township of Spalding, situated near the northern banks of the River Broughton, together with the Freshwater and Deep Creeks, draining in from the north, and the Hutt and Hill Rivers draining in from the south, show associated features that may be considered together as a geographical unit.

The width of the valley, from ridge to ridge, varies from about eight to nine miles, while the valley proper has an average width of four miles. As a general feature, the central portion of the valley, longitudinally, from north of Jamestown to Clare, has the form of a low plateau, two to three miles wide, bordered on either side by longitudinal streams, as, for example, the Hutt and Hill Rivers. This central, meridional plateau is sculptured into rounded, oblong hills, mostly flat-topped, which represent the original peneplained valley floors, which often carries consolidated river material. The bed-rock of the district consists entirely of the upper members of the Adelaide Series, beginning with the Glen Osmond Slates and Quartzites; and, rising, include the Sturtian Tillite, Tapley's Hill Slates, Brighton Limestones, and, at Clare, the Purple Slates of the Cambrian Series. The strike is approximately north and south, and at, or near, the vertical in dip. The Sturtian Tillite, which has been subjected to much denudation, and occurs mostly level with the general surface, is exposed on the western side of Yongala, and passes southward close to Spalding, following the main platform between the Hutt and Hill Rivers, southward to the eastern side of Clare. A very extensive exposure of the tillite can be seen in the bed of the River Broughton, at the swimming pool, near Spalding. Slates are the dominant feature of the district and form most of the high ground, where they are but little decomposed, but are uniformly rotten and decomposed where the ancient alluvial rests upon them. [See also forward, at page 13.]

(4) Freshwater and Deep Creeks.

Freshwater Creek has its origin in the slight rise that forms the border lands of the Hundreds of Belalie and Reynolds, and is fed by a series of flood waters that are delivered from the western flanks of the eastern ranges. The banks of the stream are usually about 15 feet in height and consist of alluvium. Where the bed-rock is exposed, which is rarely the case, it consists of slate in a kaolinized condition. There is little lateral erosion, but, at one spot, where the road approaches the banks of the stream, lateral washouts have cut into the banks and reduced the land, for an acre or more, into the condition of "bad-lands." The water in the channel is derived mostly from soakages from the sides, is of small quantity and intermittent in occurrence. The stream, after flowing for 18 miles in a north-south direction, junctions with the River Broughton at the Recreation Reserve, Spalding.

Deep Creek is situated nearer to the eastern ranges than the Freshwater Creek and has a direct drainage from the ranges, which gives a more effective erosive force to the stream. It is the deepest of the local streams and, in one part of its course, shows a sheer wall of sediment 60 feet in height. Nearer to its junction with The Broughton it is contracted and relatively small, having, by the absorption of its waters in the alluvium, on which it chiefly rests, lost much of its energy. It has a length of about six miles.

Very thick alluvial sediments occur throughout the district now under description. Alluvial ridges fill the space between the Freshwater Creek and Deep Creek. Mr. Michel sank a well in Section 391 [Hd. Andrews], near the boundary dividing the latter Hundred from the Hundred of Reynolds, to a depth of 150 feet in river deposits. A well sunk near the Masonic Hall, in Spalding, was in river sand to 28 feet, when it had to be discontinued on account of the running sand and water. The same result followed in another well situated at a short distance from the latter.

A deposit of sand in an old valley, between two ridges of Tapley's Hill shales, supplied the sand required for making the cement in the construction of the open culvert of the Bundaleer Reservoir. The deposit is at high level, above the caretaker's house, in Section 382 [Hd. Andrews], four miles to the south-eastward of Spalding, not far from "Marble Hill."

Consolidated Alluvia near Spalding.

In this district, as elsewhere, there are many examples in which the ancient alluvial deposits have been very strongly consolidated, both by silica and hydrated iron-peroxide. The silica, in the form of chalcedony, has frequently penetrated the fine argillaceous and sandy material, converting the sediments into an intensely hard and tough rock, and the coarser gravels into massive conglomerates, often of considerable thickness. The infiltration is sometimes irregular, forming concretionery and stalagtitic masses. The following local occurrences may be mentioned:—[1]

(a) In Section 88 [Hd. Reynolds], two miles northward of Spalding, situated on the northern side of the east-west road and adjoining the main road between Spalding and Jamestown, are several patches of consolidated alluvium. One of these, visible from the road, covers an area 80 square yards, and at a distance of about 100 yards further to the northward, a similar exposure occurs of about the same size. The two patches are on the same level and were originally united. Some distance to the westward of these, but in the same Section, is a much larger patch, also having a north and south direction, extending for about 140 yards. The remains, which originally consisted of clay and sand, are now strongly cemented and, where exposed, exfoliate in large spherical or irregular masses.

[1] I am much indebted to the Rev. B. S. Howland, of Spalding, for valuable assistance in exploring this locality. His intimate knowledge of the country and interest in the subject led him, not only to render willing service, but was also successful in making independent observations on the occurrence of certain consolidated gravels in the neighbourhood of Yongala, Spalding, and Booborowie, which have since been visited and corroborated by the writer.

(b) Going southward, Hundred of Andrews, Section 393, situated on the eastern side of the main road, one mile northward of Spalding, three more exposures follow a north and south line. The smallest group, covering about six square yards, occurs near the northern limits of the Section; the second is about a chain square; and the third covers a much larger area; in each case the stone is fine-grained and very siliceous.

(c) Within the limits of the township of Spalding, behind the public school, lumps of conglomerate occur scattered over the surface.

(d) Following the cemetery road, in a south-easterly direction, about a mile from Spalding, on the eastern side of Section 398, a ridge occurs, the top of which is capped by consolidated gravels that extend in a north and south direction for one-third of a mile, the cement being of a ferro-siliceous nature. On the opposite side of the road from the latter, in Section 373, on a similar elevation, are two other patches of a like kind.

(e) In Section 398, on the southern side of the Bundaleer reservoir channel, on the property of Mr. F. Trengove, is a remarkable vertical monolith of siliceous ironstone, which, from the road, has the appearance of an ancient haystack. It stands about 9 feet high and is in contact with a ferruginous quartz conglomerate. This prominent feature is in the direct line of the ancient gravels, while the connecting spaces between the rocks, *in situ*, are scattered with blocks and individual boulders of the same description.

(f) In a direct line with the preceding, after an interval of low ground, the deposits follow the top of a ridge, going southwards, through Sections 345, 290, 287, and 286, in a length of one mile, extensive slabs of the consolidated alluvia occur at about surface level, while innumerable water-worn quartz pebbles, liberated from the old alluvial deposits, are scattered over the paddocks.

(g) On a more westerly line, in Section 3528, southwards of the Spalding Recreation Reserve, a small outcrop of the conglomerate occurs, and continues southward in occasional exposures through Sections 342 and 341; also, on the opposite (western) side of the main road to Clare, in Section 407.

(5) Hutt and Hill Rivers.

These rivers take their rise in the knot of hills that surround Clare, Seven Hills and Penwortham, of which Mount Oakden and Mount Horrocks are the chief heights. They follow a parallel course throughout their respective lengths, separated by about two miles of a broken plateau, as already described. They follow a low, downward grade, from Clare, northwards, to The Broughton, near Spalding.

Like the streams situated to the north of Spalding, those on the southward side occupy the bed of an ancient river, the main physical features of which they have had no part in developing, but, like The Broughton, they are superimposed on an older system and, in the case of the Hutt and Hill Rivers, actually follow a reversed direction from that which the older river followed.

The Hutt River drains the western portions of the main valley, fed from the higher ground on either side. It is less tortuous than the Hill River, but has precisely the same general characteristics. It flows (when it carries sufficient water to reach its outlet) into the River Broughton, at the western angle of the great northern bend of the latter, shortly before The Broughton enters its rocky gorge. The Hutt River makes a very insignificant junction with the main stream by what is little more than a narrow gutter over which a man could easily straddle.

The Hill River is of little more importance than the Hutt River. It is indeed a gross exaggeration to call either stream a "river." The Hill River is seldom wider than can be stepped or jumped over, and might be more appropriately called a "ditch." It follows a most serpentine course, the banks are only a few feet in height, vertical, and consist of alluvia. The grade is low—not more than 15 inches in the mile—and the current feeble. It seldom, if ever, rises above its banks, and the weakness of its flow is seen in that, notwithstanding the sharp angles it makes, fails to undermine the banks at their acute curves. The bed is mostly dry, except at intervals where pools of water remain, probably held up by the presence of clay deposits, or older rocks either at, or near, the surface. The bed of the stream is mostly choked by a growth of reeds. It unites with The Broughton, near to that of the Deep Creek affluent, which comes in from the opposite side, and is about two miles to the south-eastward of Spalding. The junction is made by a narrow drain, while most of the water that comes down at flood times spreads out over the surrounding land, forming, for the time being, a swamp. Its length, in a direct line, is about 30 miles. It is narrower at its outlet than it is at its source.

Consolidated Alluvia between Spalding and Clare.

(a) About five miles more to the southward than the last-mentioned occurrence [see p. 5 *(g)*] and nearly opposite to the township of Euromina, on its eastern side, heaps of a ferruginous, coarse conglomerate were observed at the side of the main road, that were being broken for road metal. A local resident stated that these stones came from the higher ground on the eastern side of the Hill River valley.

(b) The most remarkable occurrence of these ancient alluvial remains that came under the writer's notice in the Hutt River and the Hill River district was in Section 571, Hundred of Milne [pl. I., figs. 1 and 2]. It is situated on the western side of the "middle road" (between the two rivers mentioned), which here runs parallel with the White Hut Creek, a tributary of the Hutt River and about a mile to the westward of Hilltown. The eastern scarp of the formation can be well seen from the road at an elevation of about 80 feet above the latter. The rock is a coarse conglomerate carrying white water-worn pebbles of quartz, up to six inches in diameter, very strongly cemented. The bed forms the capping of a flat-topped hill, which, by measurement, proved to be four acres in extent, with an apparent original thickness of about 15 feet.

(6) Clare.

In the neighbourhood of Clare and Seven Hills there is a knot of hills that intercepts the ancient waterway and forms a local water-parting. The Clare railway station is 360 feet higher than the railway station at Spalding. The physiographical history of this group of hills is obscure. The geological features agree with those that are present both north and south of this area. It is possible that in the epeirogenic elevation of South Australia some differential movements of elevation and depression took place which established local watersheds and which, under fluvial erosion would become intensified. This seems to have been the case in the reversals of the streams in the Hill River valley.

On the eastern side of Clare, the Hill River occupies a wide valley, choked with silt and is subject to overflows. The river takes its rise on the northern slopes of Mount Horrocks, and the River Wakefield, flowing southwards, takes its rise immediately to the eastward of the latter.

(7) River Wakefield Valley.

The water-parting on which the River Wakefield takes its rise, at 1,000 feet above sea level, carries alluvial sediments in a thickness that could scarcely be expected in such a position. Near Undalya the river has cut its bed in these sediments, which, on its left bank, show vertical cliffs 30 feet in height. After leaving Undalya, the river swings round to the westward and cuts into the high ground on its right bank, and apparently follows the western side of the original river channel.

Like most of the superimposed rivers of recent date, in its lower reaches it takes on a westerly course, transversely to the ranges, cutting a gorge in the older rocks, until, within about seven miles from Balaklava, it leaves the latter and enters on the great Snowtown plain which formerly carried the important trunk line of drainage that came down from the north via Crystal Brook, Koolunga, Snowtown, etc. At Whitwarta, near the apex of the northern bend of the river below Balaklava, the newer alluvial deposits are seen to rest on an older bed of compact, mottled clays, that are characteristic of the antecedent river deposits.

Consolidated Alluvia in the Wakefield Valley District.

From Undalya, the ancient valley is bounded on the westward by the Wakefield Scrub Range, and on the eastward by the Alma and Rhynie Ranges. At several points within this area consolidated fine material and siliceous conglomerates were observed.

(a) Exposures on the ridge that forms the high ground on the western side of the River Wakefield occur on Mr. R. H. Dennison's property. [Private House on Sec. 98, Hd. of Up. Wakefield.] Shortly after entering the gate on the private road to the house, in Section 86, several exposures of a compact, ferruginous conglomerate were seen on the high side of the road and level with the surface. Also on the rise of the hill fragments of the conglomerate, as well as white quartz pebbles, weathered from the latter, are scattered over the ploughed land. These deposits are about a quarter of a mile back from the river and about 100 feet above the level of the latter.

(b) At Salter's Springs, Hundred of Alma [about nine miles south-westward of Riverton], two outcrops occur in a lineal order. The first of these occurs on the north-western road, at about three-quarters of a mile from the Salter's Springs village, before reaching the six-road ends. A large mass of a ferruginous conglomerate lies by the road (on its eastern side), and in the paddocks, on either side [Sections 37 and 50], there are scattered fragments of a similar conglomerate and well-rounded quartz pebbles, one of those obtained had a circumference of 13 inches. The other deposit is situated a little over two miles from Salter's Springs, in the same direction as the preceding, on Section 14. The larger stones have been dragged to the north-eastern angle of the Section and form two heaps, of about a dozen stones each, in a slight depression in one of the head waters of the Hermitage Creek. The stone is a highly siliceous and glassy conglomerate. The white quartz pebbles make a striking feature, set in the glassy matrix, when seen in section. These two occurrences near Salter's Springs are not conspicuous and might have been missed but for the kind assistance of Mr. Robert Smyth in guiding me to the localities.

From Salter's Springs the ancient river-course continued in a south-westerly direction (to the westward of Balaklava), via Owen and Stockyard Creek, where it united with other lines of drainage in the sandy plains bordering on the St. Vincent region.

II. DAWSON, PETERBOROUGH, YONGALA, BOOBOROWIE, RIVERTON, STOCKPORT, WASLEYS, AND TWO WELLS CHANNEL.

(1) Peterborough and the North-eastern Plain.

An extensive plain extends from Peterborough in a north-easterly direction for 40 miles, passing through the Hundreds of Coglin, Cavenagh, and Minburra, having a drainage in a southerly direction. At 50 miles northward from Peterborough the drainage is reversed and flows towards Lake Frome.

This important north-easterly plain runs, approximately, parallel with the Orroroo plain from which it is separated, going northward, by the Peterborough

Range (in which the Sturtian Tillite is a marked geological feature), Black Rock Range, Peaked Hill Range, Eke's Hill, Marchant's Hill, etc. Dawson is on this plain, 15 miles northward from Peterborough.

Peterborough is unfortunately situated. The alluvial soil, on the north-eastern plain, is absorbent of the ordinary rainfall which drains from the higher ground, but with heavy rains the valley carries flood-waters that impinge on the township, to divert which a definite channel has been cut to carry off the drainage. From Peterborough the flood-waters take a south-westerly direction, passing to the northward of Yongala (which is 56 feet lower than Peterborough), and blend with the Nalia and Boniah Creeks, which have a northerly trend and are lost on the Black Rock Plain.

(2) Yongala and Canowie Belt.

(Near the Crest of the East-west Water-parting.)

Judging from the numerous deposits of the consolidated alluvium, in the neighbourhood, Yongala was in the direct line of the old river channel.

(a) The most northerly deposit of this kind, seen, was in Section 179 [Hd. Yongala], a little more than two miles north-easterly from Yongala, on the western side of the main road to Peterborough. It can be recognised as an unploughed patch, about 125 yards in from the road. The deposit covers 6 yards by 6 yards, with large blocks resting on a floor of similar material. The stone is a silicified sand-rock, the upper surface sometimes showing nodular prominences. Large stones of the same kind occur beside the road.

(b) In Section 175 (towards its northern boundary), about half a mile south-easterly from the last-named occurrence, a similar group can be seen from the road. The stone is light-grey and buff in colour, and, by means of a hand-glass, is seen to be a fine, silicified silt, containing well-rounded sand grains. Surface smooth.

(c) In the same Section, situated at its south-western corner, between the main road and the railway, one mile from Yongala, is a conspicuous deposit of large blocks that form the side of a small dam, just inside the fence and for some distance around, crossing the railway, and also in lumps along the road. It consists of fine-grained, silicified material, sometimes showing mammillary surface features.

(d) One mile east from Yongala, on the southern side of the public road, level with the surface, is a small exposure of a nearly pure form of a yellowish chalcedony, showing red lines, and spotted with small granules of red oxide of iron, each surrounded with a white aureola. Also at the same spot, on the northern side of the fence, in Section 174, is a coarser siliceous rock, very dense, in which sand grains are visible by means of a hand-glass; occasional cavities occur in the rock.

(e) In Section 19, one and a half miles south-westerly of Yongala, there is a very extensive and remarkable exposure of this class of rock. It covers the upper portion of a flat-topped ridge, either above or slightly below the surface, estimated by the owner to have an area of from seven to eight acres. It also extends into Section 22, near the fence. At the southern end it forms a compact, solid wall of rock, six feet high, with a breadth of 10 yards and a length of 90 yards. It consists mainly of a white-quartz conglomerate.

(f) At a distance of half a mile, in a north-westerly direction from the last-named, in Sections 159 and 161 [Hd. Mannanarie], there is a still larger exposure of the older alluvia. It crosses the road to Yongala, and at its northerly limits shows an elevated peak-like scarp. The stone generally is a brownish and coarse-grained sand-rock, cemented, but not quite so highly silicified as is commonly the case, except at its northerly extremity. Towards its western margin it is conglomeratic.

To the southward of the township of Yongala there are almost continuous exposures of these rocks for a distance of 10 miles, as far as Canowie Belt.

(g) Section 111, one mile from Yongala, near mile post, a few yards inside the fence, there is a patch of the fine-grained siliceous type, 5 yards by 10 yards in extent. At a quarter of a mile further, southward, is another similar exposure.

(h) Section 16, two and a quarter miles from Yongala, exposures occur in the field, on the western side of the road. Two large patches, situated approximately 350 yards in from the road, level with the surface and also in large blocks, extending over 23 yards by 13 yards. The stone is a white-quartz conglomerate —pebbles up to six inches in diameter.

(i) In the next field, 300 yards to the southward of the preceding, a similar conglomerate covers an area a chain square. Also to the south-east of same, situated in the corner of Section 15, at the three mile post, close to the district road, going west.

(j) On Travelling Stock road, opposite Section 96, there is a white silicified sandstone, consisting of four large blocks, and others, extending southwards.

(k) Section 180 [Hd. Whyte], and on by-road forming the southern boundary of the Section, situated a half-mile eastward of the main road, before reaching bend in the road, a fine-grained, light-coloured, silicified argillaceous sand, with water-worn grains, that covers 64 yards by 300 yards, much of it in large slabs, level with the surface. Also extends southwards from the road, in Section 179, and, as seen from a distance, still further south, forming crest of hill.

(l) Eight miles from Yongala, seen on district road, between Sections 164 and 490, and on each of these Sections, in eight large patches, covering many acres. The stone is very siliceous and compact, cementing fine sand mixed with some larger grains. Surface sometimes smooth and mammillary.

(m) About nine miles from Yongala, on the eastern side of the road, near the centre of Section 491, about 400 yards in from the main road (is best approached from the east by back road), a most extensive area of consolidated alluvia, forming raised terraces covering several acres. On the southern side the material consists of fine particles, cemented by silica; including two peculiar smooth-surfaced pyramids that stand up about 6 feet from the general level, having a circumference, at the base, of about 10 yards. The northern side of the deposit is a coarse conglomerate consisting of white-quartz pebbles.

(3) Booborowie South.

The ancient Yongala-Canowie valley continues well defined in a north and south direction through the Hundreds of Whyte, Anne, Ayers, Hanson, Stanley, Saddleworth, and Gilbert, to the township of Riverton, and there becomes the valley of the River Gilbert. Within these Hundreds the valley is bordered by the Mount Bryan and Bald Hill Ranges, on its eastern side; and by the Belalie, Mount Browne, and Camel's Hump Ranges on its western side.

At Booborowie South some extensive deposits of consolidated alluvia occur, as follow:—

(a) The public road that goes eastward from the Andrews railway station passes from the Hundred of Andrews into the Hundred of Ayers, between Sections 374 and 379 of the latter Hundred. After passing the first cross road, the latter takes a rise and the old conglomerate is exposed at surface on the road and continues for about a quarter of a mile, forming the lower platform of the alluvial beds. A second rise on the road forms the crest of the minor ridge [Section 90]. On this ridge, and on the slope, on the other side, there is a very extensive show of the fine-grained siliceous alluvium. In making the road over the crest the deposit had to be quarried, and the stones were left by the side of the

road in large lumps. The area covered by the beds at this spot, on the road and over the fences on either side, was proved to be 174 yards, in an east and west direction, and 43 yards, north and south.

(b) In the paddock, to the southward of the main exposures on the road, at a distance of 200 yards from the latter, large blocks of a quartz-pebble conglomerate, resting on a floor of the same material, form a patch that measures 10 yards by 6 yards.

(c) In the paddock, on the opposite side of the same road (on Mr. E. W. Hawker's property), both fine and coarse masses of consolidated alluvia occur. Also, in the same Section, about 400 yards to the eastward of the last mentioned, is another patch.

(d) Subsequently to the above observations, Rev. B. S. Howland reported the existence of another exposure, situated on the same road, about a mile further to the eastward of those just described, bordered by Section 81, and at about the same level as the preceding.

(e) Near a main road, about a mile northward of the last described, and parallel with it, there is a patch of conglomerate a few yards wide and level with the ground. It is situated to the westward of the Booborowie Creek, shortly before the latter crosses the road [Section 366], and about 240 yards to the eastward of the house on Mr. Hawker's property.

(4) Riverton and Tarlee

South of Booborowie the valley follows a south-south-east direction and is drained, throughout the whole of the Hundred of Hanson, by Farrell's Creek. The creek has a north and south course and is, in part, at a local base-level. The drainage is defective and, in winter, swamps and temporary lakes are developed. On the eastern side of both Farrell's Flat and Merildin (Mintaro) railway stations there are well-defined salt lagoon areas. In the adjoining Hundreds of Saddleworth and Gilbert, the River Gilbert carries the drainage and continues southwards to Hamley Bridge where it discharges into the River Light.

Riverton is situated on the River Gilbert, in the Hundred of that name. The following observations were made in 1911. A few stones of the older alluvium were noticed on a rise, on ploughed land, a little to the north-eastward of Mr. W. S. Kelly's homestead at Giles' Corner. Also on the public road, a short distance to the eastward of Riverton, a few similar stones had been utilized, with some others, to stop a small washout beside the road. In neither case was the formation seen *in situ*.

Tarlee. Observations made in 1921. Remains of ancient river terraces occur on the slopes of the valley, on the eastern side of the township, the deposits being more or less indurated.

(a) At one and a half miles to the north-eastward of Tarlee, in Sections 1931 and 357 [Hd. Gilbert], near the cemetery.

(b) A low ridge, having a surface of ferruginous sands and gravels, crosses the east-west district road, in Sections 275 and 326 and is also seen in a small excavation by the side of the road that divides these Sections, three feet deep without reaching the base.

(c) The following examples also occur in this neighbourhood. A little more than a mile to the southward of Tarlee, on the east-west road that forms the southern boundary of the Hundred of Gilbert, in Section 322 (adjoining the railway), there are surface stones of the usual consolidated type, as well as a heap of the same kind near the fence; the rock is also seen, *in situ*, in an excavation in the same paddocks.

The late Mr. J. J. East (1, p. 3), in a Geological Section of the country now under description, shows a Tertiary formation of a "gritty sandstone" resting unconformably on the older rocks of the chief ranges of hills. He states: "The most extensive and unbroken series of it is met with on the Alma Range, where it forms a cap and flanking formation all the way from Stockport to Saddleworth." I cannot confirm his determinations in this respect. He has evidently mistaken a light-coloured quartzite, of the Adelaide Series, which is sometimes partially decomposed, for a Tertiary rock. The "blue-clay," which he also associates with his Tertiary beds and correlates it with the blue clays of the Adelaide Plains, is evidently the decomposed condition of the blue-metal limestone and shale of the Adelaide Series. He recognised the existence of the ferruginous conglomerates of the district, that occur at a lower level, but did not realize their significance.

(5) Stockport, River Light, Hamley Bridge, and Wasleys.

(a) Stockport is the centre of one of the most extensive deposits of the ancient alluvia within the State. The River Gilbert, an insignificant stream, has cut its way through these deposits to a considerable depth. As the train, going north, nears the railway station, these beds form scarps on both sides. On the western side, a horizontal terrace forms the sky line, rising from the water level to a height of 60 feet. The scarp face on this side is composed of very strongly cemented ferruginous sands and gravels that are exposed in a quarry face where the stone is broken for road metal [pl. II., fig. 1]. The surface of the terrace carries, in places, sufficient light, sandy soil to admit of cultivation, but a large proportion shows a rocky surface that cannot be ploughed. The ancient terrace goes westward for three-quarters of a mile and is surrounded by a district road [the southerly portion is now closed] that embraces Sections 121, 122, 601, 602, and 636 [Hd. Alma]. The south-westerly portions consist of a rocky floor with a massive scarp, facing west; the rock, on one side, consists of fine material, very strongly cemented by silica, and on the other, a coarse quartz conglomerate. These stony patches cover several acres. On the northern side, these deposits cross the road and are well developed in Sections 604 and 605. In the last named, a low rise is heavily covered with a very dense, siliceous, light-coloured example, that is deceptively like our most siliceous ancient rocks.

(b) Along the southern boundary of the ancient river terrace, just described, the River Gilbert has cut a wide channel in these beds, showing a scarp of the consolidated alluvia on its southern banks, which can be traced westwards for more than a mile.

(c) On the eastern side of Stockport the conglomerate deposits attain a high level. Following the main, easterly road from Stockport, the public school on the rise of the hill joins on to Section 484 [Hd. Light]. Here the ground is strewn with alluvium in both free and consolidated conditions. Two river terraces are indicated on this side, with large blocks of conglomerate on each. At a higher level, on Section 483 [Mr. Connelly's farm, in 1913], a remarkable deposit forms the hill top [pl. II., figs. 2 and 3]. The hill is conical in shape, coloured white round the collar and is capped by a layer of reddish conglomerate. The latter is about five feet in thickness and rests upon an uneven floor of white, kaolinized slate, forming part of the higher of the two terraces. This bed of ancient conglomerate is estimated to be situated 200 feet above the flat on which the township is built and above the base of corresponding beds on the opposite side of the River Gilbert. The hill, with its capping, can be seen from the railway, on the right hand, soon after the train has left the station, going north.

(d) The main road, going southward from Stockport, is bordered on either side by similar consolidated gravels, or sand. The writer followed a little used district road that runs eastward from the main road, southward of Stockport, to Light bridge, near Linwood, a distance of two miles. Blown sand, resting on harder reddish sand, continued as the surface feature all the way. Near Linwood, above the bridge, the river flows between banks of loamy clay, 20 feet in height.

A feature of these loamy banks is the presence of an enormous number of stalactitic concretions in the bed. These weather out of the cliffs and gather in such numbers at the base that they can be shovelled up in mass. In places, similar concretions occur as flat, irregular masses at certain horizons, like the rows of flint in chalk [Obs., in 1906]. The river has, here, probably intersected the remains of the older system of drainage coming in from the north, causing some rearrangement of the original sediments.

(e) Following the south road from Stockport, through sandy country for three miles, the road crosses the River Light at the new bridge (known as Ayliffe's bridge). The river has cut its way down through a great thickness of loamy clay, with steep banks, resting in places on rotten slates. On the southern side of the river, at a distance of half a mile, is a prominent hill in the form of a promontory, from which a good panoramic view of the valley is obtained. The hill has a height of about 170 feet above the river, consists, throughout, of alluvium, which, near the upper portion, contains a few large, but loose, masses of ferruginous conglomerate and a few scattered stones of silicified finer material. From the height referred to, an ancient, mature valley can be recognised, through which the River Light, as a juvenile, superimposed, and entrenched meander, has cut its course. On the northern side of the river, about a mile distant from the latter, is a ridge of white sand, carrying a scrubby vegetation, that is well seen from a distance and is estimated to be 200 feet above the river level.

(f) Within the river area, about a quarter of a mile below the bridge, the stream flows over a very strong bar of ferruginous conglomerate; and a little lower down (past the remains of an old bridge that was destroyed by a flood) vertical cliffs of clay form the banks. Above the new bridge ferruginous conglomerates occur both in the banks and in the bed of the river, at intervals, for a mile up stream. A little below the bridge, as well as a little above the latter, sections are seen in the clay cliffs that show two periods of deposition that are unconformable to each other, an older and a newer one. The clay banks bordering the stream have an average height of 20 feet.

The physiographical features of the country under description are of much interest. From Tarlee, southwards, and from Hamley Bridge to Stockport and Linwood (in an east and west direction, covering a distance of six miles), there are no prominent exposures of the Cambrian or Pre-Cambrian rocks, which suggest that a peneplanation had been reached in this district before the disruption of the older drainage; and also a base level that permitted the accumulation of alluvia in a thickness of at least 200 feet. The elevation of the ranges increased the grade, which rejuvenated the streams and gave birth to an east and west drainage that became centred in the River Light. The latter, through most of its course, has worked its way down through soft material, approximately, to the old base level, flowing occasionally over a shallow patch with small ripples, separated by long stretches of still water and large waterholes.

Hamley Bridge is situated three and a half miles, in a straight line, to the south-westward of Stockport. The main road between these townships passes through sandy country, and in a cutting on the road, adjoining Section 228, [Hd. Alma], a vertical face of fine gravel is exposed, five feet in thickness.

(a) A quarter of a mile northward of Hamley Bridge railway station, a shallow cutting occurs on the railway, consisting mainly of travertine limestone. A little further north a deeper cutting occurs, eight chains in length and about six feet in height, the chief feature of which is an indurated variegated sand-rock, partially silicified, interbedded with which is a thinnish bed of gravel, consisting of well-rounded quartz pebbles, reaching a diameter of three or four inches. The sand-rock is overlain by travertine limestone and, in one place, these ancient alluvial beds are seen to rest on white, rotten slates.

(b) At a short distance on the railway line, going southward, after passing over the River Light, another cutting occurs, 10 chains in length, with a maximum height of 12 feet, the greater part of which consists of indurated, mottled sand-rock similar to that, just described, on the northern side of Hamley Bridge. The highly kaolinized condition of the slates at Hamley Bridge is very characteristic of the ancient river channels.

(c) Two and a half miles further southward on the eastern side of the railway, at the south-western corner of a small plantation, in Section 251 [Hd. Mudla Wirra], are lumps of ferruginous alluvium, with fragments of a like kind scattered over the adjoining paddock.

The sandy country, mixed with clay, continues in a southerly direction as far as Gawler, including Wasleys. The outline of former sand-dunes in low ridges can be recognised. These are now protected from drifting through being covered by a mallee scrub, the whole district having been formerly covered by a scrub of this nature.

A bore was put down at Wasleys by the South Australian Government in 1886, particulars of which have been courteously supplied to the writer by officers of the Engineering and Water Supply Department, as follow:—

Depth from Surface in Feet	Thickness of bed, in Feet		Depth from Surface in Feet	Thickness of bed, in Feet	
3	3	Loam.	339	35	Hard grey rock.
27	24	Red clay.	360	21	Sandstone and quartzite.
33	6	Sandy clay.	377	17	Sandstone and quartz.
72	39	Red clay.	384	7	Hard grey quartzite.
116	44	Sandy clay.	453	69	Quartzite.
181	65	Yellow sand.	520	67	White quartzite with veins.
304	123	White sandstone.			Bore abandoned at 520 feet.

The Alluvial Series appears to end at the 304 feet level.

(6) Gawler, Roseworthy Agricultural College, and St. Kilda.

(a) Gawler shows a most striking section of these ancient alluvial beds. The town is built, partly, on the scarp face [Gawler East] of the most westerly step-fault of the ranges, and, partly, on the flat country at the base of the scarp. The fault to which the scarp owes its origin has truncated the old river bed, which is excellently exposed in vertical sections. On the southern side of the township the beds have been quarried by the side of the road and the material used for foot-paths, etc. The section shows alternating beds of sand, clay, and gravel. The sands are often consolidated into a toughish sand-rock, and the gravels consist almost entirely of white, well-rounded quartz pebbles, in various grades. Numerous specimens of silicified wood, showing organic structure, have been obtained from these beds. The edge of the scarp, at the summit of the road, is about 150 feet above the level of the plain, but it still rises at a lower angle to the eastward in cultivated ground. Mr. A. J. Sexton, manager of the local hydraulic works, gave me a nine-inch specimen of silicified wood that he had obtained, in a shallow sinking, about a hundred yards back from the edge of the scarp, showing an extension of the alluvial beds to the eastward.

(b) About a quarter of a mile to the northward from the quarries on the road mentioned above, is a much more important exposure of these beds in a blind, flattish gully (Martin's Gully) that, at some time, had been excavated by natural

means. As the sand from this locality had been extensively utilized for castings in the late James Martin & Co.'s foundry, the face has been worked in many places. The "gully" is about an eighth of a mile in length, in an easterly direction, and the alluvial face is about 50 feet in height, without showing bottom. The beds vary from a very fine white or yellowish sand, more or less indurated, up to a definitely silicified rock. Near the head of the gully is a strong exposure of this latter type, in which the rock has developed smooth and curved "jointing." Casts of stems and roots of trees are not uncommon in the beds. The ancient river channel, as exposed along the face of the scarp, has a length of nearly a quarter of a mile in a north and south direction.

The isolated nature of the Gawler deposits creates a difficulty in determining the topographical relationship which these bear to the obsolete river systems. Brown, in his Geological Map of the Barossa District (2), gives these an extension eastwards of two miles, separated by a gap of one mile from the Barossa beds of, presumably, the same age. On the other hand, they may have formed an easterly curve in the important river that at one time came down from the north, via Stockport and Wasleys, which seem the more probable explanation.

It is worth noting, in this connection, that there is a marked contrast between the water-worn pebbles brought down by the extinct Gawler River and those found today in the two Paras that flow on either side of it. In the latter case the rounded stones consist almost entirely of quartzite, with few quartz pebbles; while those of the ancient river are, with few exceptions of white quartz, which is a characteristic feature of the ancient trunk rivers that had a north and south direction. In an enquiry as to the nature of the deposits that lie to the westward of the gravels exposed on the Gawler East scarp-face, the following information has been obtained.

Many years ago a bore was put down in the Waterworks yard, near the base of the scarp, which proves the extension of the old river bed in a westerly direction. Samples obtained from this bore have been preserved in the office, and the local Manager, Mr. Sexton, courteously permitted the writer to examine the same and make the following record:—

Depth from Surface in Feet	Thickness of bed, in Feet	
15	15	Surface loam.
20	5	Brown sandy clay.
26	6	Coarse sand.
33	7	Coarse gravel and sand.
40	7	Pipe clay with excessively fine sand.
49	9	Sand and ferruginously cemented gravel.
53	4	White and yellowish sand.
54	1	White quartz pebbles.
55	1	Consolidated white sand.
74	19	Argillaceous coarse sand.
76	2	Sand and small pebbles.
80	4	White sand and white clay.
85	5	White and yellow sand.
87	2	Coarse white pebbles.
93	6	Ferruginous grit.
101	8	Fine gravel, cemented.
104	3	White quartz pebbles.
107	3	White clay and sand.
110	3	Coarse, gritty sand.
117	7	Darkish clay and grit.
130	13	Coarse quartz pebbles.
149	19	Very fine sand.
155	6	Argillaceous dark-coloured sand.
156	1	Very fine argillaceous sand.

The section, down to the 49 feet level (which was sunk as a well) appears to have been in recent alluvium, as the pebbles are mostly of a quartzite type, while those below that level are almost invariably of white quartz, a feature that is common to the ancient river deposits in general. The boring does not seem, at the 156 feet level, to have penetrated the full thickness of these beds.

Further information as to the deposits on the plain adjacent to the above was kindly supplied by officers of the Mines Department. In Gawler South three wells were sunk, following a north and south direction, passing through alluvial deposits to 120 feet, the last 20 feet was in gravel. Another well, a little further to the south-west, gave a similar section, with the bed of gravel a little deeper. Two other wells situated south-westward of the racecourse, in Section 3,220 [Hd. Munno Para], a little more than a mile from Gawler East, showed gravel from the 70 feet level to 80 feet, resting on white clay. Another well, situated in Section 3,215, about one and a half miles from Gawler East, in a south-westerly direction, contained a bed of sand and gravel between the 100 feet and 130 feet levels. Another, a little further to the westward, had a thin bed of gravel at the 45 feet level, and another of 4 feet, between 72 feet and 76 feet.

There can be little doubt that the section passed through in the Waterworks yard, at Gawler, represents a downthrow of the alluvial beds seen in the upcast in the face of the scarp; but it is not so easy to define the stratigraphical relationships of similar alluvial beds at a greater distance.

Gavin Scoular (5) has recorded the results of several well sinkings on the plain, southwards of Gawler. At two and a half miles distant from the latter township, in Section 3,205 [Hd. Munno Para] a shaft was sunk; and at a further four miles, in a south-westerly direction, Section 4,151 (a mile and a half south-eastward from Smithfield), two shafts were put down, all of which gave the same records, *viz.*, the first 80 feet consisted of a "calcareo-argillaceous material," below which was a "semi-consolidated white-yellow siliceous sandstone" that was proved to a further depth of 40 feet without reaching its base. The description of the last-named formation is suggestive of the ancient consolidated alluvium, and may be an extension of the deposits of a similar type that are exposed at Gawler.

Roseworthy Agricultural College is situated about three miles southward of Wasleys, and six miles north-westward of Gawler. The alluvial remains at the latter township occur, apparently, on the eastward margin of the ancient river valley, while Roseworthy College farm is situated nearer the longitudinal centre of the old river channel. In passing from Wasleys, in a south-westerly direction, the surface features become increasingly sandy, and, in places, too loose for cultivation. South-westerly from the college numerous ridges of white sand occur that are the remnants of ancient sand-dunes, held in position by the conservative influence of the primeval scrubs. These are particularly numerous for about two miles on either side of the Gawler River, in the direction of Carclew, Virginia, and Angle Vale. Indeed, the whole of the coastline, from the Lower Light to St. Kilda, is covered with fresh-water deposits.

Particulars of a boring put down on the Roseworthy College grounds have been kindly supplied to the writer by the scientific staff of the institution, as follow:—

Height above sea level, about 320 feet.

Depth from surface, in feet.	Strata.	Thickness, in feet.	Depth from surface, in feet.	Strata.	Thickness, in feet.
1	Surface soil	1	302·5	Sandstone	27
5	Limestone	4	303	Gravel	0·5
200	Clay	195	492	Sandstone	189
250	Sandy clay	50	529	Grey clay slate	37
275	Sand	25	607	Hard quartzose sand	78
275·5	Gravel	0·5		Completed 26/10/89	

From the above Log the alluvial beds appear to have a thickness of about 490 feet.

In nearing the coast the surface features become more uniform and pass into extended plains that have had a composite origin, both terrestrial and marine, the material being, from time to time, commingled or rearranged, according to changing conditions. In following the ancient fluviatile channels through such a region, dependence must be placed on what data can be gathered from wells and borings, and these are of doubtful value where the alluvial fans from the higher ground overspread the lower. The two following may be quoted:—

St. Kilda Bore.—Information supplied by Mr. F. McCauley (of the firm, O'Loughlan, McCauley, and Smith, Contractors), Section 5,013 [Hd. Port Adelaide], two and a half miles from the coast; thickness in feet: red clay, 130; slate-coloured clay, 10; very fine white sand, 30; clay, 6; dark, tough sand, 50; fossiliferous dark sand, 10; dark rock and boulders, 5; sand with overflowing water (?).

Sir Sidney Kidman's Bore.—Information supplied by Mr. F. McCauley. Situated about half a mile southward of Penfield, and between three and a half and four miles north-easterly from St. Kilda Bore. Passes through similar beds as at St. Kilda and at similar depths, but was continued a little further than the latter. Total depth, 280 feet. Samples of the fossils from both the St. Kilda and Kidman's bores were supplied to the writer, which yielded nine genera of mollusca and the foraminifer, *Orbitolites complanata*. The latter, from St. Kilda, is a particularly fine and robust example, measuring 21 mm. in diameter and 2 mm. in peripheral thickness. The fossils have an Older Pliocene facies.

III. ROBERTSTOWN, NURIOOTPA, BAROSSA, HOPE VALLEY, BLACKWOOD, AND NOARLUNGA CHANNEL.

(1) Robertstown, Point Pass and Eudunda.

The physiographical factors that characterise the eastern limits of the Mount Lofty Ranges resemble closely those that occur on the western side. An abrupt scarp, facing east, with step-faulting in a throw-down to the Murray Plains, may be compared with the western scarp of the ranges near Adelaide, only in more subdued relief. The down-throw on the western side, to the valley of the gulfs, has given most of the existing rivers a transverse direction to the westward, while the down-throw to the eastward, on the eastern side, has diverted the drainage, in a transverse direction to the eastern lowlands, as with the Baldina Creek, Burra Creek, Deep Creek (Eudunda), Pine Creek (Dutton), and many others. In this north-eastern country an ancient peneplanation, coupled with earth movements tending to depression has obliterated the older river channels, resulting in featureless plains, deep alluvial deposits, and a riverless region.

In the Hundred of English, at the base of the eastern scarp, the ancient waterway, on that side, becomes more defined. At Robertstown, on the valley-plain, and Point Pass, at the base of the ranges, there is a very distinct down-throw to the eastward with a repetition of beds. These earth movements probably occurred during the life-history of the now extinct river. This is suggested by the very juvenile physiography of the district, seen in the steepness of the scarp, and while the latter is incised by scores of small impetuous streams in their descent to the valley, none of these streams have worked back their head-waters sufficiently far as to capture the streams of the plateau at the back.

The valley, on its eastern side, is bordered by a range of rounded and lower hills, which become more defined as they pass to the southward. At present there is no distinct north and south drainage in the locality. The torrential streams that come down the scarped face, on the west, are speedily absorbed in the alluvial of the valley, but, in wet seasons, the water gathers into swamps and temporary pools [7, p. 347].

The valley passes Eudunda [Deep Creek] on the eastern side of the township, and continues through Neales Flat, with only fragmentary and intermittent streams that follow an easterly direction.

(2) Dutton.

Pine Creek, the most important waterway of the district, intersects the Hundred from west to east, passing through the township of Dutton. The sides of the creek show thick alluvial sediments. The lower nine feet consist of a very tenacious white and yellow clay, on which rest twelve feet of sand and gravel. It is possible that the basal clay over which the stream runs represents the local slates in a highly decomposed and kaolinized condition.

Consolidated Alluvia near Dutton.

(a) About one and three-quarter miles on the northern side of the township of Dutton, in Section 262, Hundred of Dutton, on the eastern side of the road, there is an extensive show of consolidated alluvium covering one and a half acres. On the southern side of the deposit the stone is fine-grained and very siliceous, exposed in compact masses with chalcedonic lenticles; and on its northern side changes to a coarse conglomerate. It is on a rise in the field and is visible from the road.

(b) In the same Hundred (Section 35, Water Reserve), two miles to the south-westward of Dutton, there is a considerable patch of the old alluvium, similar to that last described, but more ferruginous. Further examples of a similar kind occur in large pieces by the side of the road, three miles to the south-west of the last named, in Section 242, on the boundary line between the Hundreds of North Rhine and Moorooroo, south-westward of Truro.

From the last mentioned situation the ancient river channel can be traced across the northern portion of the Hundred of Moorooroo, following the western side of Stockwell, where the valley is three miles wide. Its remains are very pronounced, going southward, through the Hundreds of Belvidere, Nuriootpa, and Barossa. The township of Stockwell is situated at the base of the eastern ranges of hills [near Truro] in which the Stockwell Creek and St. Kitt's Creek take their rise, flowing north-westerly, to the River Light. The valley, occupied by these and other creeks, appears to be connected with an older channel of drainage coming in from the north, in a course almost parallel with the Robertstown-Eudunda unit, with which it junctions near Stockwell. This will be dealt with in the next section.

(3) North-western Tributary: Upper Light and Kapunda Districts.

The River Light is another of those interesting rivers that are superimposed on the older system of drainage. It takes its rise on a low water-parting in the northern areas of the Hundreds of Saddleworth and Waterloo. In its upper reaches it follows within the limits of an ancient meridional and mature valley, as a sluggish and very serpentine stream with mud banks for 16 miles, southerly, to the township of Hamilton. Here its characteristics entirely change. It takes a sharp turn, in an easterly direction in a course transversely to the physiographical grain of the country, until at the end of 9 miles it impinges on high ranges, near Hansborough, which causes it once more to take a southerly direction, and then westerly, in a great loop. The disturbing factors which impelled the change in its course were, probably, in the first instance, the faulting down to the range on the eastward (such as occurred in other similar situations, further to the southward), which drew the drainage in that direction. Then, being diverted by the highlands on the eastward, it was driven in a reverse direction, which brought it under the control of the great down-throw on the western side and to the western sea, as has happened to all the others of our upland rivers.

It is quite impossible that the older river, that excavated the broad and mature valley in which the River Light began its course, could have taken the erratic course of the latter in its lower reaches, for from the time The Light made its easterly divergence it developed the features of a juvenile stream eroding for itself a narrow and rocky gorge, except where it intersected the sediments of an alien hydrographic system. We must, therefore, look for the southerly extension of the older fluviatile channel in a direction more consistent with its physical relationships than that presented by the present River Light.

The head-waters of the former river, in addition to the main channel now occupied by The Light, included two other lateral streams now represented by the Tothill Creek and Julia Creek. The three probably converged and formed a united stream down the valley of the present Allen's Creek, which reaches The Light a little to the south-eastward of Kapunda. The valley is continued in the same direction, but with a reversed grade, on the opposite side of The Light, now drained by the St. Kitt's Creek, the Stockwell Creek, and others.

Consolidated Alluvia near Marrabel.

The township of Marrabel is situated on the boundary between the Hundreds of Gilbert and Waterloo, seven miles east by north from Riverton, on the Upper River Light, near its junction with the Tothill Creek. A half-mile from the township, on the road going easterly, a group of large stones was observed on the roadside, facing Section 1,122 [Hd. Waterloo]. The most of the stones consisted of a fine-grained alluvium consolidated to a siliceous compact rock. The stones had probably been gathered from the adjacent grounds. At a quarter of a mile further, in the same direction, a large mass of a similar rock was observed on the opposite side of the road. About one mile distant from the township, in Section 1,131, on the southern side of the road, there is a large patch of the consolidated alluvium showing a rough exposure, which, above and a little below the surface, covers an area of two acres. The stone is a ferruginous conglomerate showing white quartz pebbles and river sand held in a dark-coloured cement. Blocks of the material were exposed that weighed many tons, while the softer portions had been quarried out for road metal, with an exposed face of nine feet in height.

(4) Stockwell.

The township of Stockwell is situated, as already stated, at the base of the eastern ranges of hills in which the Stockwell Creek takes its rise. At this point two valleys converge. One, already described, comes in from the north, *via* Eudunda and Dutton; the other comes in from the north-west, *via* Kapunda and Koonunga; the Spring Creek Ranges forming the eastern limits, and the Greenock and Moppa hills form a low barrier on the western side. The country, situated between, is low-lying and boggy, receiving the flood waters of the Stockwell Creek, Moppa Creek, and St. Kitt's Creek. The road that crosses this low-situated ground (the "back road" to Kapunda) is known as the "Bog Road" and is often under water and impassable. The country is sandy, forming part of the extinct river channel, but is rendered retentive by the sediment brought down from the higher ground by floods. This low area, situated in the neighbourhood of Neukirch, probably marks the spot where the north-westerly tributary made its junction with the main stream.

Considerable sedimentation has occurred in this ancient waterway. Near Koonunga, six miles to the south-eastward of Kapunda, the St. Kitt's Creek has washed out an extensive area in finely stratified alluvium and small gravel, showing vertical river cliffs, up to 40 feet in height, without exposing the base.

(5) Nuriootpa.

From Stockwell, southwards, the country widens out into an extensive plain, characterised chiefly by sandy sediments representing the channel of the combined streams, now extinct, described above. At five miles southward from Stockwell, Nuriootpa, in the Hundred of the same name, is situated near the centre of the plain bordered by the Angaston Ranges on the eastward, and the Greenock hills on the westward. On the western side of Nuriootpa there are low and broad ridges of white sand that have been brought under cultivation as vineyards and orchards. The local cemetery is in these sands.

This country has been interestingly described by the late J. G. O. Tepper [9], who for a time was schoolmaster at Nuriootpa. He says: "The township itself stands upon a fertile sand, gradually merging into the sandhills west and north-westward. South and south-east, more or less loose, either fertile or almost barren sand prevails to within a mile of Tanunda. Below the sand and mould, which are of slight thickness at places or missing altogether, follows first a yellowish, sandy, and gravelly clay, in many places sufficiently pure and plastic for bricks, and from 20 to 40 feet or more thick. Underlying this, and occasionally rising to the surface, is a white and blue very adhesive clay, here and there stained deep rusty, and which is remarkable on account of including layers of impure salt, associated with thin hard layers of ferruginous cement. Even the wells become brackish and finally undrinkable in those areas which have this formation. Under the blue clay follows a white, yellow, or red sandstone, porous and water bearing, but of unknown thickness, nor is it known what is below it, as at a depth of, I believe, about 200 feet, reached by boring near the hotel in search for kerosene or coal, the base rock was not reached."

(6) Tanunda.

The township of Tanunda is situated on the left-hand banks of the North Para (or Gawler) River, five miles to the southward of Nuriootpa. The intervening country is a continuation of the same general features with a considerable development of the hydrous oxide of iron as a cementing agent in the alluvium. Tepper [*loc. cit.*, p. 27], in referring to this deposit, says: "In structure it varies from that of a real sandstone, finely and evenly grained, to a coarse conglomerate of pebbles three to six inches in diameter. Sometimes cavities, as if shells had been removed, are found in it, but no fossils were ever seen here, except a fragment of wood converted into brown haematite, found south-west of Tanunda."

This so-called "Ironstone" is found, sporadically, throughout the district. In Section 124 [Hd. Nuriootpa], situated a little to the northward of Tanunda, the house of Mr. W. R. S. Dempster is situated on a hill, the surface of which consists of a very dense layer of this ironstone conglomerate, which prevents cultivation. Similar exposures can be followed for several miles. On either side of the public road, bordered by Sections 631 and 682, workings for alluvial gold are in progress, while a little further to the southward, in Section 698, on a scrub hill, there is a quarry in a 3-foot layer of fine ironstone gravel that is used for building and road purposes. There are many such workings in the neighbourhood, and the majority of the buildings in Tanunda and district have been constructed with this material.

(7) Rowland's Flat.

The North Para River runs from Tanunda in a south-south-west direction for five miles, to Rowland's Flat, where it takes a reversed direction to the northward, forming the south-eastward extremity of the Hundred of Nuriootpa. The peninsular-like area within this river bend consists of a hill of sand of remarkable extent. The area is half a mile in width, and a height of about 160 feet above the river which flows at its base. The South Australian Government, when constructing the bituminised road through the district, obtained many thousands of tons of sand from this source, which has made little impression on the quantity available. The workings at the excavations show a thickness of about 70 feet, without any evidence of the base. The exposure, on the face, shows a top layer of 12 feet of pure white sand, under which is a thicker layer of iron-stained sand.

The presence of the chalcedonized variety of the consolidated alluvia did not come under my notice in this district, although the ferruginous variety is very common, but Tepper [*loc. cit.*] records its occurrence as "a hard grey sandstone grit, cemented by silica, fringing low ridges"; and "a similar but more jaspery rock on the hillsides near Sheaoak Log, showing numerous root-like enclosures."

The North Para River, which has followed the ancient valley from Nuriootpa to Rowland's Flat, after leaving the latter, makes a sharp turn to the westward, by which it passes from a valley of mature features to those of a juvenile stream, and excavates for itself a canyon in the rocks of the Adelaide Series. This divergence to the westward was caused by the tilting of the Gawler-Barossa faulted block, which raised a modified scarp-face along its northern edge, that formed the left bank of the North Para, subsequently reduced by weathering to its present softened features.

The river intersects sediments, older or newer, in its course. At Rosenthal there is a washout of 30 feet, going down to the river. At this point the river banks consist entirely of alluvium, up to 40 feet in height, but a little lower down the stream the bed rock again appears. Near the first bend, southward, on the left bank, there are large water-worn pebbles of quartzite forming an old terrace, now under cultivation, 50 feet above the level of the river. The older rocks have a very consistent dip to the eastward; that is, to the base of the Barossa fault-scarp in that direction.

(8) Lyndoch.

The railway, which follows the North Para River from Nuriootpa to Rowland's Flat, leaves it at the latter place and continues on the ancient river-flats, through the low, sandy country to Lyndoch. Shortly before reaching the latter township, from the north, it has to make a horse-shoe bend, following the edge of the higher ground to avoid a low, swampy area on the northern side of the township. From the latter it continues through sandy country to Sandy Creek, where this class of country widens out into the Barossa alluvial mining district.

(9) Sandy Creek.

Sandy Creek railway station is situated six miles to the eastward of Gawler. On leaving the former of these stations, the line, on an incline, passes rapidly from a country of upland features to a sandy valley, or plain, which is still mainly covered with its primeval scrubs that is gradually being encroached upon by cultivation. The creek, which is only a shallow ditch, is choked with sand and only runs after heavy rains.

Throughout this wide valley-plain, from Stockwell to Sandy Creek, all the cuttings, whether by railway, rivers, streams, and roads, except where these impinge on the rises that mark the boundary of the ancient valley, are in alluvial deposits. Tepper suggested the former presence of lakes in this country, which is highly probable.

The comparative absence of coarse gravel and the great thickness of finer material throughout the district, indicate a weak transporting agent, which may have been in the form of local base-levelling, tending to develop lakes. The presence of layers of salt in the alluvium points to intermittent lagoons, and the hydrous oxide of iron would form under certain conditions as bog-iron-ore. Its presence at the surface, as a cementing agent, may have been caused by capillary action, from a soluble solution, much as travertine forms at the surface over a calcareous subsoil.

(10) Barossa and Adjoining Hundreds.

The ancient river system that is so well represented in the alluvial deposits of Nuriootpa, Tanunda, Rowland's Flat, and Sandy Creek districts, seems, at one stage in its history, to have made a breach in its channel and overflowed in a south-easterly direction, covering most of the Hundreds of Barossa and Para Wirra with some portions of adjoining Hundreds; the ancient river bed being represented by the present secondary hill-tops, which are extensively capped by its sediments.

The westerly limits of this area occur in the neighbourhood of the Sandy Creek railway station. By following the road from the latter in a south-easterly direction, the country is very sandy and has a tendency to drift. Mr. R. Paine, postmaster at Cockatoo Valley, informed the writer that he had sunk a bore on his premises to a depth of 60 feet in drift sand, but failed to reach the bottom of the deposit.

As an alluvial mining field the Barossa district has been examined and mapped with considerable detail by the Mines Department, under the late Government Geologist, H. Y. L. Brown [2], and his assistant, H. P. Woodward [3 and 4]. These writers make a distinction between the Older Gold Drift, which caps the hills, and the Newer Gold Drift, which occurs in the gullies and flats, probably by a redistribution from the older deposits.

Mr. Brown gives a general description of the beds in the following terms: "These Tertiary deposits consist of cappings of ferruginous sandstone, conglomerate, sand, clay, and quartz gravel, resting on the bed rock, sometimes in small outlying patches, at others forming large continuous sheets. They are the portions which have escaped denudation (by the action of the present drainage system) of the ancient rivers or water-courses which in Tertiary times drained the surrounding country. They occupy various positions, in some places forming cappings on hills, in others filling valleys; the difference between their surface elevation being sometimes as much as from 150 feet to 200 feet. This leads to the idea that some of the elevated cappings may be of greater age than the main deposit which lies at a much lower level, although in most cases this is not so, as the high level cappings are connected continuously and can be traced down to, and found to unite with, the latter. . . . From the widespread nature of these beds it seems likely that they mark the position of lakes, or a chain of waterholes, in which the gravel, sand, and clay denuded from the surrounding ranges was gradually deposited. The smaller cappings at a distance from the main body seem to point to the probability of the whole area in the vicinity having been under water. Of the smaller areas of Tertiary formation the most important is that which extends from Section 3,028 to Gawler, where it occupies a wide area between the junction of the North and South Para River." [2, p. 3.]

Mr. Woodward extended the field-work of the Department into the southwestward portions of the Hundred of Barossa and where the auriferous beds crossed the South Para River into the western portion of the Hundred of Para Wirra, which included portions of the Humbug Scrub [3]; and in a further map [4] into the eastern portions of the Hundred of Para Wirra, lying to the southward and eastward of Mount Crawford. Under the heading of "The Older Gold Drifts (Made Hills and Capping)" Mr. Woodward states, these "are ferruginous conglomerates, sandstones, claystone (cement), sand, clay, gravel, etc. These rocks cover a large area of this district, particularly in the eastern portion, where they form all the low hills, and flank the range to the south-east. This formation appears to be the remains of what was a lake bed in Tertiary times; levels, carefully taken, show that there was no outlet low enough to drain the central part until the present (South Para) river gorge cut its way through. The lake probably overflowed at the low saddle, towards Springton, and was fed by various tributaries, portions of the beds of which are still left, one of which comes down from Blumberg [Birdwood] cemetery; there are also two others coming from a south-west direction" [4, pp. 1, 2].

While Mr. Woodward seems to favour the view that the eastern portions of the ancient drainage had an outlet to the eastward, in his "Notes" on the western portions of the field, he assumes that the outlet, on that side, was to the westward. He states: "During the Tertiary period the main range was out of water; but two main streams flowed, one on each flank, into which small gullies probably ran. Both these creeks flowed north, as is proved by the level of their old beds descending in that direction. The one on the east side seems to have risen somewhere near Mount Gawler, thence flowing in a northerly direction, its course being now traced by a few outlying patches of made ground, and by a general line of low country crossing the present creeks. The other had its rise somewhere to the southward and passed on the west side of Mount Gawler and flowed northward towards the Humbug Scrub, where, at the head of Leg of Mutton gully, it was joined by the eastern stream. Thus increased in size, it flowed across the present river of the Barossa goldfield, and so on, in a north-westerly direction, to Gawler, where it discharged itself into the sea" [3, p. 1].

From the abnormal features pertaining to the extensive alluvial deposits of the area under consideration, it may be inferred that they are the consequence of certain crustal movements that revolutionized the former local drainage system. That large sheets of fresh water followed these movements is evident from the extent of surface that is still covered with fluviatile sands. It is significant that these lacustrine and fluviatile remains are carried on the great Barossa fault-block, and it is probable that the two things had a physiographical relationship. There seems to be two possible explanations. One of these might arise from the tilting of the fault-block down to the eastward, by which the waters of the Nuriootpa river were temporarily drawn off in that direction; or by the elevation of the Barossa Ranges in association with such a tilt created a new watershed with a confined drainage until the rising waters cut out for themselves channels through the barrier. This seems to have been effected by the rivers North and South Para (characteristically juvenile streams), and these effectively drained the area. Mr. Woodward's suggestion that one such stream, flowing westerly, discharged its waters into the sea at Gawler, as quoted above, is inconsistent with the geological evidences. It is true that marine deposits of Miocene age occur at Gawler, but the sea of that period had retreated from the locality long before the adjacent fluviatile deposits were laid down. The levels, quoted by Woodward, may have no correspondence with those that existed under the older physiography.

(11) One Tree Hill.

Extensive ancient fluviatile deposits occur on the eastern side of the Hundreds of Munno Para and the adjoining western side of the Hundred of Para Wirra, intersected by the Tenafeate Creek. This area may be considered as the south-westerly extension of the old fluviatile deposits seen in Barossa and their junction with the main river course that followed the One Tree Hill and Hope Valley channel.

Three miles, in direct measurement (south-easterly) from Smithfield the road reaches the top of the western scarp of the Adelaide Ranges. A strong quartzite faces westerly, near the crest, and just beyond are impure limestones. The plateau-form of the foothills, the ancient river level, is well seen from here.

The sandy country begins a little to the westward of the township of One Tree Hill[2] [Hd. Munno Para, Secs. 4,193-4,230]. A compact white sand-rock

(2) The "One Tree Hill," from which the township takes its name, and as shown on the map, is situated about a mile to the westward of the township.

Fig. 2. Parts of maps of the Hundreds of Munno Para, Para Wirra, and Yatala, on which are stippled the positions of alluvial remains of an ancient river, now extinct, that formerly flowed through these districts. Isolated areas occur, on rises, marginal to the valley.

outcrops on the road. This sand patch goes in a northerly direction to Sections 3,267 and 1,516; and at a further distance of about a mile and a half in the same direction, forms a sandy cap on the summit of Gawler Town Hill. [See fig. 2.]

The main patch of this sandy area (much of it still left in its virgin condition) preserves an uninterrupted spread in a north and south direction for nearly four miles, and its greatest breadth, extending into the Hundred of Para Wirra, of two miles. Mr. H. H. Blackham (to whom the writer is much indebted in examining this country) has his residence near the easterly limits of the formation, in Section 6,382 [Hd. Para Wirra]. Near the house Mr. Blackham has a gravel pit, from which was exhumed part of a silicified tree trunk that measures 4 feet 6 inches in length and has a circumference of 4 feet. This specimen is in the macerating yard of the Adelaide Museum.

In the adjoining Section, No. 4,363 [Hd. Munno Para], there is a continuous spread of sand and gravel to the One Tree Hill township, and, in places, these have been quarried. On the eastern side of Section 6,381 [Hd. Para Wirra] there is a strong outcrop of the gravels, forming a flat-topped hill with a steep scarp face. A shaft 30 feet deep has been sunk on the face of the slope (at the base of this scarp) showing eight feet of coarse gravel at top, then five feet of finer, white quartz gravel, and then fine reddish sand, at bottom. Examples of silicified wood were discovered on the surface of the sandy plateau. The thickness of these ancient alluvial deposits, when judged by the difference in height between the height of the sand-topped hills and the depth proved by the valleys and the wells sunk, cannot be less than 200 feet. Cappings on the hills along the eastern margin extend the area, as shown on the accompanying map, fig. 2.

In following the scrub road from Mr. Blackham's, in a south-easterly direction, with Kelly's Gully to the left, the road passes over a ridge of sand, etc., and rises to the top of a conical hill on the dividing line between Sections 79 and 80 [Hd. Para Wirra], which also shows a capping of sand; from which point, in a southerly direction, at a distance of about two miles, is Mount Gawler [distinct from Gawler Town Hill], which has a height of 1,789 feet above sea level. The Mount Gawler Range was probably one of the heights that was above the freshwater level when the auriferous and other alluvia were deposited in the neighbourhood.

(12) Sampson's Flat and Southwards.

After passing through One Tree Hill township in a south-easterly direction the road descends sharply to Sampson's Flat, on the western borders of the Hundred of Para Wirra, bordered on its northern side with sandy deposits. On the southern side of Sampson's Flat the drainage goes southward to Gould's Creek [the northern branch of the Little Para]. There is a small water-parting between Tenafeate Creek and a small creek which runs into Gould's Creek, from the crest of which there is a good view of the plateau country, bordered on its eastern side by the prominent Mount Gawler Range.

On leaving Sampson's Flat, going southwards, and crossing Gould's Creek, the road enters the Hundred of Yatala at its north-eastern angle, rising to a steep hill. Passing over the crest, very hard siliceous and ferruginous consolidated river sands and gravels outcrop on the road and in paddocks on either side [Secs. 1,732-1,733]. In Section 1,733 the gravels are quarried, showing a face of 12 feet in thickness without exposing the bottom. In Section 1,732 there are extensive outcrops of similar deposits on the top of the hill and along the slopes, not less than 30 feet in thickness.

(13) Anstey's Hill Road (Highbury).

No ancient fluviatile remains were noted in the rough country forming the upper region of The Little Para River, but at a distance of about two miles, southward from the last recorded exposure, they appear in the neighbourhood of Golden Grove and are continued southward to the Hope Valley reservoir [see fig. 2]. For convenience this area will be described in a reversed order, beginning at the metropolitan end.

The Anstey's Hill road crosses the River Torrens at Paradise at a height of 200 feet [military map] above sea level. As the road rises to the hill, decomposed slates of the Adelaide Series show in a cutting on the road, with a dip. E. at 62°. At a little higher level examples of a ferruginous quartzose conglomerate occur, in isolated pieces, by the roadside.

Soon after passing the Hope Valley reservoir there are more striking evidences of the fluviatile remains by the occurrence of sand, sand-rock, and fine gravel. Three well-marked river terraces can be recognised.

First River Terrace.—This accords with the flat on which the Highbury Hotel is situated, two miles distant from Paradise and at a height of 450 feet above sea level. The terrace extends over several Sections. Opposite the hotel, a by-path goes down the side of the hill towards the river. Along this path the alluvial beds are exposed in an estimated thickness of 100 feet; and these, again, rest on the slates, at about 100 feet above the level of the river.

Second River Terrace.—About a mile on the rise from the hotel is a second terrace, on the western side of the road, forming part of Hope Valley, which is preserved in its natural condition [1906] with a characteristic flora of Grass Trees [*Xanthorrhoea*] and associated plants that have their habitat on sandy soils.

Third River Terrace.—This is the most distinct and remarkable of the three terraces, at a height of 650 feet above sea level. It occurs on the eastern side of the road with an extensive flat top and scarped face to the westward, ending in a steep cliff on the southern side. The rock varies from a soft sandstone to a hard quartz conglomerate, resting unconformably on the rising ground of old rocks to the eastward [pl. iii., fig. 1].

Anstey's Hill forms the summit of the road, immediately following the highest terrace of the old river deposits, and marks the average plateau elevation of the ranges at 1,300 feet. The hill consists of a very thick quartzite that can be correlated with the Black Hill and Mount Lofty quartzite horizons.

(14) Hope Valley and Golden Grove [fig. 2].

Hope Valley forms the central feature of a well-defined section of the ancient river course that comes down from the One Tree Hill and Nuriootpa districts, following a south-westerly direction. Hope Valley represents a valley of erosion that has passed through three stages. The first of these was inaugurated when the former river excavated its bed in the slates of the Adelaide Series, to a depth of over 200 feet. A period of alluviation followed as a second stage, during which sediments were laid down to a thickness of over 300 feet. Then a second period of erosion took place, when a new channel was cut in the older fresh-water sediments, to the extent of 100 feet, as exists today. Only small transverse streams occur in the valley at the present time. The presence of lignitic material in the sediments has led to numerous bores being put down that have supplied interesting information as to the deposits.

An Adelaide syndicate put down three bores to test the existence of lignite. The first of these was in Section 827 [Hd. Yatala], situated three-quarters of a mile to the northward of the Hope Valley reservoir, which proved bed-rock at a depth of 17 feet. A second bore, in Section 308, a little to the westward of the reservoir, reached bed-rock at a depth of 145 feet. A third attempt, made in Section 845, on the eastern side of Modbury, near the western limits of the basin, touched bed-rock at 60 feet. In each of these trials the bore passed through sand, gravel, and clay, but no lignite. The South Australian Government then undertook investigations, particulars of some of the more important bores being summarized as follow:—

No. 1 Bore [10, p. 10; 11, p. 19].—In Section 2,093, near the public road on its southern side (opposite the reservoir). The bore passed through sand, sandstone, and clay; including 65 feet of drift sand, followed by 43 feet of clay and lignitic material, resting on pipe-clay at a depth of 193 feet.

The Government then put down nine bores in Section 824, situated within a short distance of the north-easterly angle of the reservoir reserve, of which the following particulars give a generalized account of some of the more interesting logs.

No. 4 Bore [12, p. 33].—Passed through red and white sandstone, 29 feet; friable argillaceous sandstone, 108 feet; pebbles, 5 feet 6 inches; lignitic clay and lignite, 57 feet; clay, 28 feet. Rotten slate was struck at a depth of 235 feet.

No. 5 Bore.—Sandstone with a bed of small quartz pebbles, 75 feet; drift sand, 64 feet; sand and small boulders, 5 feet; lignitic clay, etc., 58 feet; bottom, white clay, 8 feet. Total depth, 210 feet.

No. 6 Bore.—Sandstone, pebbles, and drift sand to 105 feet; lignitic clay, 12 feet; coarse white sand, 28 feet; lignitic clay, etc., 37 feet; bottom, white clay, 14 feet. Total depth, 197 feet.

No. 7 Bore.—Sandstone, 85 feet; drift sand, 81 feet; lignite and lignitic clay, 62 feet; bottom, white clay, 2 feet. Total depth, 230 feet.

No. 11 Bore.—Sandstone (containing 11 inches bar of ironstone), 64 feet; drift sand, 77 feet; lignite and lignitic clay, 55 feet; bottom, white clay, 17 feet. Total depth, 216 feet.

It was found that the lignite deposits do not extend eastward much beyond No. 7 bore, as they were not present in bores 9, 10, and 12.

For further information see Government *Mining Review*, No. 33 (1921).

A bore put down at Tea Tree Gully, in Section 5,485 [Hd. Yatala], two miles to the north-eastward of the Hope Valley group, passed through variously coloured clays with quartz pebbles, resting on rotten slate at a depth of 178 feet. The bore was continued to a depth of 341 feet in the upper phyllites and blue metal limestone of the Adelaide Series as bed-rock. [Information kindly supplied by Engineer-in-Chief's Department.] A shaft was sunk on the kaolinized slate, and the latter worked in the interests of the pottery works, at Hindmarsh, for many years.

The old fluviatile valley shallows on the western side and has been reduced by denudation to numerous disconnected patches of alluvial deposits, both fine and coarse, that cap the low elevations [fig. 2]. Gravels of various grades occur under such circumstances in Sections 2,114, 2,141, 2,133, 2,134; and near the cross roads, taking in parts of Sections 2,126, 2,127, 1,596, 1,595 [Hd. Yatala]. A quarry in gravel [Sec. 2,141], near the residence of Messrs. Smith Bros. [observation made in 1909], showed the following section: *(a)* At surface, consolidated gravel, puddingstone, somewhat ferruginous; *(b)* hardish freestone, 4 feet; *(c)* gravel, fine and coarse (coarser below) argillaceous in part, carrying calcareous pipes, 20 feet, resting on variegated pipe-clay. Black calcareous slate and blue-metal limestone show on the roadside, near Smith Bros., on the southern side of Section 2,143, with a dip. E. 20 S. at 35°. The same limestone occurs in a well, near-by, at a depth of 120 feet.

The ancient fluviatile remains in the Hope Valley district form a continuous mantle for many miles. In their southerly limits they pass around the Hope Valley reservoir, parallel with the course of the River Torrens, and then take, as their easterly margin, the eastern side of the main north-eastern road, rising to the base of Anstey's Hill. From there they follow the western side of the main road to Tea Tree Gully, continuing northwards to Golden Grove, where they curve round to the broken margin of these beds on the western side, as already described, forming a continuous area, seven miles long and three miles wide [see fig. 2]. On the northward side, after an interval of two and a half miles, they reappear in the extensive deposits of Sampson's Flat and the One Tree Hill district. In a southerly direction, two miles to the southward of the Hope Valley reservoir, they reappear on the southern side of the River Torrens, at the Thorndon Park reservoir.

Post-Miocene Age of the Hope Valley Alluvia.

The presence of lignitic material in the bores at Hope Valley might, at first, convey the impression that they could be correlated with similar material discovered by borings at Moorlands and other places in the Murray Plains, underlying the fossiliferous Miocene beds. That these respective deposits are of different geological ages is quite clear. Deposits of carbonaceous matter are a frequent feature in the swamps and backwaters of large rivers in their mature stage, and may be of any age. The following are points of contrast existing between the respective lignitic deposits at Hope Valley and the Murray Plains:—

(a) So far as known, the lignite at Hope Valley is limited to a patch not exceeding a mile in length.

(b) The deposits at Hope Valley show no stratigraphical relationships with the Miocene beds.

(c) Moreover, precisely similar alluvial deposits overlie the fossiliferous Miocene at Happy Valley, Morphett Vale, Reynella, and other localities, as occur at Hope Valley.

(d) The lithological features of the two formations are much in contrast. In the Moorlands district, where over 100 borings have tested the ground, beds of gravel are almost absent, while at Hope Valley they are a frequent feature (up to 26 feet in thickness), occurrences being both at depth and at the surface. Glauconitic sands and clays are common in the Moorlands sections, but are totally absent in those at Hope Valley. Quicksands form thick beds at the latter, but are not present at Moorlands. The alluvial sediments at Hope Valley, including the bores and surface terraces, show a vertical thickness of 400 feet.

(15) A Truncated Segment [fig. 3].

A remarkable tectonic feature is present in the foothills of the ranges in the neighbourhood of Adelaide. A crescentic segment has, by faulting, been let down which broke the continuity of the piedmont plateau, and for a distance of eight miles the foothills, represented by the Glen Osmond-Mitcham quartzites and slates, have disappeared. The horns of this faulted crescentic segment are: *(a)* at the Stockade, in the north; and the other, *(b)* at Marino, in the south. The line of fracture follows the base of the ranges along the slopes of the Three Sugar Loaves, Black Hill, Stonyfell, Glen Osmond, Mitcham, Tapley's Hill, and to the seaboard near Brighton [see fig. 3]. The piedmont plateau, to be consistent with the general physiographical features, should be continuous between the Hope Valley plateau and the Belair-Blackwood plateau. Instead of this, where the foothills ought to show themselves, in this interval, there is an alluvial plain, having the Hope Valley and the Belair-Blackwood sections truncated on either side. Patches of what appear to be remains of the ancient river terraces occur on the slopes of the ranges within the limits of the gap.

A deep boring, carried out by the Municipal Tramways Trust, at Kensington Gardens, near the south-eastern corner of Section 270 [Hd. Adelaide], by Messrs.

Horwood, Bagshaw, Limited, who have courteously supplied the writer with a copy of the Log, is of great interest as bearing on the geological features under discussion.

The following is a generalized record of the Log, showing the beds passed through:—

Depth in Feet.	Thickness in Feet.		Depth in Feet.	Thickness in Feet.	
22	22	Sand and boulders—bed of old creek.	610	38	Brown sand.
			626	16	Brown sand, becoming coarser.
60	38	Red clay and gravel.	635	9	Sandstone.
145	85	Clay and boulders.	667	32	Stiff black clay.
285	140	Yellow clay.	680	13	Sandstone.
290	5	Sand and gravel.	695	15	Chalky [(?) Kaolin] clay.
337	47	Boulders in yellow drift-sand.	705	10	Green clay.
368	31	White, coarse sand.	720	15	Shaly slate [(?) Bed-rock].
436	68	Red sand.	740	20	Layers of clay and white sandstone.
443	7	Sandy clay.			
550	107	Black sand.	752	12	Sandstone.
572	22	Sandy clay.			

It is possible that the last 47 feet in the above section represent the bed-rock, but the 700 feet overlying this horizon undoubtedly represent fluviatile deposits. The latter are considerably thicker than occur in other bores in the district. At the Dry Creek bore they proved to be 320 feet in thickness; at the Metropolitan Abattoirs, 368 feet; Croydon, 395 feet; Kent Town, 69 feet. If the piedmont plateau, referred to above, which carried a segment of the ancient alluvial beds, was let down by a step-fault, it would receive the wash from the ranges from several creeks that debouch on the plain, which, in association with the older alluvium, may explain the extra thickness of the sediments present in the Kensington Gardens bore. At the same time the 32 feet of "stiff black clay," between the depths 635-667 feet, may represent the impure carbonaceous beds in the Hope Valley sections, and the reported "chalky clay" resting on "shaly-slate" may represent the kaolin, or decomposed bed-rock present in all the Hope Valley bores. If the ancient fluviatile remains have been dropped, as suggested, with the faulted segment, this subsidence has occurred since the Hope Valley river ceased to flow.

(16) The River Torrens.

The question of the relation that the River Torrens bears to the ancient hydrography is full of interest. The river originated on a plateau of comparatively low relief in the process of elevation, and has, by erosion, kept pace with the epeirogenic uplift throughout its life history. The river has its head waters in the neighbourhood of Mount Pleasant, about 22 miles from its outlet at the gorge where it debouches on the Adelaide Plains, eight miles from the city.

The river basin includes the relatively lower ground bordered by the Mount Torrens [1,918 feet] Range and Forest Range, on its southern side; and the Mount Gould [1,725 feet] Range, on the northern. At Mount Pleasant the river flat has a height of 1,400 feet above sea level. Ten miles lower down the stream, at Gumeracha, the river is at the 1,100 feet level, with adjacent heights, on either side, of 1,400 feet. Twelve miles lower down stream, where the river emerges from its gorge, the normal water level is 300 feet above sea level, with adjacent heights within the gorge of 1,400 feet on its northern side and 1,200 feet on its southern.

In the upper reaches, where the rocks are generally more yielding, narrow lateral deposits have been laid down, but when the stream cuts through the hard barriers of rock, near its outlet at the gorge, the river bed is narrow and enclosed

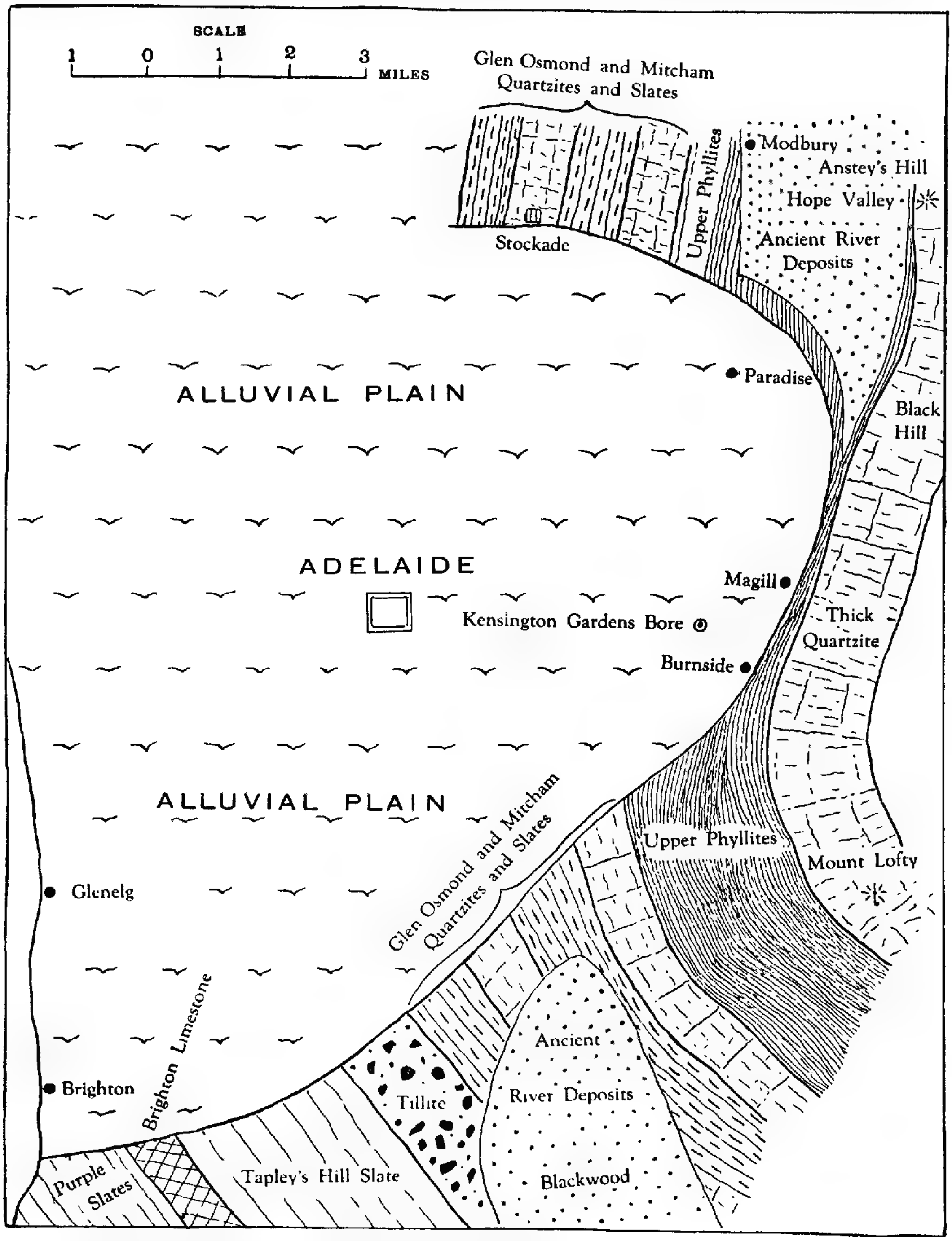

Fig. 3. Sketch plan of foothills, near Adelaide, showing the break in their continuity and let down, by faulting, of a segment, eight miles in length, together with the ancient fluviatile remains on top; also showing the truncated portions of the latter, as cappings, on the platforms on either side of the broken portion. The Glen Osmond and Mitcham quartzites form one bed, but through a synclinal fold are repeated on the plan.

by steep precipitous sides. The absence of waterfalls and river terraces of any account are indications of a youthful stage of erosion. Rapids occur near Castambul, starting at the base of the "Devil's Staircase" and continue down stream for about a quarter of a mile in a fall of about 50 feet. The gorge is cut in the Basal Grits of the Adelaide Series, resting unconformably on the Pre-Cambrian massif. In one part of the rapids is a pothole sufficiently large to allow six or eight men to sit comfortably in it, and in front of the rapids is a hole excavated in the hard rock that goes by the name of the "Devil's Hole," which is said to be 15 feet in depth, probably excavated at the base of a former waterfall that has now been reduced to rapids.[3]

With respect to the geological age of the river, the evidences seem to suggest that it was called into existence under the deformation that was incidental to the elevation of the Mount Lofty Ranges. In that movement the country received a tilt to the westward—a pitch-down in the direction of the fault-trough—which became the controlling factor in determining the lines of drainage on the southern side of the uplift, having a westerly direction.

While the river shows juvenile characteristics, as already described, it is evidently of considerable antiquity, as it has incised its bed through some of the hardest rocks to a depth of at least 1,400 feet. The fact that it has been able to keep its course open to the westward is proof of the very slow movements operating in the elevation of the ranges, and supplies a rough index datum in estimating the age of this Pleistocene (or earlier) earth movement.

(17) Blackwood and Eden Hills.

The steep faces of the Mitcham and Brighton hills mark the limits of the Adelaide Plain on its southern side where the highlands curve round to the coastline. The main South Road rises to the plateau at Tapley's Hill, at which elevation a fine panoramic view of the Belair-Blackwood plateau can be obtained, bounded, on the eastward, by the ranges that form the Upper Sturt platform levels.

The Belair-Blackwood plateau is, really, a broken continuation of the Hope Valley plateau, at about the same level and with similar physical features. The most of the surface in the neighbourhood of Blackwood consists of a loose, sandy soil, especially on the western side from the railway, and southwards. Some parts are under cultivation, while other portions are still in a virgin condition of sandy scrub. On the northern side of the railway station a deep cutting has been made in the beds, partly tunnelled by the railway, showing a face of about 20 feet at the southern end of the cutting, where the alluvial beds rest unconformably on rotten slates of the Adelaide Series.

The beds consist, more or less, of cemented sand-rock, irregularly stained by iron oxide. Lumps of similar rock are widely scattered over the district, indicating the presence of these beds below the surface. In the approach to the railway station an interesting section is exposed [pl. iii., fig. 2] of an ancient river channel filled with fluviatile deposits that are not seen at the surface level and have no relationship to any form of existing drainage.

On the western side these deposits extend to Eden Hills, forming a high-level platform at about 200 feet above the Eden railway station. At this level, a little to the eastward of the Friends' Meeting House, indurated sand-rock is seen on the road and in the gully, on the left. The softer portions of the formation have been excavated for sand.

At a slightly greater elevation, forming the summit of the plateau, in the fork of two roads that include Section 104 [Hd. Adelaide], there is an extensive flat of

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(3) In the construction of the new Gorge Road through this narrow defile, much of these interesting rock structures in the bed of the river have been destroyed.

dark-coloured, carbonaceous, sandy clay, very absorbent and boggy, in wet seasons, and deeply cracked during the dry. It could not have originated in such a position, and suggests its former occurrence as a back-water or stagnant pool in a stream.

At Mr. Wade's brickyard, situated a little to the southward of the last named, the following section was noted [Observation made in 1918]:—Top clay (soft), allowing for rise in the ground, 20 feet; mottled clay, 6 feet; white, very fine, indurated sand bed, containing isolated pebbles up to six inches in diameter, 6 feet; giving a total of 32 feet. Bed-rock, rotten slates penetrated by quartz veins.

On the Belair side, a capping of sand-rock is seen in many places. Near the Inebriate Retreat [1904] indurated sand-rock, covered by dark-coloured clay was seen exposed in waterholes, having a thickness of 8 feet, without bottoming.

In a south-westward direction and nearly due south of the Eden railway station, high-level alluvium forms cappings on the flat surfaces on both sides of the Blackwood Creek, south-westward of the Metropolitan brick works; also on the higher levels, bordering the Sturt River, in the same locality.

(18) Happy Valley.

By a curious coincidence the three metropolitan reservoirs, namely, Hope Valley, Thorndon Park, and Happy Valley, are situated within the channel of the ancient river bed, the depression between the ranges being favourable for water storage. The first two mentioned are on the northern side of the great break in the foothills, and the third is on the southern side. Thorndon Park reservoir, which is somewhat affected by the faulted segment, is 100 feet lower than the others, while Hope Valley and Happy Valley are, respectively, about the same height with regard to sea level.

The reservoir at Happy Valley is situated on an extensive ancient river terrace, which forms the floor on which the water rests and exhibits scarp faces on two sides. These remains are among the most impressive of their kind in South Australia. The rock varies from an argillaceous to a siliceous sandstone, of a pure white to a reddish, mottled colour, and from a consistency that is somewhat easily acted upon by the weather to that of a very compact, weather-resisting rock. A channel has been excavated on the southern side of the reservoir to convey the overflow into the Field River. This channel is bordered on its southern side by cliffs of the sandstone rock, varying in heights to 25 feet, which are continuous in a westerly direction for one and a quarter miles. At the south-westerly angle of the reservoir, a bridge on the main road crosses this channel. Here the beds have an exposed thickness of 15 feet, with vertical walls and a solid floor which appears to be impervious to the water resting upon it. From this point the water follows an excavated canyon-like channel, in the same rock, for a quarter of a mile, when it spills over into lower ground as it unites with the natural drainage of the district. The Hope Valley sediments rest on the decomposed slates of the Adelaide Series, while the Happy Valley deposits rest, in part, on the eroded beds of the fossiliferous Miocene.

In 1904, Basedow (13) noted these occurrences at Happy Valley, but described (following Tate) the fossiliferous beds, as Eocene, and the alluvial beds, as Miocene Sandstone.

Evidences of the great width of the ancient river valley are abundant in the surrounding neighbourhood. On the eastern side, opposite the reservoir, thick deposits of sand occur on the slopes towards Cherry Gardens. The cemetery at Cherry Gardens, as well as several of the adjacent Sections, situated at a distance of four miles from the reservoir, has a surface of fine alluvial sand, which may possibly indicate a lateral tributary of the main stream coming in from an easterly direction. These high level positions seem to connect with those at Blackwood, which are about at the same elevation.

Going southwards from the Happy Valley reservoir the ancient river deposits are continuous for many miles, clothing the floor and sides of a well-defined valley. Immediately adjacent to the reservoir are numerous vineyards, the soils of which are conspicuously sandy. Within half a mile southward of the reservoir, the foot-hills, on the eastern side, show a terrace of the variegated sandstone in which the buildings of the Horndale winery have been set, by excavations, in successive elevations, to a height of 60 feet; and a bore on the premises penetrated the same rock to a depth of 40 feet without reaching its base. At a further distance of three-quarters of a mile in a south-westerly direction, as reported by Basedow, a bore put down at the Vale Royal winery passed through 30 feet of the same kind of rock without reaching bottom.

(19) Reynella, Morphett Vale, and Hackham.

The ancient river valley in this neighbourhood tends a little west of south with a gentle down-grade in that direction. There is no longitudinal drainage in the valley, and the streams that debouch from the hills on the eastern side are rapidly absorbed as they reach the valley flats. The Adelaide-Willunga railway follows the western side of the valley, passing through many cuttings between Reynella and Noarlunga, most of which are in the alluvial deposits of the extinct river. The following occurrences may be noted:—

(a) One mile before reaching Reynella from the northward, the main south road passes by a bridge over the railway where the latter runs through a deep cutting of the ancient river sediments. These are of a light-coloured, sandy nature, false-bedded; about 20 feet are exposed in the section, and the beds are 424 feet above sea level.

(b) On the southern side of Reynella the railway makes a deep cutting through a ridge that shows a stratigraphical unconformity. The lower 25 feet consist of rotten slate, nearly horizontal in the bedding, with a slight anticlinal fold at the southern end of the cutting. Resting on these slates are 15 feet of variegated, fluviatile sand-rock.

(c) A boring at Reynella (on the property of Mr. F. L. Byard, three-quarters of a mile to the southward of the Happy Valley reservoir, and situated on a flat about 40 feet below the reservoir level) was carried out by Mr. E. S. Horwood. The contractor reported that soft sand and sedimentary soils were met with to a depth of 247 feet, including a bed of brown coal, 18 inches thick, at a depth of 70 feet, and another similar bed, 6 inches thick, at a lower level. At the depth of 247 feet the bore entered hard rocks of the Adelaide Series ["The Register," January 3, 1922]. It seems probable that this section could be correlated with the beds passed through in the borings at Hope Valley, referred to above; or, otherwise, the sub-Miocene lignitic series.

(d) At the 18¼ mile-post (three-quarters of a mile southward of Reynella) a cutting occurs in the Purple Slates, 9 feet in height, with a dip of 35° (or more) W.S.W. Portions are much kaolinized. No alluvial remains occur in this cutting. The railway here makes a curve to the south-east that carries the line more into the valley.

(e) At the 19¼ mile-post (three-quarters of a mile before reaching Morphett Vale) a deep cutting, that reaches a maximum height of 35 feet, exhibits some interesting features. With the exception of a few feet at the surface, the whole of the section consists of the characteristic variegated sand-rock, which has been

greatly eroded by rain and has thereby developed a secondary cliff on the face. Differential weathering has produced cavities, stalactitic forms, and deep rain gushes that cause rapid changes in the wearing away of the sides. The cutting is a quarter of a mile long. The base of the beds is not seen.

(f) At the 19½ mile-post, shortly before reaching the Morphett Vale railway station (which is 78 feet lower than that at Reynella), the railway tends easterly towards the present valley flat. On the western side of the railway, near Morphett Vale, the consolidated sand-rock forms a considerable ridge with its slope towards the line. The crest of the ridge is covered by a layer of loose and bleached sand that is partly wind-blown. Near the highest point this sand is about four feet in thickness, under which is a foot of black, rather carbonaceous sand, which probably represents an old surface layer with vegetation. Under this, again, is a bed of yellowish sand, two feet in thickness. The true floor of undisturbed sediments underlies the latter, consisting of the usual indurated sand-rock, carrying, in places, thin layers of travertine limestone. The face of the ridge, towards the valley, is moderately steep, and as the prevailing wind that acts on the exposed side is evidently a south-easterly one, that side of the hill has been bared of sand, exposing the indurated alluvial beds, while the disintegrated sand has been carried by the wind to the crest and spread over the neighbouring fields in that direction. There are several acres bared in this way, and the older alluvial deposits have become deeply channelled by the rain on the slopes of the hill—in one instance the rain has cut out a gutter six feet in depth. This sandy ridge has been the camping ground of aborigines. Several circles of stones were noticed, still in position, that had been used for cooking purposes, and a large number of their chippings were scattered over the bared floor and patches of charcoal occurred in the undisturbed layer of sand at the top. These stone chippings were observed throughout the four feet of loose sand on the top of the hill, and on the bared floor, but there were no signs of them in the indurated sands.

(g) The ridge, on its southern side, slopes down to the Morphett Vale Creek, by which it is intersected, while the old river deposits appear again on the other side of the creek, and are once more exposed by the railway in the first cutting on the line after passing the Morphett Vale railway station, at a quarter of a mile distance from the latter. The cutting shows a maximum height of 40 feet [pl. iv., fig. 1], and with the exception of two and a half feet of surface soil, consists entirely of the usual highly-coloured rock in white and red. A deep red has been the original feature, as to colour, the white patches and vertical lines having been caused by the solvent action of rain water on the iron-stained grains of sand.

(h) The ridge is continued on the eastern side of the cutting, just described, in a gradual slope that extends to the centre of the valley. In this extension of the fluviatile remains the upper portion, having a thickness of several feet, consists of disintegrated sand-rock, more or less wind-blown into hummocks and depressions that carry a characteristic flora of native pines, *Banksia,* and an undergrowth of *Mesembrianthemum.* A space of about an acre has been wind-blown and bared to the top of the red sand-rock, resting on which a considerable number of chipped stones, by the aborigines, occur. As the slope of the ground nears the valley floor the vegetation changes to good-sized gum trees.

At the township of Morphett Vale there is an outlier of the fossiliferous Miocene in the form of glauconitic clay and sands. It can be seen in a road cutting at the back of the township, and was also proved in sinking a well opposite to the institute. Samples from the latter were given to the writer in March, 1886, by Mr. King. These Miocene deposits occur at a higher level than the ancient alluvial beds and were eroded by the former river when cutting its channel.

(i) The next cutting on the line occurs shortly before reaching Hackham railway station. The embankment, connecting the two cuttings, in a length of ten chains, has been constructed entirely of the stone quarried from the cutting near Morphett Vale, described above. The face of the Hackham cutting has a height of about 24 feet and is interesting as showing a stratigraphical junction of the ancient fluviatile system and the fossiliferous Miocene. [Pl. iv., fig. 2.] The latter, at the southern end of the cutting, forms a low anticline with a maximum dip of 5° S. The railway, also, has a gradient of 1 in 45, rising north. This, with the slight rise of the Miocene in the direction of the upgrade, thins out the alluvial beds and the cliffs consist mainly of Miocene. In the latter *Turritella aldingae* is a very common fossil, but as the beds have been letched of their lime the fossils occur only as impressions and casts, the lime, to some extent, being replaced by silica. The alluvial beds are of the usual type and include a bed of small gravel which thickens towards the southern end. The pebbles consist almost entirely of white quartz, much water-worn. The alluvial sand-rock is also calcareous, in places, through proximity to the Miocene, and the latter has also led to the formation of travertine near the surface. At the southern end of the railway cutting the main road comes within a few yards of the latter, and in the road cutting a very similar geological section is seen, as, also, in the ground at the back of the Hackham railway station, and on a district road that goes westerly from the latter. In a low cutting on the main road, on the southern side of the last-named village, a reddish sand-rock is exposed, mixed with travertine.

An Ancient River Bed seen in the Railway Cutting, about a mile before reaching Hallett's Cove from Adelaide.

The bed rests directly on the fine-grained quartzites of the Purple Slates Series. The pebbles in the bed are highly water-worn and vary in size up to two feet, the average being about a foot in diameter. They show a glaze or polish that reflects strongly in the sunlight. They are contained in a darkish-coloured indurated mudstone. The pebbles can be easily dislodged from the matrix and leave behind a smooth surface with a cast of their outline. The exposure is over 100 yards in length. There is no drainage in the neighbourhood with which they can be associated. The stream appears to have had, approximately, a north and south direction, and was, probably, a lateral contributory to the main river that drained the St. Vincent Plain before the incoming of the sea.

(20) Noarlunga and Aldinga.

At a little more than a mile in a south-westerly direction from Hackham, on a north-south district road, between Sections 46 and 47 [Hd. Noarlunga], water-worn pebbles occur on ploughed land about 80 feet above the main road. The larger stones, up to a foot in diameter, have been gathered from the land and thrown over the fence on to the road. Fluviatile deposits also occur on the opposite side of the valley. Here the stone has been quarried to a small extent. The upper portion of the bed, by disintegration, makes a loose and sandy soil.

Approaching Noarlunga and the banks of The Onkaparinga, the ancient sediments are much in evidence. On the road, near the church, where the road goes sharply down to the river level, a bed of gravel, containing large stones, is seen in section. The land along the northern banks of The Onkaparinga is very sandy, while on the southern side of the river the evidences are still more marked. At a height of about 200 feet above the river level the entire surface has a thick deposit of indurated red sand. The superficial loose sand has been removed by the wind, exposing the undisturbed sand-rock that, from a distance, appears as a conspicuous red patch. On this bared ground, deeply eroded by rain channels, many stone chippings of the aborigines were found. [Observation made in May, 1904.]

These deposits can be traced, going easterly, along the southern boundary lines of Sections 72, 19, 20 and 65, following the ridge as far as Section 68 [Hd. Willunga] at Sea View, the residence of the late Chief Justice, Sir Samuel Way, (where indurated gravels surround the house) covering an east and west distance of two and a half miles.

On the main road connecting Noarlunga and Aldinga, as the road approaches the margin of the wide valley on which the latter township is situated, several deep cuttings are passed through in which good sections of the old fluviatile beds are exposed. These beds do not show a dip to the valley but are horizontal and truncated, marking stages when the valley sediments stood at a much higher level than at present.

This great northern river, now extinct, formed a junction with another river that came from the east, now represented, in part, by The Onkaparinga, which will be considered in the next section.

IV. RIVER ONKAPARINGA AND ITS DESERTED VALLEY.

A group of hills around Mount Pleasant, Mount Torrens, and McVitties Hill, with their respective ranges, form an east-west water-parting in which several rivers take their rise. Reedy Creek flows eastward to the Murray, while the Rivers Torrens and Onkaparinga flow westward to Gulf St. Vincent.

The Upper Onkaparinga, as a sluggish stream, flows through open country that has subdued relief, passing the townships of Charleston, Woodside, and Balhannah. Some of the head waters of the Onkaparinga have been captured by the younger and more energetic River Torrens. There is a striking contrast between the Upper and the Lower Onkaparinga. Instead of widening out, as it nears its outlet, it contracts its valley area and becomes an entrenched meander, held within canyon-like walls. This reversal of the usual order in river development is explained by the fact that The Onkaparinga, at one time in its history, changed its course in its lower reaches, forsaking its original channel and excavating a new one.

The point at which this divergence took place appears to have been in the neighbourhood of Mount Bold. The river, after passing the latter, makes a great loop in a sudden turn to the southward, followed by an equally sharp turn to the northward. It was at this most southerly bend that the river appears to have changed its course. Here the high rocks, on its left banks, end abruptly, and an alluvial bank takes their place which, divergently from the river, is continued in valley form for many miles in a westerly direction and carries all the evidences of being the deserted channel of an important river. It is bounded on its southern side, in part, by the Saddle Bags Range, and, on its northern, by the higher ground through which the present River Onkaparinga has its deep-seated bed.

Mr. Durrant, a local gold digger, informed the writer that a shaft had been sunk in Section 305 [Hd. Kuitpo], at the southern bend of the river where the river is supposed to have changed its course, that passed through sand and gravel for more than 100 feet without reaching bed-rock; the upper part of the shaft went through a quartz-pebble conglomerate, evidences of which can be seen on the surface to this day. The width of the ancient alluvial deposits in this locality is defined on its northern side by Sections 756 and 757 (the property of Elijah White and Son[4]) at a height of 270 feet above the level of the river. The most of the hill top is covered with more or less consolidated coarse sand and conglomerate consisting of white, water-worn quartz. The deposits have been worked showing

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(4) The personal references in this district were made from observations and notes taken in October, 1908.

a quarry face of 5 feet in thickness, without exposing the base, the material having been utilized in the construction of the adjacent road.

On the southern side of the valley, commencing at the southerly bend of the river, similar material skirts the side of the Saddle Bags Range. A very distinct ancient river terrace with a scarp face of sand and conglomerate continues for some distance parallel with the new road (lately constructed in connection with the building of the weir of the Mount Bold reservoir). The terrace is some 50 feet above the level of the road and its material has been utilized for making the latter.

From this point of proximity to the river the ancient alluvial deposits continue, uninterruptedly, in a south-westerly direction to the margin of Gulf St. Vincent. A line taken across the valley, in the neighbourhood of Clarendon, supplies the following evidences.

On the southern side of Clarendon is a ridge known as Pickett's Hill which runs parallel with the river and is 240 feet above it. At one mile from Clarendon, near the top of the hill mentioned and on the southern side of the crest [Sec. 758, Hd. Kuitpo], a cutting on the road shows a striking section of the consolidated alluvial beds, 14 feet in thickness, resting unconformably on rotten slates. The alluvial beds do not follow the slope of the hill, but are horizontal to the plane of the valley below. At a somewhat higher level than the cutting on the road, the beds curve round slightly to the northward, passing through the grounds of Mr. T. B. Brooks [Sec. 745], following the southern side of the crest of the ridge at a height of 300 feet above the Onkaparinga, but are not seen on the river side of the hill.

At a lower level, going southerly, Baker's Gully and the Kangarilla Flats, including the cemetery and blockers' settlements, consist entirely of sand or coarser alluvial material. On Mr. Edward Steer's ground, Sections 840 and 826, there are large deposits of very clean sand and gravel. In the first-named Section the gravel is about 12 feet in thickness, resting on sand. The pebbles are mostly quartz, limited to two inches diameter, mostly smaller. The coarser sand and such stones as passed through a quarter-inch mesh were obtained here for the cement in constructing the Clarendon weir, amounting to 4,000 yards of material. From Section 826, situated about half a mile from the last mentioned, 600 yards were obtained for the same purpose.

Continuing southwards, on Joseph Oakley's land, in Section 854, a well was sunk in gravel, clay, and marl, to a depth of 20 feet, below which was 20 feet of quicksand which led to the relinquishing of the sinking. Samples of silicified wood were found in this shaft. On the adjoining Section, 166, southwards, owned by C. E. Parsons, 80 feet of quicksand was met with. The well was bricked up, but the run of fine sand between the bricks was so great that the whole quickly collapsed. The line of section, north and south, just described, proves that the ancient river valley at this part was, at least, three miles wide.

What was probably a tributary of the river that formerly flowed down this wide valley, came in from the south-east, between ranges now represented by Mount Panorama and Knott's Hill, on the eastern side, and by Wickham's Hill and low ranges on the western. The writer entered this valley by Stony Nob on the western side of Mount Panorama. The valley is flat and shallow, covered by a thick deposit of white sand which forms the bed of Peters' Creek, on the one side, and a heavy sandy road on the other. The valley was followed as far as the Knott's Hill school-house but was not traced further. It is probable that the Meadows Creek has captured the upper portions of Peters' Creek.

These ancient fluviatile deposits can be traced in a further westerly direction through the Hundred of Willunga, where, in several places they are found resting on fossiliferous Miocene beds. A well sunk by Mr. F. G. Scammell in the south-eastern corner of Section 11 (situated about two and a half miles to the westward of Wickham's Hill) gave the following record:—Sandy loam, 2 feet; stiff reddish-yellow clay, 8 feet; gravel, 21 feet; fine sand, 33 feet; soft sandstone with iron-stone bands, 12 feet. This gives a thickness of 76 feet of alluvium; below which was Miocene fossiliferous sandstone, 14 feet. [Govt. Geol. Ann. Rep., 1914 (1915), p. 9].

The district road that crosses the line near the McLaren Vale railway station rises to the hill on its northern side. About 30 feet above the level of the railway a bed of fossiliferous Miocene crosses the road. The fossils, which are chiefly in casts, are of common and characteristic species. In going up to the next rise, towards Sea-View, a cutting in the road shows the alluvial beds resting on a friable outcrop of glauconitic clay, also of Miocene age. The hill, which is about 150 feet above the level of the valley, is capped with beds of sand, gravel and ferruginously cemented conglomerate.

The River Onkaparinga supplies an interesting physiographical study. Next to the River Murray it is the most ancient of South Australian rivers and may be classed as an antecedent river, having been contemporaneous with some of the later stages in the great geographical revolution that brought to a close an older hydrographical system and initiated a new one. In this deformation, that proved fatal to most of the original river systems of South Australia, The Onkaparinga, like The Murray, has kept its way open to the seaboard. Its origin can be definitely fixed as Post-Miocene, as its original channel was excavated in the raised sea-bed of that period. The tectonic movements that raised the Mount Lofty Ranges and brought about great block-faulting (under which the Mount Lofty segment was pitched down to the base of the Willunga fault scarp) may have created the conditions favourable for its origin, the faulting having brought into existence a sunk-land that became a natural channel for the local drainage. This may be considered as the initiatory stage in the river's existence. [See 6, p. 53-59.]

A second stage was reached, when by base-levelling, slow sinking of the earth's crust, and loss of grade, the river aggraded its bed, overspread its banks on the northern side, carrying with it its alluvia which, in the deeper channels, reached a thickness of at least 300 feet. The river had now reached its maturity; largely blocked by its own sediments, it spread its waters over a wide flood-plain, in a meandering course, by lateral erosion. At this stage its delta-like channels had a width of ten miles, extending from Sellick's Hill, in the south, to Noarlunga in the north, possibly making a junction with the Hope Valley-Blackwood river (if they synchronized in age) in its lower stretches. [See ante, p. 35.]

A third stage was initiated by a reversal of earth movements, from a negative to a positive development, causing an increase of grade that gave rejuvenated energy to the stream. At this juncture the old-time Onkaparinga happened to have had its course near the northern limits of its valley, and in that situation began to erode its own sediments, reaching bed-rock. The ditch thus created restricted the river to a definite narrow channel, which marks its rejuvenation stage and fixed its topographical features; following a serpentine course, and from being a base-level stream it became an entrenched meander, as it is in the present day. Collateral evidences of the relatively recent age of the present channel of The Onkaparinga are seen in the fresh condition of the Purple Slates over which it flows in its lower portions, as compared with the rotten and kaolinized condition of the slates that are seen in the deserted channels of the extinct rivers. This development of a higher grade throughout the region, incidental to the process of elevation, also had its influence on the upper reaches of the river which, under the rejuvenation stimulus, also incised their channels, creating secondary valleys within the main valley.

A fourth stage in the history of The Onkaparinga is seen in the partial re-excavation of the deserted valley that lies to the southward of the present outlet of the river, extending from near Mount Bold to the present sea coast. No streams of importance exist in this wide valley today. The residual sediments of the former river course absorb all the drainage that comes from the Willunga Ranges, while a few minor streams originate near the coast, and these have had only a modern existence. [See "Story of Aldinga," "The Chronicle," No. 3,994, June 1, 1933, p. 46.] It is probable that the excavation of the deserted river valley may have been accomplished, chiefly, during the period of cooler temperatures and greater rainfall in South Australia which immediately preceded modern times.

There is a certain chronological relationship between the River Murray and The Onkaparinga, inasmuch as their respective origins date back to the antecedent, main hydrographic systems of the country and from their being the only rivers of those ancient systems that have maintained their outlet to the sea in South Australia during the subsequent physiographical changes. There are clear evidences that The Murray formerly reached the sea through the present Wimmera district of Victoria. The elevation of the south-eastern portions of South Australia, amounting to 250 feet, within Pleistocene and Recent times gradually forced The Murray channel in a westerly direction until arrested by the highlands of South Australia. The geological history of this great river has been dealt with by the writer in a paper, "Notes on the Geology of the Great Pyap Bend (Loxton), River Murray Basin, and Remarks on the Geological History of the River Murray" [Trans. Roy. Soc. S. Aust., vol. liii., 1929, pp. 167-195, pls. vi.-viii.].

V. CORRELATION AND AGE OF THE BEDS.

The late Professor Ralph Tate noted the occurrence of consolidated alluvia in some places in South Australia, which he defined as "Upland Miocene"; but he offered no explanation of their occurrence, and incorporated under the same terms formations that were of widely different geological ages.

Some of the features pertaining to these beds, if met with in Central Australia, would be classed as Desert Sandstone, and it is not improbable that some of the beds, so called, might be synchronized with the remains of rivers, once active but now extinct, in the southern portions of their courses.

Several geological observers have recognised the existence of certain "high-level, flat-topped alluvial deposits" in Central Australia, more or less consolidated by interstitial cement, often carrying silicified wood. Madigan (14) has referred these older alluvial deposits of the interior to a special class that he names the Arltungan Beds. Among the localities mentioned were the Todd, Paddy's Hole, Hale, and Plenty Plains. The author quoted states *(loc. cit.,* p. 97): "They had every appearance of being remnants of an older filling of the same valley plains in which they now lie. One such was described from the western region, in the plain, in the middle of the Waterhouse Range, where coarse gravel contained large silicified tree trunks . . . On the Plenty Plain, the flat-topped remnants are much bigger and more conspicuous, standing out as small tablelands or mesas." One of these described had "a flat-top that stood about 90 feet above the plain. The bottom 50 feet was grey sandy clay, overlain by 15 feet of red ferruginous sandstone, and capped by 25 feet of white chalcedony, the thickest of such cappings observed." The resemblances of these Arltungan beds to similar remains found in the dry river channels of South Australia, is suggestive of a probable correlation of the two as to age as well as a direct physiographical relationship in a former larger hydrographical system.

The geological history of these old sands and conglomerates is of absorbing interest, for they have shared in one of the greatest geological revolutions that has happened in the southern portions of Australia. When were these dry river channels, many hundreds of miles in length, the beds of refreshing streams? If they were fed by streams from the Far North the present physical barriers could not at that time have had any existence, so that their active stage must have antedated the elevation of the Mount Lofty Ranges, and, therefore, antecedent to what E. C. Andrews has called "The Kosciusko Epoch," a period that may be referred to a geological stage within either late Pliocene or early Pleistocene times.

An important datum, in fixing the age of these beds, is their definite Post-Miocene occurrence. At Happy Valley, Morphett Vale, Hackham, and McLaren Vale the ancient channels intersect and overlie the marine deposits of the Miocene period. Another datum bearing on the age of this line of ancient drainage is available. The bed of the extinct river in the neighbourhood of Adelaide rests on the highest of the shelvings caused by the step-faulting of the western scarp of the ranges, forming the foothills in the line of Hope Valley, Belair, and Blackwood, having an elevation of from 600 feet to 1,000 feet above sea level. No important river could occupy such a position with the present configuration of the country. We must assume that at the time of the river's existence it had, approximately, reached the base-level of the river system, which was before the major tectonic movements occurred that caused the great trough-fault of the gulfs, and transformed the river system, by a change of grade, from a north and south to an east and west direction.

At a later date, when the older rivers had ceased to carry their burdens to the sea, an intensification of the trough-fault caused further step-faulting along the slopes of the ranges, when a segment of the foothills was faulted down, over 700 feet, carrying the old river sediments with it. This happened subsequently to the truncation of the older drainage system, but before the earth settlements, near Adelaide, had reached their maxima.

There are two fossiliferous Pliocene horizons (an older and a newer) in the neighbourhood of Adelaide, but neither of them is found in stratigraphical relationship with the extinct river basin. The evidences seem to favour the view that the encroachments of the sea, that laid down at least the newer of these deposits, occurred subsequently to the truncation of the older river systems. A better acquaintance with the palaeontology of these so-named Pliocene beds may lead to their being placed, chronologically, at higher geological horizons.

Conclusion.

The present attempt to determine the effects produced by the elevation of the Mount Lofty Ranges on the older river systems of the country and the delimitation of the main river channels of these ancient systems must be regarded, to a certain extent, as tentative. The country concerned is very extensive; the time involved in the tectonic revolution, considerable; the evidences are superficial, and more or less evanescent under the meteorological conditions to which they have been exposed; and further, the disturbing influence of a superimposed system of drainage which intercepts and to some extent has rearranged the material of the older systems of drainage, all tend to obscure the question.

On the other hand, the facts are so clear and consistent, over hundreds of miles of lineal deposits, that the general principles involved seem to be beyond question. Some local adjustments may be required as to the routes followed by the trunk lines, and by detailed observations more tributaries may be added to complete the respective river systems as they once existed.

The older physiography illustrates the amplitude of the freshwater resources that formerly distributed their life-giving streams, not only over the coastal regions of the continent, but, also, over much of what is now the arid interior.

It is perhaps necessary to state, that as the observations recorded in these two papers have ranged over more than 30 years, certain local names and references may be found out of date, and as a warning the date of observation has in some cases been included in the text.

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DESCRIPTION OF PLATES.

Plate I.

Fig. 1. Ancient Consolidated Gravels forming a plateau in the ridge between the Hutt and Hill Rivers. Escarpment facing east. Hundred of Milne, Section 571. Photo, Prof. W. Howchin.

Fig. 2. Ancient Consolidated Gravels. Same site as in Fig. 1; showing bird's-eye view of the surface of the plateau. Photo, Prof. W. Howchin.

Plate II.

Fig. 1. Ancient River Plateau on the western side of Stockport, showing escarpment facing east. Photo, Prof. W. Howchin.

Fig. 2. High-level Ancient River Terrace of Consolidated Gravel; east side of Stockport, 200 feet above the site shown in Fig. 1. Photograph taken from near base of hill. Photo, Prof. W. Howchin.

Fig. 3. The same as shown in Fig. 2, in near view. Photo, Prof. W. Howchin.

Plate III.

Fig 1. Escarpment of Ancient River Terrace, 80 feet, situated on the eastern side of Hope Valley, near Anstey's Hill. Photo, Prof. W. Howchin.

Fig. 2. Section of Old Consolidated Alluvium resting unconformably on decomposed slates. Back of Blackwood railway station. Photo, Prof. W. Howchin.

Plate IV.

Fig. 1. Ancient Alluvial Sand-rock, exposed in railway cutting near Morphett Vale. Photo, Prof. W. Howchin.

Fig. 2. Railway cutting, near Hackham, showing Ancient Gravels resting unconformably on fossiliferous Miocene beds. The line of junction is shown by the position of the hammer. Photo, Prof. W. Howchin.

INFLAMMABLE GASSES OCCLUDED IN THE PRE-PALAEOZOIC ROCKS OF SOUTH AUSTRALIA

BY L. KEITH WARD, B.A., B.E., D.SC.

Summary

In the latter part of 1921 a borehole was drilled by the American Beach (K.I.) Oil Coy., N.L., in search of petroleum at a place selected by the divining rod. 7 miles to the south-west of Penneshaw (Hog Bay), Kangaroo Island. After passing through 135 feet of the older sand-dune formation, probably of Pleistocene age and consisting of calcareous and siliceous sands, the drill entered a thick bed of bluish clay, possibly of Tertiary age, containing no boulders and -extending- to a depth of 292 feet from the surface. Beneath the clay the drill penetrated mica-schist, phyllite and quartz-mica-schist. The borehole was visited when the total depth was 307 feet, and in the face of strong advice to the contrary, the Company decided to continue boring. Misfortune met the driller, who lost the sinker bar and drill attached at 366 feet. The Company had arranged for a deep hole and insisted on the fulfilment of the contract. A new hole was, therefore, drilled at a site only 4 feet from the first hole, so that the "stream of oil" might not be missed.

INFLAMMABLE GASES OCCLUDED IN THE PRE-PALAEOZOIC ROCKS OF SOUTH AUSTRALIA.

By L. Keith Ward, B.A., B.E., D.Sc.

[Read April 13, 1933.]

I. OCCURRENCE AND COMPOSITION.

In the latter part of 1921 a borehole was drilled by the American Beach (K.I.) Oil Coy., N.L., in search of petroleum at a place selected by the divining rod, 7 miles to the south-west of Penneshaw (Hog Bay), Kangaroo Island.

After passing through 135 feet of the older sand-dune formation, probably of Pleistocene age and consisting of calcareous and siliceous sands, the drill entered a thick bed of bluish clay, possibly of Tertiary age, containing no boulders and extending to a depth of 292 feet from the surface. Beneath the clay the drill penetrated mica-schist, phyllite and quartz-mica-schist. The borehole was visited when the total depth was 307 feet, and in the face of strong advice to the contrary, the Company decided to continue boring. Misfortune met the driller, who lost the sinker bar and drill attached at 366 feet. The Company had arranged for a deep hole and insisted on the fulfilment of the contract. A new hole was, therefore, drilled at a site only 4 feet from the first hole, so that the "stream of oil" might not be missed.

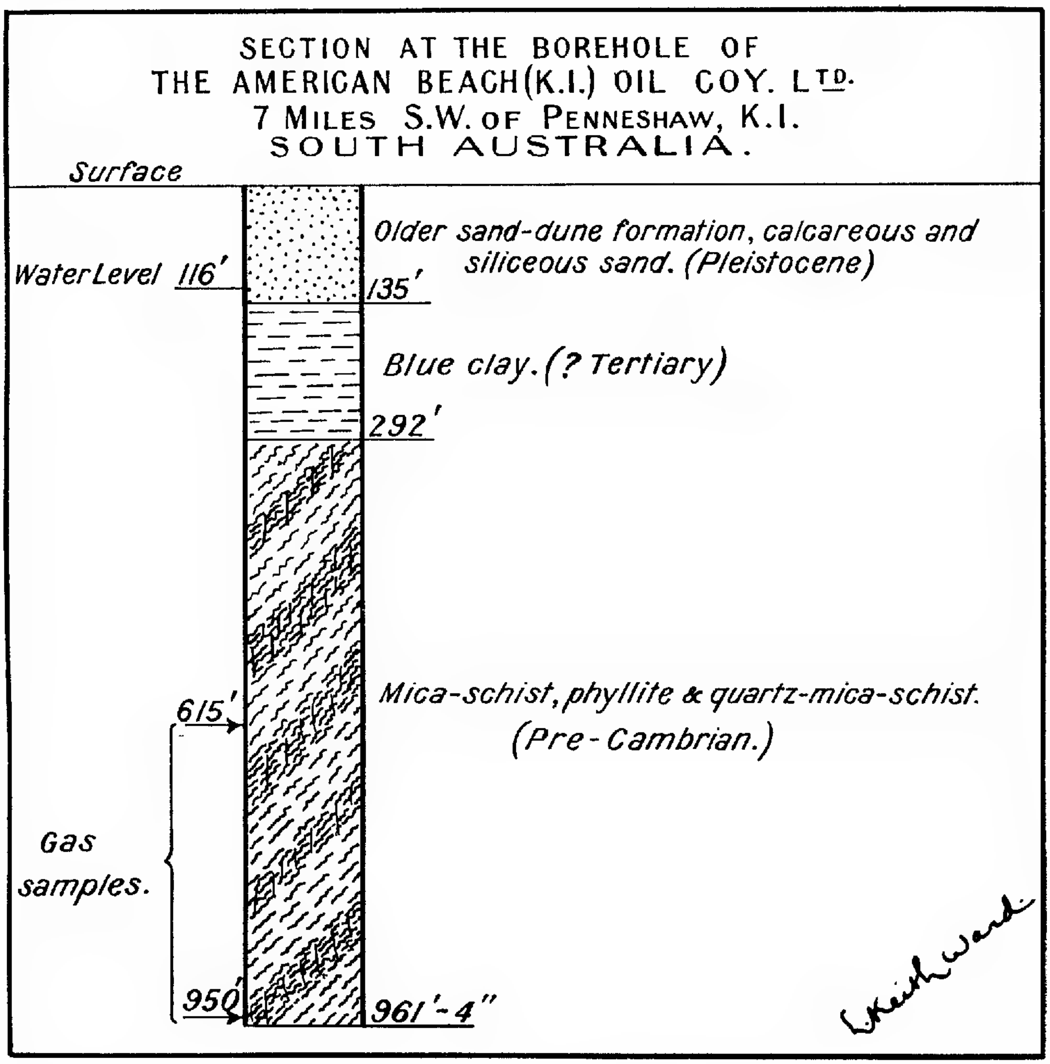
In July, 1922, inflammable gas was reported from the borehole, and extraordinary statements were made regarding a ball of fire travelling backwards and forwards between the bore site and the sea. The Company was urged to obtain samples of the gas, and the method of collection from the bailer was explained. Samples were collected and analysed by the Government Analyst, at a time when a depth of 615 feet had been reached. Boring was continued and more gas was reported, a further sample, obtained from 950 feet, being submitted to the Works Chemist of the South Australian Gas Works. The details of these analyses are as follows:—

	I.	II.
Depth of borehole	615 ft.	950 ft.
Analyst	W. A. Hargreaves	N. L. Woore
Carbon dioxide	5·3%	0·52%
Oxygen	4·3%	3·55%
Ethylene, etc.	0·5%	Nil
Carbon monoxide	Nil	Nil
Hydrogen	51·3%	68.64·%
Methane	2·6%	4·68%
Nitrogen (by difference)	36·0%	22·61%
Total	100%	100%

Boring operations ceased when a total depth of 961 feet 4 inches was reached, and have not been resumed. Water level in this borehole was at a depth of 116 feet from the surface.

More recently, in 1931, a borehole was started at a place $6\frac{1}{2}$ miles to the east of Minlaton, on Yorke Peninsula, where the Permo-Carboniferous tillite has been removed by erosion from the Cambrian archaeocyathinae limestone. This site also was selected by diviners. The hole is now 1,800 feet deep, and may be deepened. Splendid samples have been kept at all stages of this work, and have been submitted for examination. The following condensed section is based on these samples:—

Surface to 253 ft.	....	Cambrian limestone with Archaeocyathinae.
253 ft. „ 292 ft.	....	Basal Cambrian shale, sandstone and grit.
292 ft. „ 548 ft.	...	Upper Pre-Cambrian limestone with some phyllite and calcareous and siliceous slate.
548 ft. „ 855 ft.	....	Upper Pre-Cambrian crystalline limestone.
855 ft. „ 1,800 ft.		Upper Pre-Cambrian light and dark grey limestone.



The Cambrian beds appear to be horizontal or nearly so, but the attitude of the subjacent limestone is unknown. Water level stands at 160 feet below the surface in this borehole.

Inflammable gas was first observed in the sludge raised in the bailer when a depth of 370 feet had been reached. Samples were not recovered till the hole was 790 feet deep, and further samples were taken by Mr. R. W. Segnit and the writer when the depth was 860 feet. Another sample was taken by the driller when the bottom of the hole was 1,666 feet below the surface. All these samples have been analysed by the Government Analyst, with the results shown in the following table:—

	I.	II.	III.	IV.	V.	VI.
Depth from surface	790 ft.	790 ft.	860 ft.	860 ft.	860 ft.	1,666 ft.
Carbon dioxide ..	0·8%	0·2%	0·8%	0·8%	0·6%	Nil
Oxygen	Nil	Nil	3·2%	2·4%	3·0%	1·2%
Ethylene, etc. ..	Nil	Nil	Nil	Nil	Nil	Nil
Carbon monoxide .	Nil	Nil	Nil	Nil	Nil	Nil
Hydrogen	74·0%	76·0%	60·0%	64·4%	60·0%	84·0%
Methane	7·5%	7·5%	5·4%	7·0%	5·6%	Nil
Nitrogen (by difference)	17·7%	16·3%	30·6%	25·4%	30·8%	14·8%
	100%	100%	100%	100%	100%	100%

In neither case, at Kangaroo Island or near Minlaton, has it been possible to estimate the quantity of the gas liberated. Drilling was done in each case by a percussion plant. Water level is far below the surface, and it is not possible to say whether there is any appreciable amount of gas rising through the deep column of water in the borehole. The gas was seen bubbling out of the sludge after its discharge from the bailer, and could be seen escaping from the top of the bailer when it is raised from the bottom of the hole to the surface.

It would appear that the pressure of the water column facilitates the solution of the gas as it is liberated from the rock pounded up by the drill, and that on the diminution of this pressure (by the raising of the bailer to the surface) the gas in solution bubbles off.

It does appear, moreover, that the amount of gas set free and taken into solution is variable in different parts of the same formation. It has been found, when efforts have been made to collect samples, that it is sometimes easy to fill a quart bottle from a single bailer, and that on other occasions several bailers must be raised to the surface in order to get a single bottleful of gas.

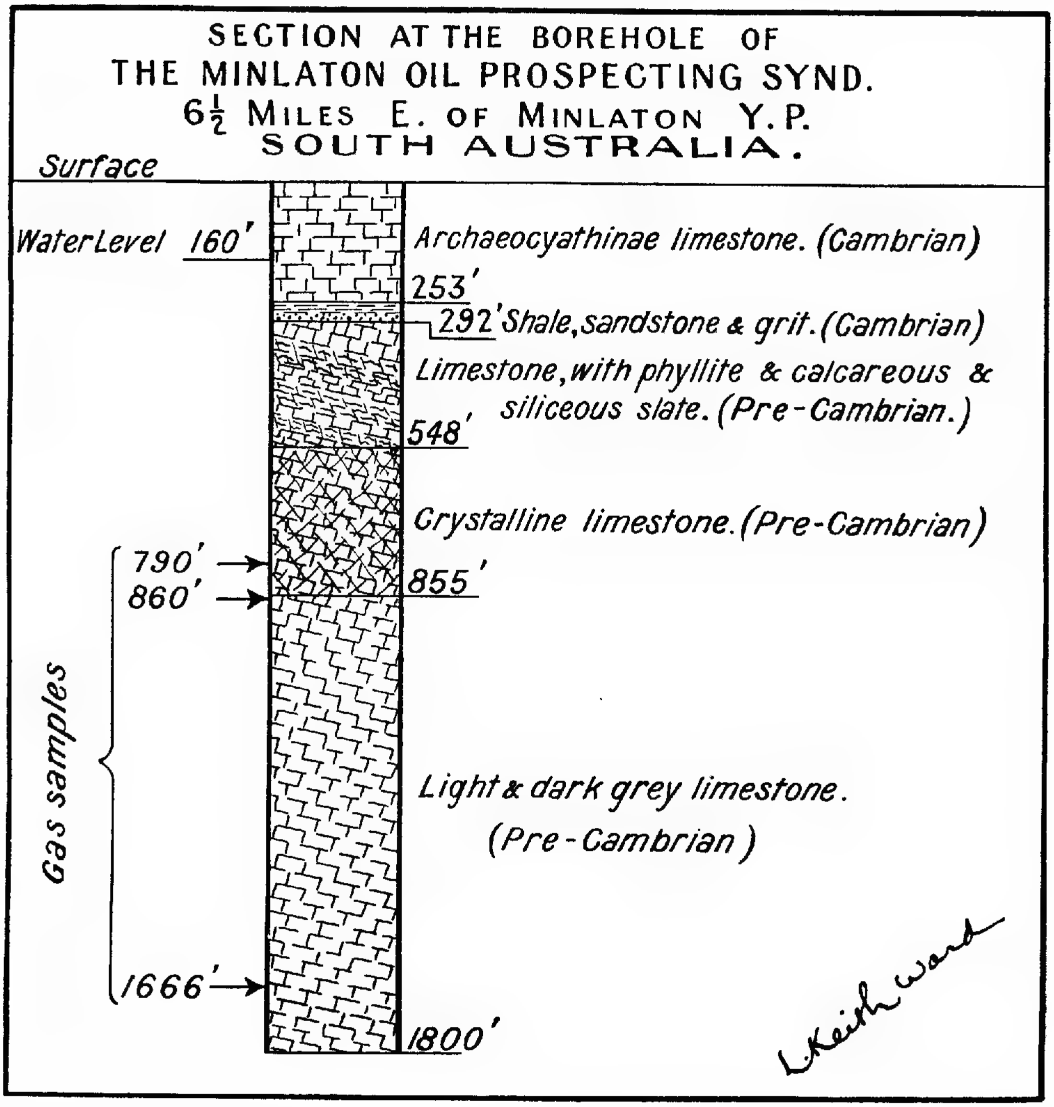
II. ORIGIN OF THE GASES.

A cursory glance at the composition of these gases shows that they are entirely distinct from the "natural gas" that is associated with many occurrences of petroleum, from the "fire damp" that is liberated from coal seams, and from the "marsh gas" derived from the decomposition of vegetation under wet conditions that prevent oxidation by the atmosphere.

Yet the kind of gas obtained in these boreholes has been found before in the systematic examination of rocks and meteorites for the nature and amount of their gas content. The classic work is that of Professor R. T. Chamberlin, of Chicago, whose study of "The Gases in Rocks" was published in 1908 by the Carnegie Institution, of Washington, as one of the series of contributions to cosmogony and the fundamental problems of geology. A summary of the work of many investigators will be found on pages 276 to 288 of the fifth edition of "The Data of Geochemistry," by F. W. Clarke, published as Bulletin 770 of the United States Geological Survey.

The essential point of difference between the gases obtained by Wright, Tilden, Travers, Gautier, Chamberlin, and Brun from various rocks and those concerned in this paper, lies in the fact that the investigators named recovered their samples from specimens heated to redness in vacuo, whereas the gas samples here mentioned were obtained by the mere pounding up of the unheated rocks during drilling.

Both Gautier and Chamberlin attribute the greater part of the gases to reactions within the rocks themselves, brought about by heat; but recognise that there are gases in some minerals like beryl that must have an origin outside the mineral host, which does not carry enough water and iron to give the amounts of hydrogen present. Chamberlin regards the water giving rise to the hydrogen as derived largely from the micas of the deep-seated rocks, that is to say of magmatic origin. He proved by numerous analyses that the gases in rocks consist of H_2S, CO_2, CH_4, H_2, and N_2, but that chlorine and its compounds are absent. The



ferromagnesian rocks carried the most gas, and in general hydrogen and the oxides of carbon predominated. Chamberlin found, also, that H_2 and CO_2 are about equally important in deep-seated rocks, but that CO_2 predominated in surface flows. So far as age is concerned the oldest rocks contained the most gas, and recent lavas gave much less than Archaean plutonic types. One noteworthy feature of Chamberlin's work was his neglect of the carbonates—limestones and dolomites—doubtless because of the probable obliteration of other gases by the CO_2 that would be set free by his method of treatment.

Commenting on the results of the analyses of the South Australian gases, one would be inclined to note particularly:—

(a) The presence of methane in notable proportions in highly altered and apparently non-carbonaceous rock types. The possible origin is mentioned below in paragraph *(c)*.

(b) There is an obvious source of carbon in a limestone, but not in the case of mica-schist, phyllite or quartz-mica-schist, unless there is present some small but unnoticed proportion of a carbonate mineral.

(c) The presence of methane and hydrogen looks strange in the presence of carbon dioxide and the complete absence of carbon monoxide. The presence of a powerful reducing agent would lead one to expect the reverse position, unless there has been some such reaction as Gautier claimed to have induced at high temperatures. He gave the following equations:—

At 900° to 1,000° .. $4CO + 2H_2 = 2H_2O + CO_2 + 3C$.

At 1,200° to 1,220° . $4CO + 8H_2 = 2H_2O + CO_2 + 3CH_4$.

(d) No organic matter has been observed in the old limestones at Minlaton, although there are organic remains in the overlying Cambrian limestone,

The occurrences being such puzzling ones for which to provide a satisfactory explanation, Professor R. T. Chamberlin has been consulted and has been good enough to write several times on the subject. He drew attention to the fact that the case is essentially different from the situation obtained in his experimental work, in that he heated the rock material and that the bulk of the gas obtained was undoubtedly the result of reactions which took place at the temperatures used by him. But he stated further that he was able to show that a proportion of the gases, in some cases at least, was already present in the rock in the gaseous condition. Professor Chamberlin's later communication (June 24, 1932) deals with the origin of the constituents of the gas in the following words:—

"The methane would seem to me to be probably of organic origin, even though coming from a quartz-mica-schist. I am assuming that this rock was originally a sediment containing organic matter, and that in the processes of consolidation, metamorphism, etc., decomposition of this matter gave rise to methane and that gas thus far has not been able to escape, or in any case a considerable amount of it still remains in the rock. Carbon dioxide has probably also come from the same process; hydrogen might also, if during metamorphism the temperature became sufficiently high. Hydrogen, of course, may also have come in from some action below. That carbon dioxide has not been reduced to the monoxide seems to me to indicate that the temperature has never been sufficiently high to cause this reduction.

"Such results as I obtained are inherently involved in volcanic and other high temperature phenomena, and hence their importance in those fields. There being no carbon monoxide in the gas upon which you report, whereas methane is particularly high, it seems to me that the set-up is different, and the gases primarily have resulted from low-temperature reactions probably in large part involving organic material. I think that, if this difference be kept clearly in mind, you will find the results not inharmonious.

"I know that there are various occurrences of methane and carbon dioxide, with perhaps minor amounts of hydrogen also, where the source is presumably the decomposition of organic material. The Dexter gas well in Kansas and various other occurrences in unmetamorphosed Palaeozoic rocks are illustrations. Apparently in your case the peculiarity is the gas coming from intensely metamorphosed rock, but, after all, if that were originally a sediment, and much of the gas could not escape, the results would be somewhat like what you have."

In an earlier letter (March 23, 1932) Professor Chamberlin had stated:—

"In some potash mine near Stassfurt there are blowers of gas of which hydrogen composes 93%. A possible explanation of this might be the reaction between water and ferrous compounds which goes on when the temperature is raised sufficiently. I am wondering whether in the process of metamorphism which developed the slates and phyllites, the temperature might have been raised 100° or 200°, which caused some reaction between water and ferrous compounds. At the same time, a slight rise in temperature would break up organic matter, giving rise to methane. Some of these gases would then remain within the rocks until tapped by boring."

In granting permission for the publication of these quotations from his letters, Professor Chamberlin, on December 15, 1932, made further suggestions in the following terms:—

"The only later suggestion which occurs to me is the possibility that all the gas has not come from the same source. The presence of methane and ethylene seems to me to suggest organic origin, but the high proportion of hydrogen rather suggests that it has come from inorganic sources. So as a wild guess the methane has come from ancient sediments, whereas the hydrogen may have come from a magmatic source or from a high-temperature chemical reaction between ferrous iron and water.

"It would seem to me possible for the hydrogen to have moved upward and to have become mixed with the methane somewhat closer to the surface. This is highly speculative, but after all it seems to me not impossible. If so, there probably was not much carbonate or carbon dioxide involved in the lower depth, otherwise I should be inclined to expect carbon monoxide in the gases. Of course, some carbon dioxide could be taken up in carbonation of rock materials, and hence the small amount found."

Before leaving the subject, it should be remarked that no examination has been made of the residual nitrogen to ascertain whether helium is present. There are no data, therefore, for the consideration of a radio-active origin for any of the gas.

If we are right in assuming an organic origin for some at least of the gas, the interesting question arises as to the possibility of the survival of this gaseous matter in the occluded state in rocks that have lost by metamorphism all other traces of their organic content.

These facts of occurrence and composition, and these questions of origin are brought forward in the hope that others may assist to clear up a rather puzzling mystery that shows already signs of wide distribution in space and perhaps in time. One cannot expect that similar phenomena will be observed where the hole is a dry one, or where an artesian flow exists to carry off the gas as fast as it is liberated from the rock broken up by the drill. But it seems reasonable to expect that other similar occurrences will be noted by observant drillers where a considerable depth of water stands in the holes, if they watch carefully for effervescence in the water and sludge raised to the surface.

A PRELIMINARY ACCOUNT OF THE COLLEMBOLA-ARTHROPLEONA OF AUSTRALIA

BY H. WOMERSLEY, A.L.S., F.R.E.S.

Summary

That the Collembola as a whole, and this superfamily in particular, has received very little attention from entomologists in Australia is doubtlessly due to their small size and to the supposed lack of economic importance. Most of the species recorded and described in this paper were collected by the writer while working in Western Australia as an officer of the Commonwealth Council for Scientific and Industrial Research.

A PRELIMINARY ACCOUNT OF THE COLLEMBOLA-ARTHROPLEONA OF AUSTRALIA.

By H. Womersley, A.L.S., F.R.E.S. (Entomologist, South Australian Museum).

PART I.—SUPERFAMILY PODUROIDEA.

[Read June 8, 1933.]

That the Collembola as a whole, and this superfamily in particular, has received very little attention from entomologists in Australia is doubtlessly due to their small size and to the supposed lack of economic importance.

Most of the species recorded and described in this paper were collected by the writer while working in Western Australia as an officer of the Commonwealth Council for Scientific and Industrial Research.

In addition, very great help and encouragement have been received from Dr. R. J. Tillyard and other friends who have collected material in other States and forwarded it for identification and study. To all these the writer tenders his deepest thanks. All such records are acknowledged by placing the collector's initials after the particular record.

Three species of this superfamily were described in 1899 by Sir J. Lubbock as from Tasmania (168). His names for these were *Anoura tasmaniae, A. dendyi,* and *A. spinosa.* In 1906, Börner placed the last two species in new genera and left the first in the genus *Achorutes* Temp., which had replaced *Anoura.* Börner's names for the first two species were *Acanthanura dendyi* and *Holacanthella spinosa* (38). In 1925, Dr. G. H. Carpenter (Mem. & Proc. Manchester Lit. and Phil. Soc., vol. lxix.), while describing some Collembola from New Zealand showed that Lubbock's species had been erroneously recorded from Tasmania, and that they had been found in New Zealand.

The first authentic record, then, of species of Collembola belonging to this superfamily occurring in Australia would appear to be that of J. W. Rainbow (198) in 1907. In that paper the author described two new species, *Achorutes speciosus* and *Isotoma troglodytica,* from New South Wales. Through the courtesy of the Curator of the Australian Museum at Sydney, the writer has been able to examine the type slides of Rainbow's material, and it is now shown that these two species are synonymous with earlier known European species, namely *Xenylla mucronata* Axelson and *Proisotoma minuta* (Tullberg). The second species belongs to the superfamily Entomobryoidea, and will be dealt with in a later paper.

In 1917, Schött (226), in his paper on the Collembola collected in Australia by the Mjöberg Swedish Expedition of 1910-13, recorded only the following five species:—*Hypogastrura armata* (Nicolet), *Pseudachorutes incertus* Schött, *Ceratrimeria maxima* (Schött), *Achorutes rosaceus* Schött, *Achorutes cirratus* Schött.

In this paper further records are given for four of Schött's species as well as *Xenylla mucronata;* in addition 24 species are added to the list, making a total of 30 species of Poduroidea now known to occur in Australia. The full list is as follows:—**Hypogastrura armata* (Nicolet); **H. manubrialis* (Tullberg); **H. manuubrialis* var. *neglectus* Börner; **H. purpurascens* (Lubb.); **H. pseudo-purpurascens* Womersley; **Xenylla maritima* Tullberg; **X. grisea* Axelson; *X. littoralis,* n. sp; *X. occidentalis,* n. sp.; **X. mucronata* Axelson; **Friesia mirabilis* (Tullberg); *Ceratrimeria maxima* (Schött); **Odontella lamellifera*

(Axelson); *Pseudachorutes incertus* Schött; **P. rhaeticus* (Carl); **Brachystomella parvula* (Schäffer); *B. fungicola*, n. sp.; *B. afurcata*, n. sp.; *B. acantha*, n. sp.; *B. anomala*, n. sp.; **Anurida granaria* (Nicolet); *Neachorutes glauerti*, n. gen., n. sp.; *Achorutes rosaceus* Schött; *A. cirratus* Schött; *A. hirtellus* Börner; *A. newmani*, n. sp.; **Onychiurus fimetarius* (Linn., Lubbock); **O. ambulans* (Linn., Tullberg); **O. armatus* Tullberg; *Tullbergia trisetosa* (Schäffer); *T. australis*, n. sp. Of this number nine species and one genus are new to science, and no fewer than 15 species and one variety are well-known European forms. The latter are marked by an asterisk.

Economic Importance of the Poduroidea.

Although considerable attention is being focussed on the economic importance of certain Collembola belonging to the family Sminthuridae, little notice appears to have been taken of the species discussed in this paper.

The attention of economic entomologists was first directed to the Collembola by Dr. G. H. Carpenter (68) in 1905, when he recorded *Hypogastrura (Achorutes) armata* (Nicolet) and *Onychiurus (Lipura) ambulans* (Linn., Lubbock) as attacking bean seeds, and *H. (A.) armata* and *H. (A.) longispina* (Tullberg) as occurring on fruit lying on the ground.

In 1911, before the First International Congress of Entomology, held at Brussels, F. V. Theobald (241) surveyed the recorded instances of damage due to species of Collembola. He enumerated 23 species, of which 20 are at present regarded as valid, the remainder being synonyms. Representatives of the Poduroidea in Theobald's list number eight, five of which occur in Australia. These species are:—*Hypogastrura (Achorutes) armata* (Nicolet), *H. (A.) manubrialis* (Tullberg), *H. (A.) longispina* (Tullberg), *H. (A.) purpurascens* (Lubbock), *H. (A.) rufescens* (Nicolet), *Onychiurus (Lipura) armata* (Tullberg), *O. (L.) ambulans* (Linn., Tullberg), *O. (L.) fimetarius* (Linn., Lubbock), *Kalaphorura (Lipura) burmeisteri* (Lubbock).

In addition he gave the following personal observations of damage by these small insects:—1. *H. (A.) purpurascens* (Lubbock) on cabbages; 2. *H. (A.) rufescens* (Nicolet) damaging mushrooms; 3. *O. (L.) ambulans* (Linn., Tullberg) attacking celery, cauliflower, sea kale and asparagus; 4. *O. (L.) fimetarius* (Linn. Lubbock) attacking strawberry plants.

In 1906 W. E. Collinge (82) recorded *O. (L.) ambulans* on bulbs damaged by eel-worm, and *H. (A.) armata* from nursery gardens in Birmingham, England In his "Manual of Injurious Insects" (82) the same author proves that Collembola are often the primary cause of injury to orchids, bulbs, beans, peas, and fruit trees, the resultant injuries allowing the access of fungal spores, thus leading to subsequent decomposition of the plant tissues. Recently three species of *Onychiurus* have been described from Japan by J. Matsumota and T. Satto (177) as occurring on and damaging wheat.

Apart from feeding on foliage and decaying organic matter, the members of this superfamily of Collembola are often found inhabiting the gills of various fungi, and in microscopic mounts the intestines are often found to contain fungal spores. From this it follows that even if the initial damage caused by these insects is not of itself great, yet they may readily be the cause of more serious and extensive harm.

In addition, while many of the species are essentially soil feeders, they will also attack the young roots and rootlets of plants. If present in large numbers, as they often are, this may lead to serious harm and even death of the plants.

On the other hand, at least one species, *Hypogastrura viatica* (Tullberg) has been shown to be of considerable industrial use (29). It can be used to clean automatically the top of sewage filter beds from the growths of algae, which otherwise interfere with the proper working and necessitate periodical stoppage for its removal.

While the recorded cases of damage by this group of Collembola may be considered as slight, it must always be kept in mind that those species which are now shown to occur in Australia, probably as introductions, may, under the more suitable climatic conditions, become major pests and cause extensive and widespread damage as in the case of the Clover Springtail.

Collembola-Arthropleona Börner, 1901.

This suborder of the Collembola, which comprises all those forms with elongate bodies, has been divided by Börner (44) into two superfamilies which he calls Entomobryomorpha and Poduromorpha. As these names are decidedly cumbersome, it would seem better to follow the suggestion of Dr. R. J. Tillyard and adopt the customary superfamily ending "oidea."

The two families are separated thus:—

1. (2) Prothorax free, similar to the other thoracic segments, furnished with hairs, not hidden under mesothorax. Cuticle mostly granular, in some cases with pseudocelli. Antennae short, 4-segmented.
 Superfamily Poduroidea
 = Poduromorpha Börner, 1913

2. (1) Prothorax not haired, more or less hidden under mesothorax. Cuticle smooth, haired or scaled. Antennae long, 4-6-segmented.
 Superfamily Entomobryoidea
 = Entomobryomorpha Börner, 1913

Superfamily PODUROIDEA.

Family HYPOGASTRURIDAE Börner, 1913.

Syn.=Achorutini Börner, 1901 (ad partem); *Achorutinae* Börner, 1901 (ad partem); *Hypogastrurinae* Börner, 1906.

Genus Hypogastrura Bourlet, 1839; Börner, 1906.

Syn.=Podura Linne, 1746 (ad partem); *Achorutes* Templeton, 1835 (ad partem); *Hypogastrura* Bourlet, 1839; *Achorutes* Tullberg, 1872; *Schöttella* Schäffer, 1896.

Subgenus Hypogastrura s. str. Börner, 1906; Linnaniemi, 1912.

Syn.=Achorutes Schäffer, 1896 (ad partem); *Achorutes* Börner, 1901 (ad partem); *Hypogastrura* s. str. Börner, 1906 (ad partem).

Hypogastrura armata (Nicolet).

(Text fig. 1, *a-c*.)

Podura armata Nicolet, 1841; *Achorutes armatus* Tullberg, 1871; *Achorutes boletivorus* Packard, 1873; *Achorutes texensis* Packard, 1873; *Achorutes pratorum* Packard, 1873; *Achorutes marmoratus* Packard, 1873; *Achorutes filiformis* Wahlgren, 1906; *Hypogastrura armata* (Axelson) Linnaniemi, 1911.

Description—Length, 1·5-2·0 mm., with moderately long dorsal setae, often serrated. Ocelli, eight on each side on black patches. Postantennal organ with four unequal peripheral lobes. Antennae shorter than head. An exsertile sac between third and fourth antennal segments. Fourth antennal segment with 7 olfactory hairs and an apical knob. Claws slender, with inner tooth near the middle and a lateral outer tooth. Empodial appendage with basal lamella and apical spine which often reaches tip of claw. One long tibio-tarsal hair present, which is not clavate. Dens twice as long as mucro. Mucro apically rounded, outer lamella with deep incision and tooth-like lobe. Anal spines longer than

Fig. 1.

a. *Hypogastrura armata* (Nicolet). Claw and tip of tibiotarsus.
b. „ „ „ Mucro from side.
c. „ „ „ Antennae III. and IV.
d. „ *manubrialis* (Tullberg). Mucro and dens from side.
e. „ „ „ Claw and tip of tibiotarsus.
f. „ *pseudopurpurascens* Womersley. Claw and tip of tibiotarsus.
g. *Xenylla maritima* Tullberg. Furca from side.
h. „ „ „ Anal segment.
i. „ *grisea* Axelson. Antennae IV. and apex of III.
j. „ „ „ Anal segment from above.
k. „ „ „ Furca from side.

claws, narrow, curved and placed on papillae which touch at their base. Colour variable, from brownish to blackish.

Three varieties of this species are recognised and can be separated by the following key:—

1. (4) Anal spines present.
2. (3) Bristle of empodial appendage reaching beyond tip of claw and apically bent.—*H. armata* var. *cuspidata* Axelson.
3. (2) Bristle of empodial appendage straight and only reaching tip of claw.—*H. armata* (Nicolet) *forma principalis.*
4. (1) Anal spines absent.—*H. armata* var. *inermis* Axelson.

This almost cosmopolitan species was first recorded from Australia in its typical form by Schött in 1917 (226). This form is, however, generally widely distributed, and the writer has seen specimens from the following localities:—Adelaide, S. Aust. (no date, in S.A. Museum collection); Urrbrae, Adelaide, S. Aust., October, 1929 (Waite Institute); Perth, W. Aust., October 4, 1930; Guildford, W. Aust., October 6, 1930; Albany, W. Aust., October 17, 1930; Claremont, W. Aust., December 19, 1930; Belgrave, Vict., April 19, 1931 (H. F. D.); Sherbrook, Vict., April 19, 1931 (H. G. A. & H. F. D.); Studley Park, Vict., August, 1931 (H. G. A.); Pinjarra, W. Aust., September 29, 1931 (D. C. S.).

Var. Inermis Axelson.

Studley Park, Vict., August 1931 (H. G. A.); Woodside, S. Aust., July, 1933 (H. W.).

Hypogastrura manubrialis (Tullberg), 1869.

(Text fig. 1, *d-e.*)

Achorutes manubrialis Tullberg, 1869; *Achorutes Schötti* Reuter, 1895; *Achorutes assimilis* Krausbauer, 1898; *Achorutes neglectus* Börner, 1901.

Description.—Length to 1·5 mm. Colour blackish-brown to grey-blue, mottled. Hairs short curved. Antennae shorter than head. Antennae IV. with 4 olfactory hairs. No eversible sack between antennae III. and IV. Postantennal organ with five peripheral lobes. Claw without inner tooth, with basal lateral tooth. Empodial appendage filiform, with basal lamella. Tibiotarsal tenent hair only indistinctly clavate. Mucro two-thirds as long as dens. Dens ventrally tuberculate. Mucro narrow, with simple or curved apex and simple lamella. Anal spines very small, on separated papillae.

The following varieties are recognised:—

1. (4) With anal spines and papillae.
2. (3) Mucro long and pointed with very narrow lamella. Blackish-brown.—*H. manubrialis* (Tullberg) *forma principalis.*
3. (2) Mucro broad with broader lamella.—Var. *assimilis* (Krausbauer).
4. (1) No anal spines or papillae.—Var. *neglectus* (Börner).

Localities.—*Forma principalis*: South Perth, W. Aust., June 28, 1928 (K. C. R.); Perth, W. Aust., August, 1931; Urrbrae, Adelaide, S. Aust., July, 1930 (Waite Institute). Var. *neglectus* (Börner): Adelaide, S. Aust. (in S.A. Museum collection, without date).

Hypogastrura purpurascens (Lubbock), 1868.

Hypogastrura purpurascens Linnaniemi, 1912 (ad partem).

Description.—Length, 2·0 mm. Colour very variable but mostly blue-black. Hairs short and sparse. Ocelli, 8 on each side on dark patches. Postantennal organ with 4-5 peripheral lobes and central boss. Antennae IV. with olfactory hairs. No eversible sac between antennae III. and IV. Claw with subapical inner tooth. Empodial appendage with broad inner lamella. Tibiotarsus with 2-3 clavate hairs in a transverse row. Furca with apical hook and distinct narrow lamella to the mucro. Anal spines small, curved, one-fourth as long as hind claw and on rather long papillae.

In the S.A. Museum is a tube of specimens of this species taken in Adelaide, but without data.

Hypogastrura pseudopurpurascens Womersley.

(Text fig. 1, *f*.)

Hypogastrura purpurascens Linnaniemi 1912 (ad partem).

This species was separated from the European *H. purpurascens* Lubbock (265) on the relative disposition of the clavate tibiotarsal hairs, colour, and habitat. In Lubbock's species the clavate tibiotarsal hairs are placed in a transverse line, whereas in this species the lateral hairs are twice as far from the apex as the medial one. The insects are usually of a brownish mottled colour and do not appear to assume the blue-black of typical *purpurascens*. In habitat it appears to be confined to the crevices of rotten bark rather than to damp walls. In his valuable monograph Linnaniemi (158) alludes to this difference in the arrangement of the tibiotarsal hairs, but has apparently not appreciated its importance.

Australian localities for this species are:—Bridgetown, W. Aust., November 3, 1930; Belgrave, Vict., April 19, 1931 (F. H. D.); Sherbrook, Vict., April 19, 1931 (H. G. A.).

Genus Xenylla Tullberg, 1869.

Xenylla maritima Tullberg, 1869.

(Text fig. 1, *g-h*.)

Xenylla brevicauda Reuter, 1895.

Description.—Length, 1·5 mm. Colour, grey-blue to black. Antennae shorter than head, IV. with 3-4 olfactory hairs. Claws without inner teeth. Clavate hairs on tibiotarsi 1 to 2. Mucro fused to dens, with apical hook and narrow lamella. Anal spines small on broad adjacent papillae. Ocelli, 5 on each side. Clothing sparse, of curved, seldom serrated hairs.

This is a well-known European species which has not previously been recorded from Australia. The writer has seen specimens from the following:—Perth, W. Aust., November 24, 1930; same, May 23, 1931; Studley Park, Vict., August, 1931 (H. G. A.); Denmark, W. Aust., October, 1931.

Xenylla grisea Axelson, 1900.

(Text fig. 1, *i-k*.)

? *Xenylla gracilis* Guthrie, 1903.

Description.—Length, 1·2 mm. Colour, grey; seldom bluish. Hairs long and outstanding. Cuticle granular. Antennae two-thirds as long as head, IV. with 4-5 olfactory hairs. Claw toothless. Tibiotarsus with 2 clavate hairs. Furca short and strong. Mucro with broad inner lamella and curved hook-like apex. Anal spines 2, large, on adjacent papillae.

This is a well-known European species. It occurred on decaying bulbs at Claremont, W. Aust., March 3, 1931.

Xenylla littoralis, n. sp.

(Text fig. 2, *a-f*.)

Description.—Length, 1·4 mm. Colour, dark brownish to blue-black. Antennae three-fourths as long as head, ratio of segments I. : II. : III. : IV. =

20 : 20 : 20 : 20, IV. with approximately 4 olfactory hairs, III. with the usual form of sensory organ. Ocelli, 5 on each side on black patches. Postantennal organ absent. Claw with strong inner tooth just beyond the middle. Empodial appendage absent. Tibiotarsus with 2 clavate hairs reaching tip of claw. Furca long, mucro distinctly separated from dens, tapering to a fine point and with narrow entire inner lamella, mucro slightly longer than dens. Dens with two inner setae. Anal spines minute, on papillae of their own length, bases of papillae not touching. Ratio of mucrodens : tibia III. : claw III. = 5 : $3\frac{1}{4}$: 2. Clothing of fairly numerous short setae, slightly longer analwards.

This species appears to be of truly littoral habitat. It occurs under stones between high and low tide marks along the coast along with *Neachorutes*

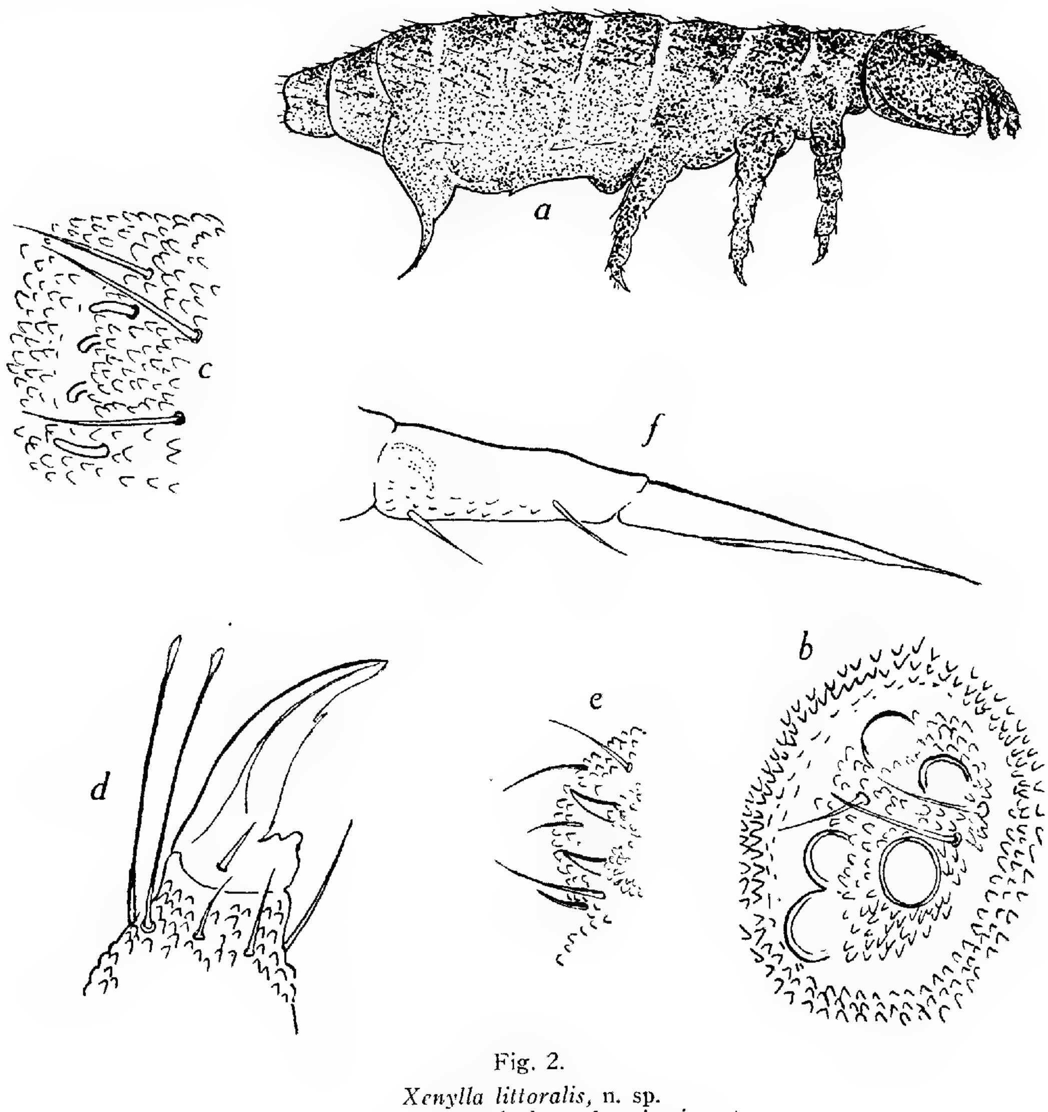


Fig. 2.

Xenylla littoralis, n. sp.

a. Lateral view of entire insect.
b. Ocellar field.
c. Sensory organ on antennae III.
d. Claw and tip of tibiotarsus.
e. Anal spines.
f. Furca from side.

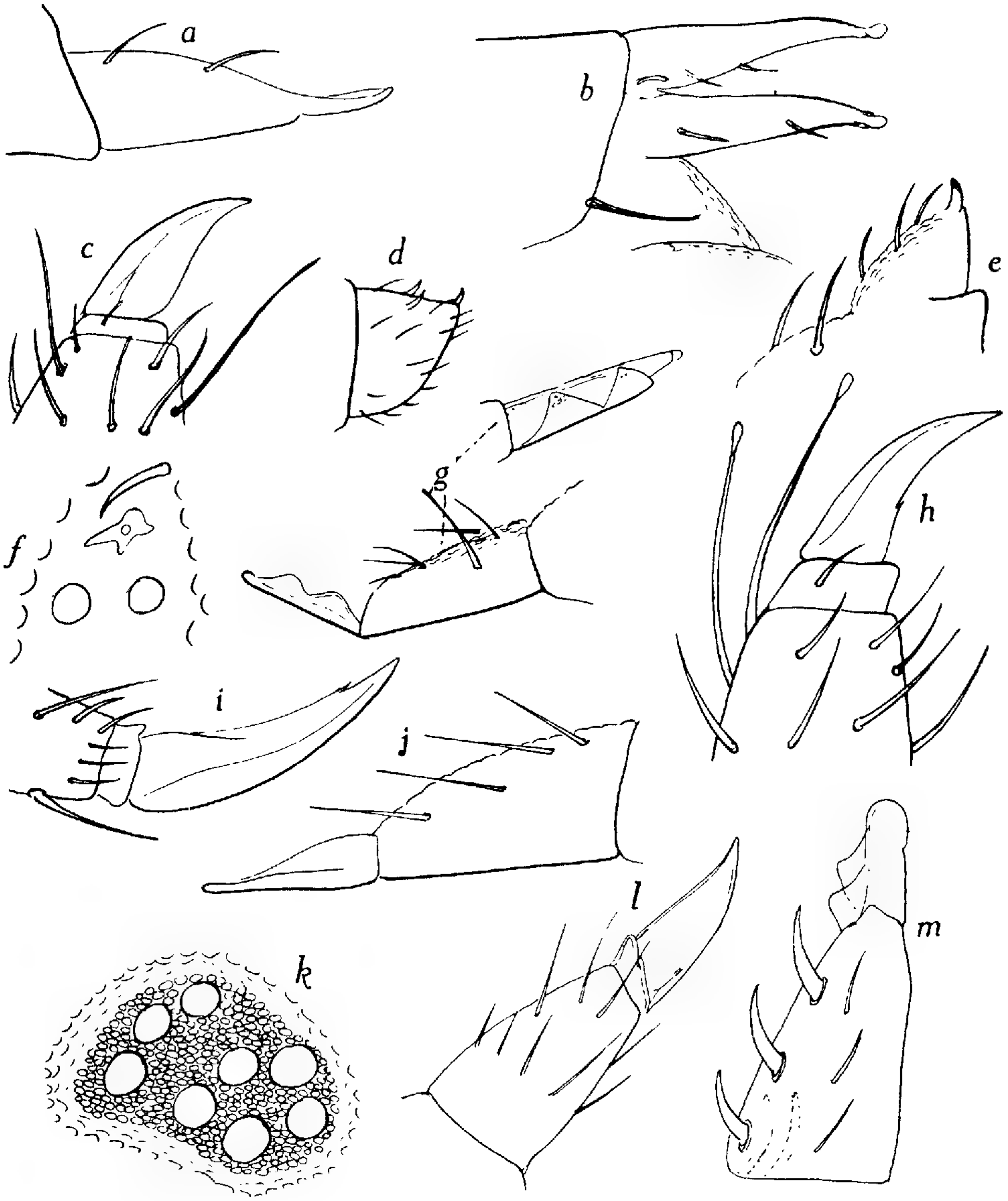


Fig. 3.

a. *Xenylla mucronata* Axelson. Mucrodens from side.
b. „ *occidentalis*, n. sp. Furca.
c. *Friesea mirabilis* (Tullberg). Claw and tip of tibiotarsus.
d. „ „ „ Anal segment from side.
e. „ „ „ Furca from side.
f. *Odontella lamellifera* Axelson. Anterior ocelli and postantennal organ.
g. „ „ „ Furca from side and another view of mucro.
h. „ „ „ Claw and tip of tibiotarsus.
i. *Pseudachorutes rhaeticus* Carl. Claw and tip of tibiotarsus.
j. „ „ „ Furca from side.
k. *Brachystomella acantha*, n. sp. Ocellar field.
l. „ „ „ „ Tibiotarsus and claw.
m. „ „ „ „ Mucro and dens from side.

glauerti, n. sp., and *Axelsonia littoralis* Moniez. It was first obtained by Mr. L. J. Glauert from Rottnest Island, Western Australia. Its nearest allies appear to be *X. longicauda* Fols. from Japan and *X. orientalis* Handschin from the Dutch Indies. From the first it differs in the presence of an inner tooth to the claw and in having anal spines. From the latter the form of the mucro is distinct.

Localities.—Rottnest Island, W. Aust., January 31, 1931 (L. J. G.); Christy's Beach, Port Noarlunga, S. Aust., January 17, 1932 (D. C. S.).

XENYLLA MUCRONATA Axelson, 1903.

(Text fig. 3, *a.*)

Achorutes speciosus Rainbow, 1907.

Description.—Length, 1·3 mm. Colour, bluish. Claws small, with small inner tooth. Furca narrow, mucro separated from dens.

Through the kindness of the Curator of the Australian Museum, Sydney, the writer has been able to examine the type slide of Rainbow's species. This has revealed the fact that *speciosus* Rainbow is but a synonym of *mucronata*. The statement by Rainbow that the eyes in his species number eight on each side is erroneous. Actually there are only five, which is the normal number for the genus *Xenylla*. Possibly the dark pigmentation of the eye-patch misled him. The absence of the empodial appendage also confirms it as a *Xenylla*.

Localities.—Bathurst, N.S.W., 1907 (Rainbow); You Yang Mountains, Vict., September 24, 1931 (Miss J. W. R.); Kenwick, W. Aust., April 4, 1932 (H. W.).

Xenylla occidentalis, n. sp.

(Text fig. 3, *b.*)

Description.—Length, 0·6 mm. Colour, dark brownish. Antennae rather more than half as long as head, ratio of segments I. : II. : III. : IV. = 7 : 7 : 9 : 11, IV. with at least 4-5 olfactory hairs, sensory organ on ant. III. probably normal but indeterminate. Ocelli, 5 on each side on dark patches. Postantennal organ absent. Claws apparently without inner teeth. Empodial appendage absent. Two clavate tibiotarsal hairs. Furca strong, mucro short only about one-fifth the length of dentes, with broad lobe-like appearance, dens with two inner setae. Anal spines very minute, scarcely more than enlarged granulations of the cuticle. Tenaculum with 3 barbs. Mucro four times as long as hind claw.

This species is very distinctive in the structure of the mucro and cannot be confused with any other described species. It has been taken as follows:—Red Hill, W. Aust., August 27, 1931, in fungus (D. C. S.); Kalamunda, W. Aust., May 30, 1931, in fungus (D. C. S.).

Genus FRIESEA Dalla Torre, 1895.

Syn. = *Triacna* Tullberg, 1871; *Macgillivraya* Grote, 1894.

FRIESEA MIRABILIS (Tullberg), 1871.

(Text fig. 3, *c-e.*)

Triaena mirabilis Tullberg, 1871.

Description.—Length, 1·0 mm. Colour, grey-blue, mottled. Antennae shorter than head, IV. with 4-5 olfactory hairs. Claws toothless. Empodial appendage present, without terminal seta. No clavate tibiotarsal hairs. Furca very small, mucro represented only by a hook. Anal spines three, occasionally four, on small papillae. Body hairs not clavate.

A single specimen of this European species was found along with *Xenylla grisea* Axelson, on decaying bulbs at Claremont, W. Aust., March 19, 1931.

Several specimens, including one of the form *quadrispina* Axelson with four anal spines, were taken in garden soil by means of the Berlese funnel at Glen Osmond, South Australia, March, 1933.

Genus Ceratrimeria Börner, 1906.

Ceratrimeria maxima (Schött).

Schöttella maxima Schött, 1901.

Description.—Length, 2·5 mm. Colour, grey-blue with light stripes, ventral surface whitish. Body stumpy, segments dorsally with prominent pleural areas. Antennae short, segments III. and IV. indistinctly separated, IV. with trilobed terminal organ. Ocelli, 8 on each side. Postantennal organ half elliptical with about 30 tubercles. Mouth parts suctorial. Integument with hexagonal areas. Claws broad with lateral lamellae, with large lateral teeth. Empodial appendage absent. Anal spines absent.

This interesting species was recorded from Queensland by Schött (226) in 1917. The writer has had specimens from Belgrave, Vict., April 19, 1931 (H. F. D. & H. G. A.); Sherbrook Falls, Vict., April 19, 1931 (H. G. A.).

Genus Odontella Schäffer, 1897.

Syn. = *Xenyllodes* Axelson, 1903 (ad partem).

Odontella lamellifera Axelson, 1903.

(Text fig. 3, *f-h.*)

Xenyllodes lamellifera Axelson, 1903; *Odontella suecia* Wahlgren, 1906.

Description.—Length, 1·3 mm. Colour, blue-grey with distinct mottlings, skin richly tuberculate. Hairs short and sparse. Antennae shorter than head, segment IV. with curved olfactory hairs. Ocelli, 5 on each side. Postantennal organ with 4 peripheral lobes in a groove. Claw toothless. Tibiotarsi with two simple spur hairs. Mucro equal to dens in length, with two characteristic lobes on inner lamella. Anal horns about equal in size to the cuticular granules, two in number.

This is a rare species, hitherto known only from Northern Europe. It is, therefore, of much interest that it should be found in Australia. It was obtained from the following localities by means of the Berlese funnel:—Sherbrook Falls, Vict., April 19, 1931 (H. G. A.); Belgrave, Vict., April 19, 1931 (H. F. D.).

Genus Pseudachorutes Tullberg, 1871.

Syn. = *Schöttella* Schäffer, 1896 (ad partem).

Pseudachorutes rhaeticus (Carl), 1899.

(Text fig. 3, *i-j.*)

Schöttella rhaetica Carl, 1899.

Description.—Length, 1·5-3·0 mm. Colour, dark brown to black. Antennae with trilobed apical knob and 3-4 olfactory hairs on segment IV. Postantennal organ with 12-15 peripheral lobes. Claw toothless, seldom with small inner tooth and lateral tooth. Clavate tibiotarsal hairs and anal horns absent. Dens somewhat swollen and with strong tubercles. Mucro straight dorsally, apex curved, lamella with notched edge. Hairs short and sparse. Mandibles present and needle-like.

This species is markedly distinct from the only true species of this genus known from Australia, namely *P. incertus* Schött. It can now be recorded from the following places:—Parkerville, W. Aust., October 5, 1930 (H. W.); Belgrave, Vict., April 19, 1931 (H. G. A.); Sherbrook, Vict., April 19, 1931 (H. G. A. & H. F. D.); You Yang Mountains, Vict., September 24, 1931 (Miss J. W. R.); Sassafras, Vict., December, 1931 (H. G. A.).

Genus Brachystomella Agren.

Syn. — *Schöttella*, Schäffer, 1896 (ad partem); Schtscherbakow, 1899 (ad partem); Carl, 1901 (ad partem); Schött, 1902 (ad partem). *Brachystomella*, Agren, 1903; Stach, 1929. *Schöttelodes* Becker, 1905. *Chondrachorutes* Wahlgren, 1906; Denis, 1924.

In 1929 Stach (238) restudied the species *Schöttella parvula* Schäffer, as well as all the then known allied species. He went into the position very thoroughly and showed that Schäffer's species belonged to the genus *Brachystomella* of Agren, which differed very definitely from *Pseudachorutes* s. str. in the entire absence

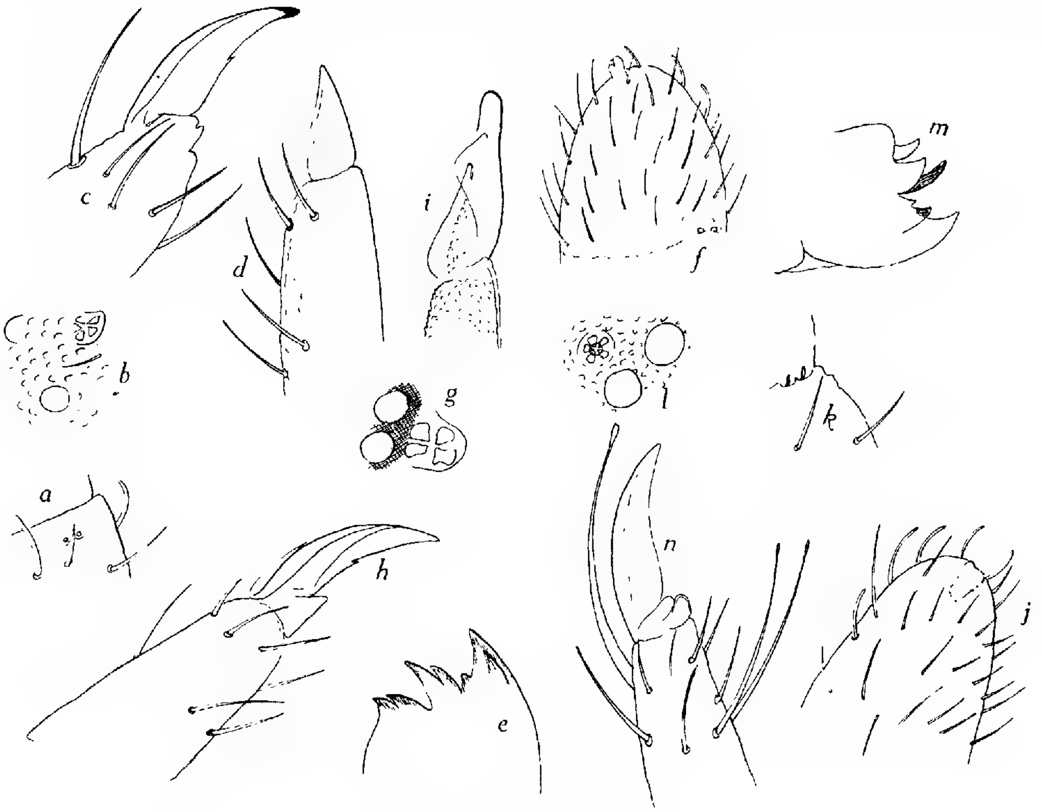


Fig. 4.

a. *Brachystomella parvula* (Schäffer). Sensory organ on antennae III.
b. ,, ,, ,, Anterior ocelli and postant. organ.
c. ,, ,, ,, Claw and tip of tibiotarsus.
d. ,, ,, ,, Mucrodens.
e. ,, *fungicola*, n. sp., Head of maxilla.
f. ,, ,, ,, ,, Antennae IV. and tip of III.
g. ,, ,, ,, ,, Anterior ocelli and postant. organ.
h. ,, ,, ,, ,, Claw and tip of tibiotarsus.
i. ,, ,, ,, ,, Mucro from side.
j. ,, *afurcata* ,, ,, Apex of antennae IV.
k. ,, ,, ,, ,, Sensory organ of antennae III.
l. ,, ,, ,, ,, Anterior ocelli and postant. organ.
m. ,, ,, ,, ,, Head of maxilla.
n. ,, ,, ,, ,, Claw and tip of tibiotarsus.

of mandibles. In the place of these organs, the heads of the maxillae are modified by being strongly toothed.

BRACHYSTOMELLA PARVULA (Schäffer), 1896.

(Text fig. 4, *a-d*.)

Schöttella parvula Schäffer, 1896; *Schöttella media* Axelson, 1900; *Chondrachorutes wahlgreni* Denis, 1924; *Schöttella minor* Schtscherbakow, 1899; *Schöttella albomaculata* Carl, 1901; *? Schöttella crassicornis* Schött, 1902; *? Brachystomella maritima* Agren, 1903.

Description.—Of *Pseudachorutes* build. Length, 1·0 mm. Colour, brownish, mottled. Ocelli, 8 on each side. Postantennal organ with 5-6 peripheral lobes. Tibiotarsi with 2-3 long hairs, not clavate or only indistinctly so. Claws with inner tooth. Mucro short and tapering. Dens with 5-6 setae. Mandibles wanting, maxillae with broad, toothed head.

This European species appears to be common and widely distributed throughout the southern part of Australia. Specimens have been seen from the following localities:—Corney Point, S. Aust., date? (M. Klem); South Perth, W. Aust., June 28, 1926 (K. O. R.); Beverley, W. Aust., October 2, 1930 (H. W.); Nangara, W. Aust., November 11, 1930 (B. A. O'C.); Crawley, W. Aust., May 14, 1931 (H. W.); National Park, W. Aust., September 3, 1931 (D. C. S.); Mandurah, W. Aust., April 29, 1931 (H. W.); Queenwood, Preston Valley, W. Aust., June 12, 1931 (H. W.); Encounter Bay, S. Aust., May, 1929 (J. B. C.); Urrbrae, Adelaide, S. Aust., 1930 (Waite Institute); Studley Park, Vict., August, 1931 (H. G. A.).

Brachystomella afurcata, n. sp.

(Text fig. 4, *j-n*.)

Description.—Length, 1·2 mm. Colour, bluish-black. Antennae slightly shorter than head, ratio of segments I. : II. : III. : IV. = 8 : 8 : 10 : 12, III. and IV. only indistinctly separated, IV. with trilobed apical knob and 4-5 olfactory hairs, antennal organ III. as figured. Ocelli 8 on each side on a dark field. Postantennal organ with 5 peripheral lobes as figured. Mandibles absent, head of maxillae broad and toothed. Claws without teeth. Tibiotarsus with 3 strongly clavate hairs, one subapical and outside, two inside and more proximal. Furca absent. Clothing of sparse but fairly long and fine setae.

This species is closely related to *B. parvula* Schäffer, but differs in the absence of the furca and the strongly clavate tibiotarsal hairs.

Localities.—Beverley, W. Aust., June 4, 1931 (H. W.); Pine Island, Murrumbidgee River, F. C. T., June, 1931 (R. J. T.); Red Hill, W. Aust., August 27, 1931 (D. C. S.).

Brachystomella acantha, n. sp.

(Text fig. 3, *k-m*.)

Description.—Length, 0·9-1·0 mm. Colour, yellowish. Head and antennae bluish, eye patches black. Antennae slightly shorter than the head, ratio of segments I. : II. : III. + IV. = 10 : 10 : 20, IV. with trilobed apical knob, organ on ant. III. indeterminate. Ocelli, 8 on each side on black patches. Postantennal organ wanting. Claws strong without inner teeth. No clavate tibiotarsal hairs. Empodial appendage wanting. Mandibles wanting. Head of maxillae as in genus. Furca small, dens twice as long as mucro with three strong, curved spines on ventral aspect, mucro with inner and outer lamellae with lobes, apex of mucro rounded. Clothing of sparse, short fine hairs. Cuticle finely granular.

This rather small but strikingly distinct species was found in numbers in a species of *Boletus* at Crawley, Western Australia, May, 1931 (D. C. S.) along with *Brachystomella fungicola*, n. sp.

Brachystomella fungicola, n. sp.

(Text fig. 4, *e-i.*)

Description.—Length, to 3·5 mm. Colour, brownish, lighter ventrally. Antennae as long as head, ratio of antennal segments I. : II. : III. : IV. = 30 : 35 : 25 : 35, segments III. and IV. indistinctly separated, IV. with trilobed apical knob and 2 (?) olfactory hairs, III. with organ as figured. Ocelli, 8 on each side on a dark field. Postantennal organ with 4 peripheral lobes. Mandibles wanting, head of maxillae as figured. Tibiotarsi without clavate hairs. Claws strong with inner tooth. Empodial appendage absent. Furca well developed, dens broad and tuberculate and twice as long as mucro, mucro with inner and outer lamellae, basally granular. Cuticle finely granular and clothed with fine and short but sparse hairs.

This species is very distinctive in the structure of the mucro and claws. It has been taken at Mandurah, W. Aust, April 30, 1931; Crawley, W. Aust., May, 1931 (D. C. S.).

Brachystomella anomala, n. sp.

(Text fig. 5, *a-g.*)

Description.—Length, 2·5 mm. Colour, bluish-brown. Antennae slightly shorter than head, ratio of antennal segments I. : II. : III. : IV. = 10 : 10 :

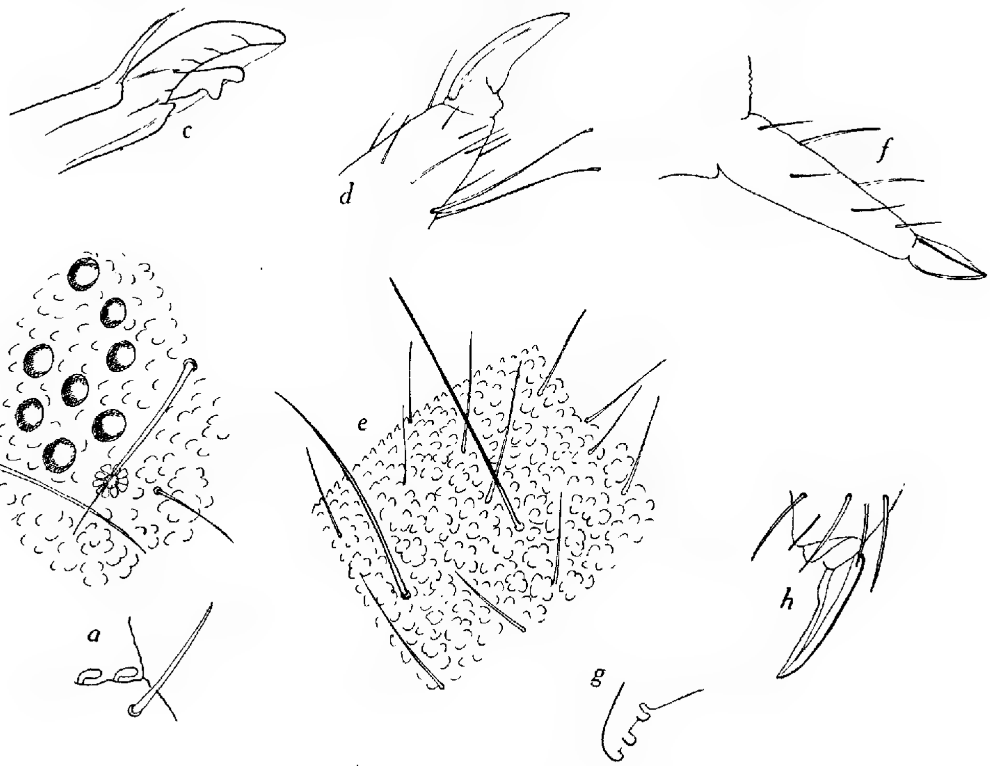


Fig. 5.

a. Brachystomella anomala, n. sp. Sensory organ of antennae III.
b. ,, ,, ,, ,, Ocelli and postantennal organ.
c. ,, ,, ,, ,, Head of maxilla.
d. ,, ,, ,, ,, Tip of tibiotarsus and claw.
e. ,, ,, ,, ,, Dorsal cuticle.
f. ,, ,, ,, ,, Dens and mucro from side.
g. ,, ,, ,, ,, Rami.
h. Anurida granaria (Nicolet). Claw.

10 : 11, IV. with small trilobed apical knob, olfactory hairs (?), organ on antennae III. indeterminate. Ocelli, 8 on each side, not on a pigmented field. Postantennal organ rosette-like, with 12 lobes. Mandibles absent, head of maxillae as in *Anurida* (text fig. 5, *c*). Claws without inner teeth. Empodial appendage absent. Tibiotarsal clavate hairs 2 on inner side, long. Furca well developed, dens granular and about three times as long as the mucro, mucro broad with simple inner lamella. Rami of tenaculum with 3 barbs. Cuticle strongly granular with numerous long, simple setae.

Described from four specimens from the following localities:—Sassafras, Vict., December, 1931 (H. G. A.), 3 specimens; Sherbrook, Vict., April 19, 1931 (H. G. A.), 1 specimen.

It is with considerable doubt that this species is placed in the genus *Brachystomella*. From other species of this genus it differs very definitely in the strongly granular structure of the cuticle, in this respect recalling that of *Anurida granaria* (Nicolet). Mandibles are wanting, but the complex head of the maxilla resembles that of *Anurida* rather than *Brachystomella*. The ocelli are 8 on each side, and not 5 as in *Anurida maritima* Guerin, or absent as in *A. granaria* (Nicolet). The postantennal organ also resembles that of the latter species. The furca is similar in structure to that of *Brachystomella parvula* (Schäffer).

In all probability this species will have to be placed ultimately in a new genus.

Genus Anurida Laboulbene, 1865.

Syn.=*Anoura* Nicolet, 1847 (ad partem); *Aphoromma* MacGillivray, 1893; *Anurida* Schött, 1893.

Anurida granaria (Nicolet), 1847.

(Text fig. 5, *h*.)

Aphoromma granaria MacGillivray, 1893.

Description.—Length, 1·8 mm. White. Ocelli absent. Postantennal organ present, rosette-like with 12-21 lobes. Antennae shorter than head. Antennae IV. with 8 olfactory hairs. Claws toothless. Empodial appendage absent or only represented by a small nodular piece without bristle. Hairs short and sparse. Cuticle with large granules.

This is a typical soil inhabiting species and most probably has been introduced into Australia. It has been found in material from Mount Lofty Ranges, Adelaide, S. Aust., November 17, 1931 (D. C. S.).

Genus **Neachorutes**, n. gen.

Description.—General facies as in *Anurida maritima* Guerin. Antennae 4-segmented, longer than head. Ocelli, 8 on each side on dark field. Postantennal organ absent. Furca long and simple, dens somewhat bowed in the horizontal, mucro small and not distinctly separated from dens. Mandibles present, strongly toothed apically but without molar area. Claws strong. Tibiotarsi without clavate hairs. Male with last abdominal segment strongly produced.

Genotype *Neachorutes glauerti*, n. sp.

Neachorutes glauerti, n. sp.

(Text fig. 6, *a-i*.)

Description.—Length of male, 3·0 mm.; of female, 2·4 mm. Colour, deep bluish-black. Antennae nearly twice as long as head, ratio of segments I. : II. : III. : IV. = 6 : 8 : 12 : 10. Ocelli, 8 on each side on a dark field. Postantennal organ absent. Clavate tibiotarsal hairs absent. Furca very well developed, long and thin, especially the dentes which are slender, parallel-sided and highly granular. Mucro small, less than one-seventh of the length of the dens and with distinct lamella. Rami of tenaculum with 4 barbs. Clothing very sparse except on appendages, on apical antennal segments the setae are twice the width of segments, all setae simple. The adult male differs from the female in that the last abdominal segment is produced in an upturned manner, the prolongation being as long as the basal segment itself. The cuticle richly granular.

This genus and species is of littoral habitat and occurs under stones between high and low water marks. It can withstand immersion in a good depth of water, and is often taken in numbers in the crevices of rocks lying in several feet of water. From its habitat it can possibly be regarded as replacing *Anurida maritima* Guerin of the Northern Hemisphere in the Australian region.

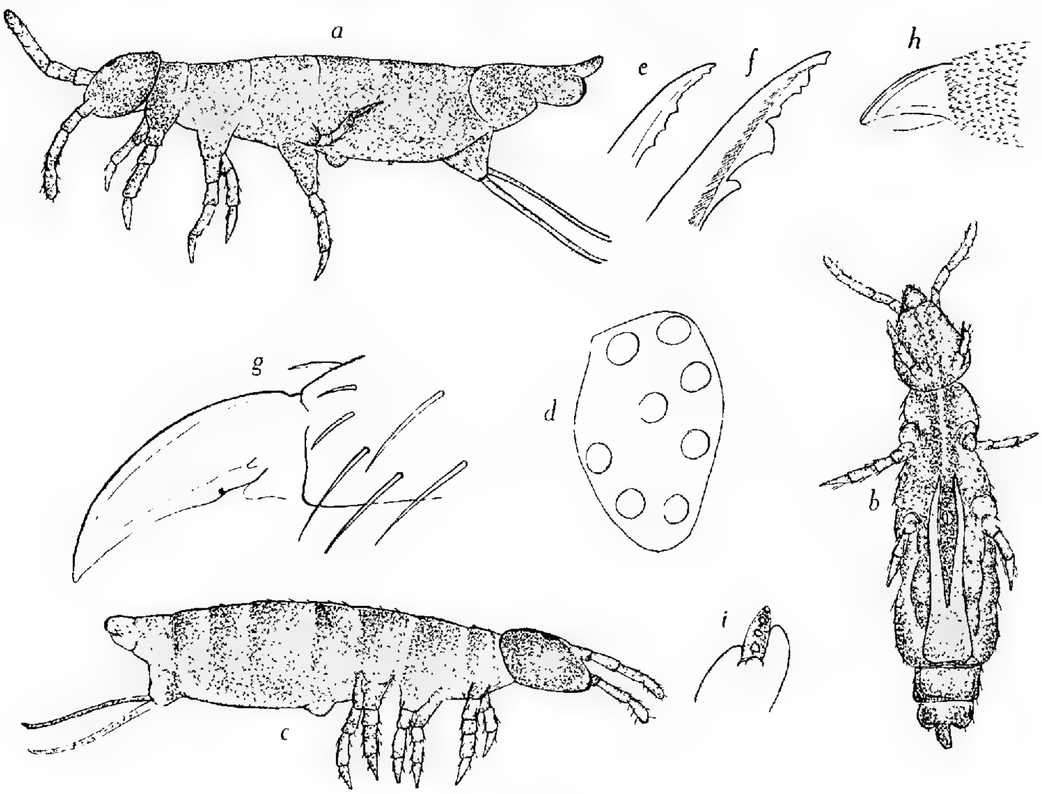


Fig. 6.

Neachorutes glauerti, n. g., n. sp.

a. Male insect, side view.
b. ,, ,, ventral view.
c. Female insect, side view.
d. Ocellar field.
e. Head of maxilla.
f. Head of mandible.
g. Tip of tibiotarsus and claw.
h. Tip of dens and mucro.
i. Rami.

It was first discovered by Mr. L. J. Glauert, of the Perth Museum, on Rottnest Island, Western Australia, in the described habitat, along with another interesting littoral species, *Axelsonia littoralis* (Moniez). The detailed localities are:—Longreach Bay, Rottnest Island, W. Aust., January 3-6, 1930 (L. J. G.); Freshwater Bay, Swan River, W. Aust., February 2, 1930 (Miss Horgan); Point Perron, W. Aust., 1931 (H. W.); Christy's Beach, S. Aust., January 17, 1931 (D. C. S.); Marino, S. Aust., March 24, 1929 (R. H.).

Genus ACHORUTES Templeton, Börner.

Syn.=*Achorutes* Templeton, 1835 (ad partem) ? *Blax* Koch, 1840; *Anoura* Gervais, 1842; *Anura* Tullberg, 1869; *Neanura* MacGillivray, 1893.

ACHORUTES ROSACEUS Schött, 1917.

Description.—Length, 1·5-2·0 mm. Colour, in life, rose; in spirit, white. Facies of typical *Achorutes* form. Cuticle uniformly tuberculate. Ocelli, 2 on each side on edge of head prominence. Postantennal organ absent. Antennae IV. with a trilobed organ. Claw toothless. Dorsal setae strong but simple.

This species was described by Schött from North Queensland in 1917 (226). In Western Australia it seems to be generally abundant and has been taken as follows:—Perth, W. Aust., October 4, 1930; Denmark, W. Aust., October 17, 1930 (H. W.); Margaret River, W. Aust., April 25, 1931 (L. J. N.); Mandurah, W. Aust., April 30, 1931 (H. W.); Mount Lofty Ranges, S. Aust., March 2, 1931 (H. G. A.).

ACHORUTES CIRRATUS Schött, 1917.

Description.—Length, 1·5 mm. Colour, in spirit, white. Cuticle in regular fields and prominences of tubercles. Ocelli, 2 on each side, not pigmented. Postantennal organ wanting. Antennae IV. with an apical trilobed organ. Claws simple. Setae on outstanding prominences of abdomen, large, strongly feathered but not clavate.

This species, also described by Schött from North Queensland, has been since found in the following localities:—Studley Park, Vict., August, 1931 (H. G. A.); You Yang Mountains, Vict., September 24, 1931 (Miss J. R.).

Achorutes newmani, n. sp.

(Text fig. 7, *d-e*.)

Description.—Length, to 3·0 mm. Colour, in life, creamy white. Antennae only half as long as head, segments subequal, IV. with 4 or 5 olfactory hairs, antennal organ III. inconspicuous and indeterminate. Ocelli, 3 on each side, without pigment, one placed sublaterally and subposteriorly on a prominence, the other two not on a prominence, their own diameter apart and four to five times their diameter from the anterior edge of the prominence on which is the other ocellus. The dorsal surface is highly tubercular and shows a number of prominences as is usual in this genus, as follows:—On head, three transverse rows, anterior one of two each with four strong setae, medial row of five, the three middle ones with 3 setae and the outer ones with 4, a posterior row of six, the middle four with 2 setae and the outer ones with 4 setae; thorax I., a row of six, the outer prominences with 1 setae, the others with 2 setae; thorax II., a row of six, outer ones with 4, others with 3 setae; thorax III., row of six as in thorax II; abdomen I., II., and III. with a row of six, median pair with 3 setae, mediolateral pair with 3 strong setae and 1 fine seta, ectolateral with 2 setae; abdomen IV. with row of six, medial pair with 2 setae, mediolateral with 2 strong and 1 fine setae, ectolateral with 3 setae; abdomen V. with row of four, median pair with 3 setae, outer ones with 3 strong and 1 fine setae; abdomen VI. with two prominences, each with 6 setae dorsally. Mouth organs small, needle-like, mandibles present without molar plate. Claws without inner tooth, but basal lateral teeth present, tuberculate almost to tip of claw. Empodial appendage absent. Furca absent. Clothing of the strong, rather blunt and indistinctly ciliated setae as on the prominences.

This species is closely related to *A. zehntneri* Handschin described from Java. It differs in not having the carmine colouration in life of Handschin's species and in the absence of an inner tooth to the claw. The relative disposition of the ocelli is also distinctive. It is named in honour of the Government Entomologist of Western Australia, in whose company the writer was when he first found this species in large numbers under loose bark at Picton Junction, Western Australia, October 10, 1930.

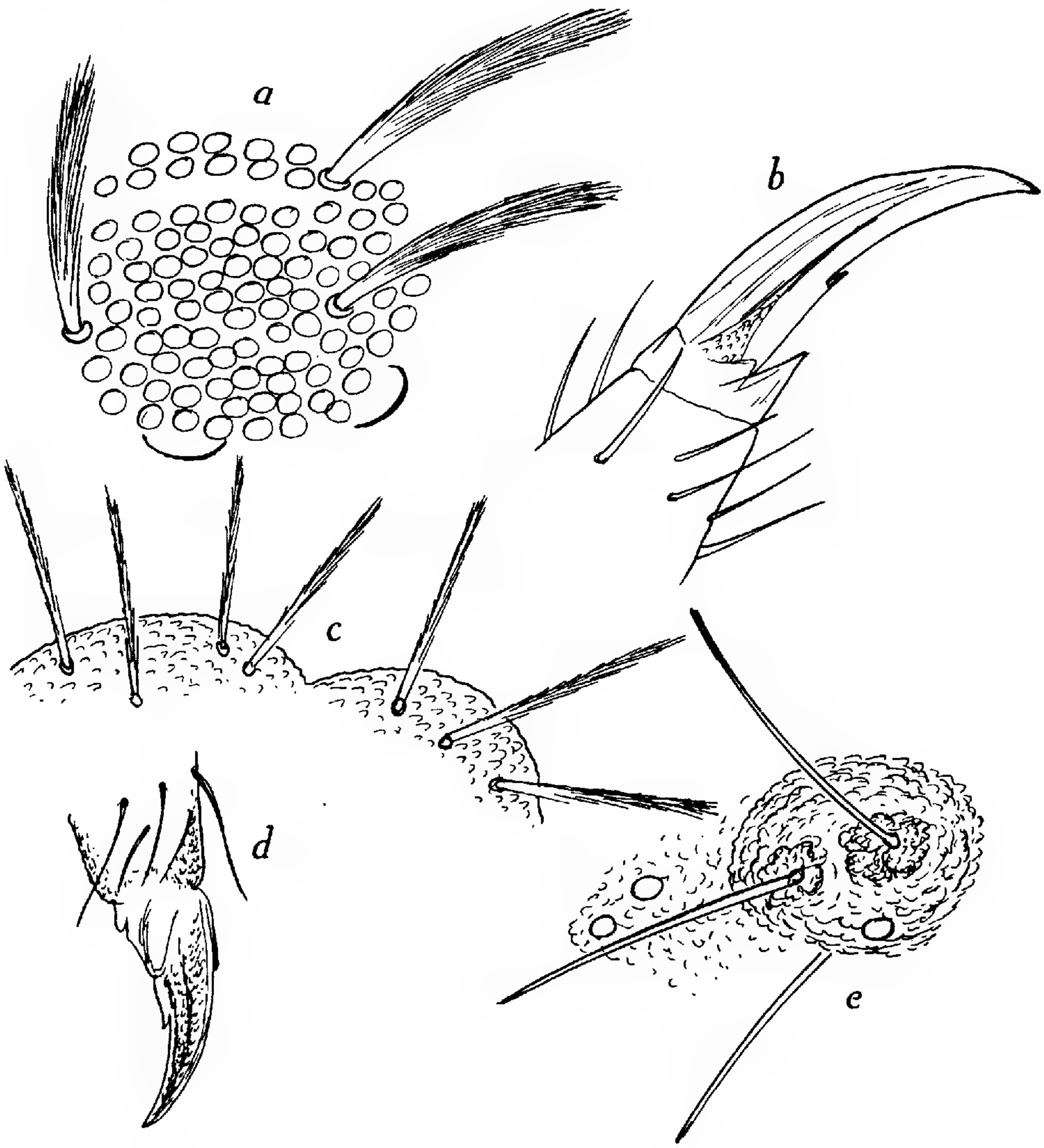


Fig. 7.

a.	*Achorutes hirtellus* Börner.	Ocelli.
b.	,, ,, ,,	Tip of tibiotarsus and claw.
c.	,, ,, ,,	Anal tubercles and setae.
d.	,, *newmani*, n. sp.	Tip of tibiotarsus and claw.
e.	,, ,, ,, ,,	Ocelli.

ACHORUTES HIRTELLUS Börner, 1906.

(Text fig. 7, *a-c*.)

Description.—Length, 2·0 mm. In spirit, as in life, yellowish-white. Claw with ventral tooth. Ocelli, 2 on each side, unpigmented. Dorsal setae long, feathered and strongly clavate.

A single specimen taken at Sherbrook Falls, Victoria, April 19, 1931 (H. G. A.) is somewhat doubtfully referred to this species.

Family ONYCHIURIDAE Börner, 1913.

Syn.=*Aphorurinae* Börner, 1901; *Aphorurini* Börner, 1901; *Onychiurinae* Börner, 1901.

Genus ONYCHIURUS Gervais, 1841; Börner, 1901.

Syn.=*Podura* Linne, 1758 (ad partem); *Lipura* Burmeister, 1838 (ad partem); *Onychiurus* Gervais, 1841, in littoris; *Adicranus* Bourlet, 1843 (ad partem); *Anurophorus* Nicolet, 1841 (ad partem); *Aphorura* MacGillivray, 1893; *Protaphorura* Börner, 1909.

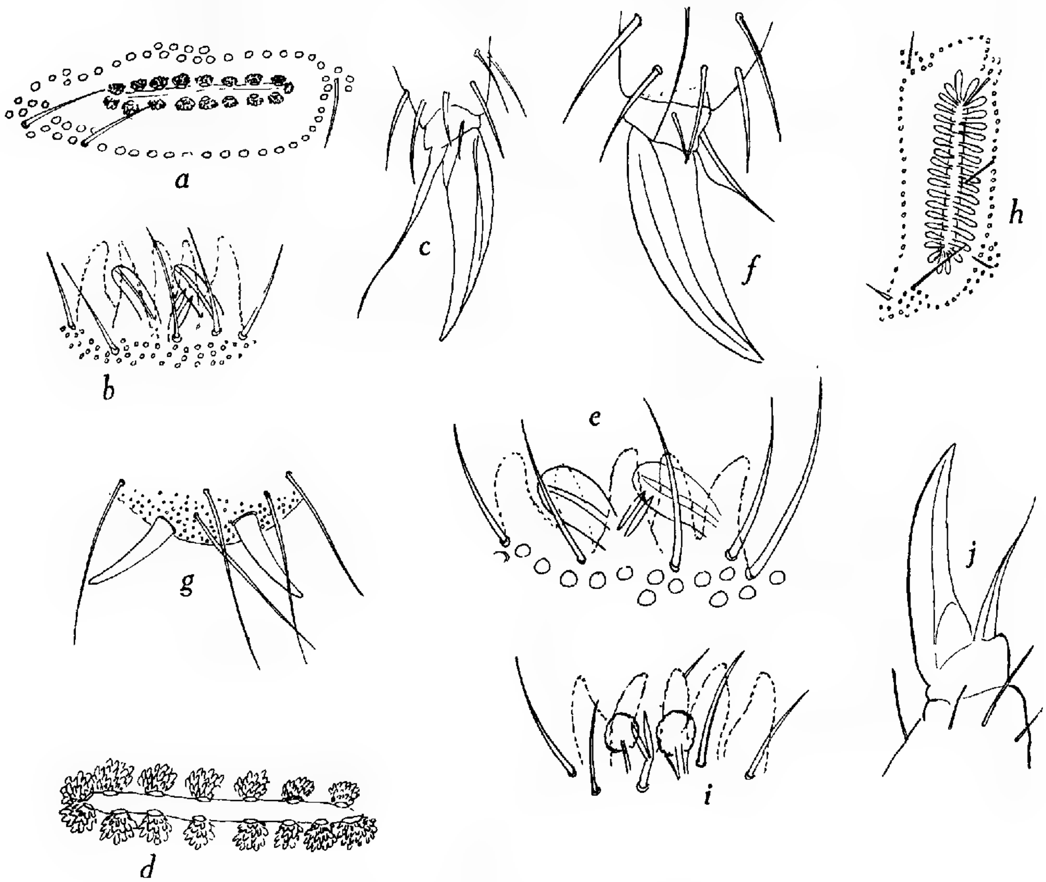


Fig. 8.

a. *Onychiurus fimetarius* (Linn.) Postantennal organ.
b. „ „ „ Antennal sensory organ.
c. „ „ „ Claw and tip of tibiotarsus.
d. „ *ambulans* „ Postantennal organ.
e. „ „ „ Antennal sensory organ.
f. „ „ „ Claw and tip of tibiotarsus.
g. „ „ „ Anal spines.
h. „ *armatus* (Tullberg). Postantennal organ.
i. „ „ „ Antennal sensory organ.
j. „ „ v. *denticulata* Handschin. Claw.

ONYCHIURUS FIMETARIUS (Linne, Lubbock).

(Text fig. 8, *a-c*.)

Podura fimetaria Linne, 1766; *Lipura fimetaria* Lubbock, 1867; *Lipura inermis* Tullberg, 1869; *Lipura wrightii* Carpenter, 1895; *Aphorura inermis* Schäffer, 1896; *Onychiurus pseudofimetarius* Folsom, 1916.

Description.—Length, 1·5-2·0 mm. White. Sensory clubs of antennal organ III, smooth. Postantennal organ with 12-16 clusters of tubercles. Pseudocelli on antennae bases 2, behind 1. Claw toothless, small. Empodial appendage with bristle as long as claw. Anal spines wanting.

This is a common inhabitant of garden soils, and when it occurs in large numbers often does considerable damage. In Australia it has been found as follows:—In hot-houses, Government Gardens, Perth, W. Aust., November 18, 1930; ditto, February 13, 1931 (H. W.); Mount Lofty Ranges, S. Aust., November 7, 1931 (D. C. S.); Glen Osmond, S. Aust., April, 1932 (D. C. S.); on *Cortinarius*, sp., Neutral Bay, N.S.W., 1929 (J. B. C.); in S.A. Museum, without data; in green-house, Adelaide, March, 1933 (H. M. H.).

ONYCHIURUS AMBULANS (Linne, Nicolet).

(Text fig. 8, *d-g*.)

Podura ambulans Linne, 1758 (ad partem); *Anurophorus ambulans* Nicolet, 1847; *Lipura ambulans* Lubbock, 1862; *Aphorura ambulans* MacGillivray, 1862; ? *Aphorura willemi* Börner, 1901.

Description.—Length, 2·0 mm. White. Antennal organ III, with smooth sensory clubs. Postantennal organ with 12-15 granular tubercles. Antennae bases with 2 pseudocelli. Claws toothless. Empodial appendage with basal lamella and bristle. Anal spines present, large and slightly curved, on smaller papillae.

This species is to be found in soil like the preceding one. It is very common in Europe where it exists in two forms, *O. ambulans* (Nicolet) *forma principalis*, with anal spines, and *O. ambulans* var. *inermis* Agren, without anal spines. It occurs commonly in most cultivated soils in the Perth area of Western Australia, but only the typical form has so far been found.

ONYCHIURUS ARMATUS (Tullberg), 1869.

(Text fig. 8, *h-j*.)

Lipura armata Tullberg, 1869; ? *Lipura fimetaria* Dalla Torre, 1888; *Aphorura armata* Reuter, 1898.

Description.—Length, 0·9-2·5 mm. White. Antennal organ III, with sensory clubs like bunches of grapes. Postantennal organ with 16-32 simple tubercles. Claws with or without teeth. Anal spines long, weakly curved, or papillae sometimes absent.

This is another common soil inhabitant in Europe. Owing to its attacking the rootlets of plants and killing them by sheer weight of numbers, it must be regarded as of economic importance. The variety without anal spines, var. *inermis* Agren, has not yet been found in Australia, but both the typical form and the variety *denticulata* Handschin, which has an inner tooth to the claw, have been found as follows:—*Forma principalis:* Government Gardens, Perth, W. Aust., February 2, 1932; in green-house, Adelaide, S. Aust., March, 1933 (H. M. H.). Var. *denticulata* Handschin: Mount Lofty Ranges, S. Aust., October 29, 1931.

Genus Tullbergia Lubbock, 1876.

Syn.=*Stenaphorura* Absolon, 1900; *Mesaphorura* Börner, 1901; *Börneria* Willem, 1902.

Tullbergia trisetosa (Schäffer) Börner.

(Text fig. 9, *a-c*.)

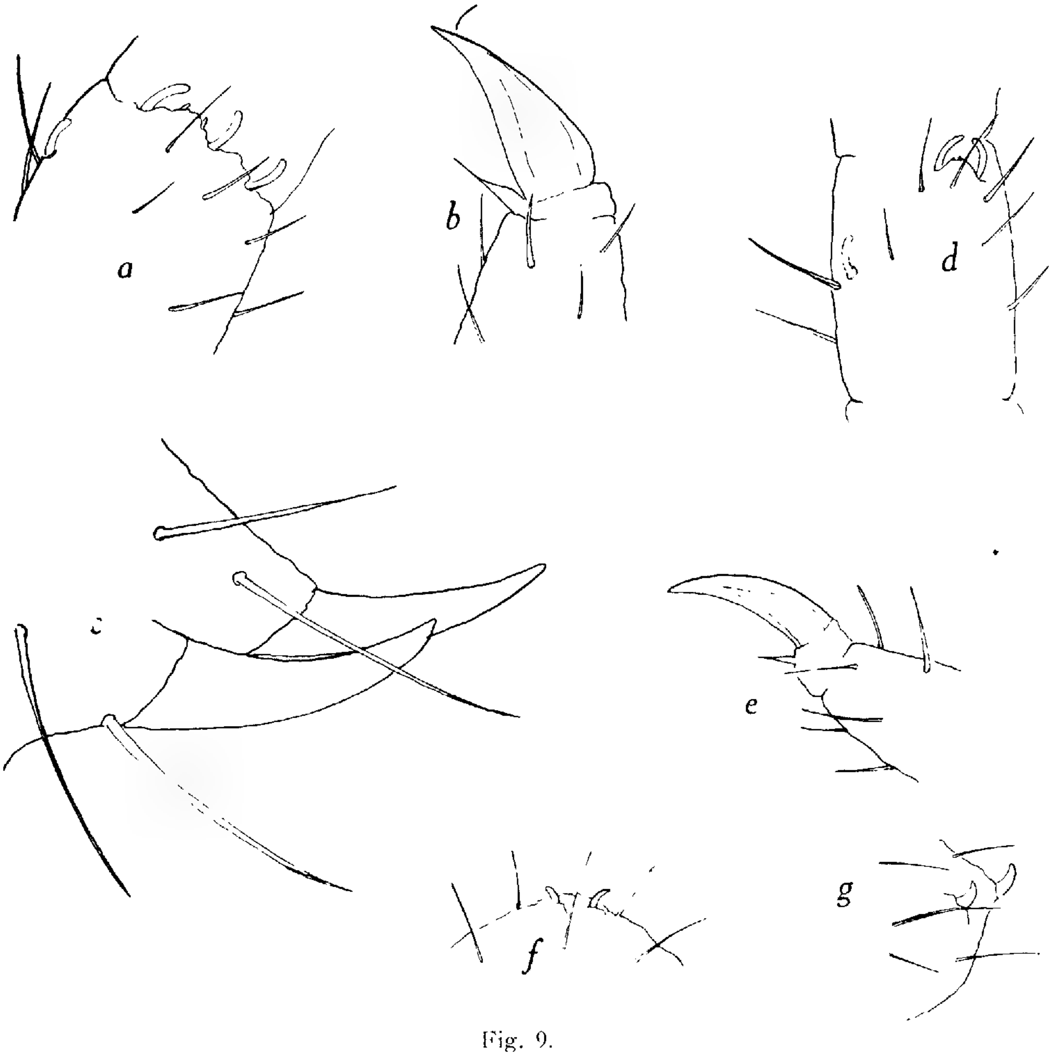


Fig. 9.

a. *Tullbergia trisetosa* (Schäffer). Sensory organ on antennae III.
b. ,, ,, ,, Claw and tip of tibiotarsus.
c. ,, ,, ,, Anal spines.
d. ,, *australis*, n. sp.. Sensory organ on antennae III.
e. ,, ,, ,, ,, Claw and tip of tibiotarsus.
f. ,, ,, ,, ,, Anal spines from above.
g. ,, ,, ,, ,, ,, ,, ,, side.

Aphorura trisetosa Schäffer, 1897; *Aphorura trisetosa* var. *quadrisetosa* Willem, 1902; *Börneria quadrisetosa* Willem, 1902.

Description. Length, 1·4 mm. Colour, whitish-yellow. Antennae slightly shorter than the head, ratio of antennal segments I. : II. : III. : IV. = $7\frac{1}{2}$: $7\frac{1}{2}$: 11 : 12. IV. with 3 or 4 olfactory hairs. III. with sensory organ of 3 parallel-sided stout sensory clubs lying behind a layer or fold of the cuticle; between the two inner clubs is a pair of minute sensory rods; papillae apparently absent; on ventral side of antennae III., at about the middle of the segment, is a fourth slightly curved and parallel-sided club. Antennae base marked off from the rest of the head by a smaller size of the cuticular tubercles. Claws strong, without inner tooth. Empodial appendage present with narrow inner basal lamella and apical bristle which almost reaches the middle of the claw. Clavate tibiotarsal hairs absent. Eyes absent. Postantennal organ long with 80-100 tubercles. Furca absent. Anal spines 2, long and slightly curved on papillae of almost their own length. Anal spines twice as long as the hind claws. Cuticle strongly granular. Clothing of fine and long setae, especially analwards. Pseudocelli = ant. base 1, base of head 1 plus 1, thorax I., II., and III., 1 plus 1, abdomen I.-III. 2 plus 2, IV.-V. 1 plus 1, VI. 0.

The Australian specimens which are referred to this species differ in the number of tubercles in the postantennal organ from the figures given by Börner (35). His number is 100, whereas in the material examined it is round about 80. The localities are:—Sherbrook Falls, Vict., April 19, 1931 (H. G. A. and H. F. D.); Belgrave, Vict., April 19, 1931 (H. G. A.); Mount Lofty Ranges, S. Aust., November 7, 1931 (D. C. S.); You Yang Mountains, Vict., September 9, 1931 (Miss J. W. R.); Specimens in the S.A. Museum (?), Adelaide, no other data.

Tullbergia australica, n. sp.

(Text fig. 9, *d-g.*)

Description.—Length, 0·9 mm. Colour, white. Antennae slightly shorter than head, ratio of segments I. : II. : III. : IV. = 4 : 4 : 6 : 7, IV. with 4 olfactory hairs, organ on III. with 2 strongly curved parallel-sided sensory clubs almost touching at their tips, and two minute rods. Ventrally on ant. III. there is also a third sensory club. Cuticular granules on antennae bases about the same size as those on the head. Ocelli absent. Postantennal organ with about 60 tubercles. Claws without inner teeth. Empodial appendage present with small inner lamella and terminal bristle which does not reach to more than one-third the length of claw. Clavate tibiotarsal hairs absent. Furca absent. Anal spines small, on small papillae not touching at the base. Pseudocelli large. Base of antennae with 1, base of head 1 plus 1, thorax I. to abdomen III. 1 plus 1, IV. 2 plus 2, V. 1 plus 1. Cuticle finely granular.

This species is very closely related to the European *T. krausbaueri* Börner, from which it differs in the presence of the third club on antennae III., in the number of lobes in the postantennal organ and in the number and arrangement of the pseudocelli. It has been taken as follows:—Crawley, W. Aust., October 2, 1930 (D. C. S.); November 19, 1930 (D. C. S.); April 16, 1931 (H. W.); Kalamunda, W. Aust., June 15, 1930 (D. C. S.); Sassafras, Vict., 1931 (H. G. A.).

Key to the Genera of the Collembola-Arthropleona.

Superfamily PODUROIDEA.

A. Without pseudocelli. With or without ocelli. Sensory organ of antennae III. with rods but without sensory cones or outer papillae. Antennae IV. without subapical pit but always with retractile sensory knob.

I. Head hypognathus. Ocelli placed on hind part of head. Dentes bowed horizontally, annulated distally, over-reaching ventral tube. Manubrium resembling that of the Collembola-Symphypleona, with a special medial support piece of the dentes.

Family PODURIDAE Börner, 1906.
(A single genus and species *Podura aquatica* Linne, not known from Australia.)

II. Head obliquely prognathus. With or without ocelli, if present then on the front of the head. Dentes not annulated, fairly straight, seldom reaching ventral tube, or the furca more or less reduced. When present the furca is simple and without the medial support piece of the dentes.

Family HYPOGASTRURIDAE Börner, 1906.

(*a*) Mandibles with well-developed molar plate.

Subfamily HYPOGASTRURINAE Börner, 1906.

1. Postantennal organ absent. Ocelli, 5 or 4 on each side. Empodial appendage absent. Furca more or less reduced. Anal spines 2, usually very small.

Genus XENYLLA Tullberg, 1869.

Postantennal organ present.[1] 2

2. Postantennal organ simple, elliptical or indistinctly lobed. Empodial appendage absent. Anal spines absent or present.

Postantennal organ compound with peripheral lobes. 3

3. Ocelli absent. Postantennal organ simple, cordate. Mandibles without proximal portion, basally with a pair of hooks. Head dorsally with a pair of curved spines or hooks. Anal spines 2, as long as the claws. Empodial appendage absent.

Genus *Gomphiocephalus* Carpenter, 1908 (not Australian).

Ocelli present. Mandibles normal. Empodial appendage absent. Anal spines absent.

Genus *Schöttella* Schäffer, 1896 (including *Beckerella* Axels, 1912) (not Australian)

4. Furca poorly developed. Ocelli absent. Postantennal organ with 4-6 lobes. Empodial appendage present. Anal spines 2, very small, often absent.

Genus *Willemia* Börner, 1901 (not Australian)

Furca well developed. Ocelli, 8 or fewer on each side. Postantennal organ with 4, seldom 7, lobes. Empodial appendage present or not. 5

5. Cuticle with large granulations. Furca well-developed but mucro small in relation to dens. Ocelli, 8 on each side. 6

Cuticle smooth or with only fine granulations. Ocelli, 8 or fewer.

Genus HYPOGASTRURA (Bourlet, 1839) Börner, 1906 (including subgenera *Schäfferia* Absolon, *Typhlogastrura* Bonet, *Mesachorutes* Stach, *Mesogastrura* Bonet, *Folsomiella* Bonet).

6. Anal spines 3, large and on large papillae. Empodial appendage rudimentary.

Genus *Triacanthella* Schäffer (in New Zealand but not Australia).

Anal spines small, 2. Empodial appendage well developed.

Genus *Proxenyllodes* Denis, 1926 (not Australian)

(*b*) Mandibles entirely absent or without molar plate.

Subfamily ACHORUTINAE Börner, 1906.

(*c*) Anal segment with undivided supra-anal valve, with or without furca.

Tribe PSEUDACHORUTINI Börner, 1906

1. Anal spines present, although sometimes hardly larger than the cuticular granules.

Anal spines entirely absent. 4

2. Anal spines 4 or more, almost straight, papillae scarcely present.

Genus *Polyacanthella* Schäffer, 1900 (not Australian).

Anal spines 3, 1 behind 2 in front, occasionally 0 or 5, always curved and on distinct papillae. Furca reduced. Ocelli, 8 or fewer on each side. Empodial appendage absent.

Genus FRIESEA Dalla Torre, 1875.

Anal spines 2, sometimes small and little more than cuticular granules. Postantennal organ present. Ocelli, 5 on each side. 3

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[1] Except in *Hypogastrura (Mesogastrura) coeca* Jonesco?

3. Empodial appendage present. Mucrones with normal lamellae Postantennal organ large, trilobed.

Genus *Xenyllodes* Axelson, 1903 (not Australian).

Empodial appendage absent. Mucrones with two consecutive lobes. Anal spines represented by two rather larger granules of the cuticle. Postantennal organ small, 4-lobed.

Genus ODONTELLA Schäffer, 1897.

4. Eight ocelli on each side. 8
Fewer than 8 ocelli on each side. 5

5. Postantennal organ present. Ocelli generally present. 6
Postantennal organ absent. Ocelli, 2 or 3. Empodial appendage absent. Mouth-parts reduced.

Genus *Paranura* Axelson, 1902 (not Australian).

6. Mouth-parts very much reduced. Maxillae styliform without teeth. Empodial appendage absent. 7
Mouth-parts not so much reduced. Head of maxillae with teeth, not styliform. Ocelli, 5 on each side or absent. Empodial appendage present. 8

7. Ocelli, 1 on each side. Postantennal organ trilobed. Furca very much reduced, dentes and mucrones not differentiated. White, elongate.

Genus *Stachia* Folsom, 1932 (not Australian).

Ocelli, 2 or 4 on each side. Postantennal organ 6-20 lobed. Colour, bluish-grey or bluish-white.

Genus *Micranurida* Börner, 1901 (not Australian).

8. Mandibles with only a curved apical tooth and a subapical lobe-like expansion. Postantennal organ with 13-15 lobes. Ocelli wanting.

Genus *Anuridella* Willem, 1906 (not Australian).

Mandibles with many teeth and no lobe. Ocelli, 5 on each side or absent. 9

Genus ANURIDA Laboulbene, 1865.

9. Furca very long and slender. Dens many times (seven) as long as mucro. Antennae 3 times as long as head. Male with abdomen VI. produced. Ocelli, 5 on each side. Postantennal organ absent.

Genus NEACHORUTES, n. gen.

Furca much shorter or absent, when present of normal length. Antennae scarcely, if at all, longer than the head. 10

10. Species of flattened form with prominent pleural areas. 11
Species of normal build. 12

11. Furca present. Ocelli, 8 on each side. Postantennal organ half-elliptical with numerous lobes. Empodial appendage absent. Cuticle marked in hexagons. Body segments with cross furrows.

Genus CERATRIMERIA Börner, 1906 (including *Linnaniemia* Philiptschenko, 1926).

Furca absent. Ocelli, 5 on each side. Postantennal organ circular with 12-13 lobes. Empodial appendage absent.

Genus *Platanurida* Carpenter, 1925 (not Australian, but occurs in New Zealand).

12. Mandibles absent. Ocelli, 8 on each side. Postantennal organ present or absent. Furca present or absent.

Genus BRACHYSTOMELLA Agren, 1903. (including *Guacharia* Jackson, 1927).

Mandibles present, styliform. Ocelli, 8 on each side. Postantennal organ present or absent. Furca present.

Genus PSEUDACHORUTES Tullberg, 1892.

(*d*) Anal valve 2-lobed, broad. Abdomen VI. relatively large. Body generally with segmental tubercles. Postantennal organ of numerous cutaneous tubercles or absent.
Tribe ACHORUTINI Börner, 1906.

1. Body covered with numerous spines.
Genus *Holacanthella* Börner, 1906 (in New Zealand, not Australian).

Body not as above. 2

2. Sides of thoracic and abdominal segments produced backwards in long processes.
Genus *Acanthanura* Börner, 1906 (not Australian, but known from New Zealand).

Not as above. 3

3. Head of maxillae as in *Anurida* with a large-toothed head and 2-3 finely-toothed lamellae as well as a basal erect lobe, seldom without these. 4

Head of maxillae needle-like, without teeth or lamellae, at most at the base as in 4 with a tooth-like lobe.
Genus ACHORUTES Templeton, 1835; Börner, 1906.

4. Abdomen VI. hidden under V. Postantennal organ present, of numerous clustered lobes.
Genus *Morulina* Börner, 1906 (not Australian)

Abdomen VI. visible from above, not hidden under V.
Genus *Protanura* Börner, 1906 (not Australian).

B. With pseudocelli. With or without furca. Antennae with 2-3 sensory clubs, sensory rods, with or without papillae and protective setae. Antennae IV. mostly with subapical groove, seldom with retractile knob. Ocelli absent. Postantennal organ mostly present and well developed.
Family ONYCHIURIDAE (Lubbock, 1867) Börner, 1913.

1. The 2 or 3 sensory clubs of antennal organ III. smooth, curved towards one another, often an accessory club ventrally about the middle of the segment Ant. IV. with typical olfactory hairs. Postantennal organ with numerous simple lobes. Empodial appendage absent or bristle-like. Furca absent. Body long and narrow. 2

The 2 sensory clubs on antennal organ III. smooth or tuberculate, not curved towards one another. Postantennal organ of few or many simple or clustered tubercles or absent. Empodial appendage generally well developeed. Furca present or absent or rudimentary. Body broader and more robust. 3

2. Pseudocelli on body segments in the form of a rosette lying in a pit.
Genus TULLBERGIA Lubbock, 1876.

Pseudocelli consisting of two unequal, slightly curved rods lying in a pit. Lightly chitinised, brownish species.
Genus *Paratullbergia* Womersley, 1930 (not Australian).

3. Furca present, well developed with distinct manubrium, dentes and mucrones. Anal spines 4. Postantennal organ absent.
Genus *Tetrodontophora* Reuter, 1882 (not Australian)

Furca, when present, quite rudimentary. Postantennal organ present. 4

4. Cuticle with large granulations. Pseudocelli few, without a ring of chitin. Empodial appendage with basal lamella. Anal horns strong on large papillae.
Genus *Kalaphorura* Absolon, 1901 (not Australian).

Cuticle with numerous pseudocelli with distinct chitinous rings. No large cuticular granulations. Postantennal organ with simple tubercles or grape-like clusters. Furca absent or when present very rudimentary. With 4, 2 or 0 anal spines.
Genus ONYCHIURUS Gervais, 1842; Börner, 1901.

BIBLIOGRAPHY.

This will be given at the end of Part II. of the paper, which will deal with the Entomobryoidea.

TWO NEW DANTHONIAS

BY A. B. CASHMORE

Summary

Danthonia Duttoniana, n. sp. Culmi 50-60cm alti, robusti ; folia angusta, 15-25 cm. longa, glabra; panicula sublaxa, 8-15 cm. longa, circa 5 cm. lata, ramis inferioribus 6-10 cm. longis, basin versus longe nudis; spiculae glomeratae, pedicellis 20-30 mm. longis, distantibus; glumae exteriores latae, 15-20 mm. longae ; spiculae 5-9-flores, aristis glumas exteriores valde superantibus; pars basilaris glumae floriferae fusca, lata, 3-4 mm. longa, supra et subter annulo pilorum cincta ; lobis lateralibus 6-10 mm. longis, pro dimidio eorum aristatis; arista centralis 14-17 mm. longa, infra geniclum brunnea et arcte torta; palea 7 mm. longa, acuta, emarginata, dorso glabra.

TWO NEW DANTHONIAS.

By A. B. Cashmore (Waite Agricultural Research Institute).
(Communicated by J. M. Black, A.L.S.).

[Read June 8, 1933.]

Danthonia Duttoniana, n. sp. Culmi 50-60 cm. alti, robusti; folia angusta, 15-25 cm. longa, glabra; panicula sublaxa, 8-15 cm. longa, circa 5 cm. lata, ramis inferioribus 6-10 cm. longis, basin versus longe nudis; spiculae glomeratae, pedicellis 20-30 mm. longis, distantibus; glumae exteriores latae, 15-20 mm. longae; spiculae 5-9-flores, aristis glumas exteriores valde superantibus; pars basilaris glumae floriferae fusca, lata, 3-4 mm. longa, supra et subter annulo pilorum cincta; lobis lateralibus 6-10 mm. longis, pro dimidio eorum aristatis; arista centralis 14-17 mm. longa, infra geniculum brunnea et arcte torta; palea 7 mm. longa, acuta, emarginata, dorso glabra.

Mount Lofty Range; Victoria; New South Wales.

Differs from *D. semiannularis* in the larger and looser panicle, with numerous spikelets and the lower panicle-branches much larger and naked towards the base for about half their length. This species, mentioned as *D. Duttoniana* but not described by Mr. E. Breakwell in his "Grasses and Fodder Plants of New South Wales," p. 234 (1923), was named after Mr. J. Dutton, observer at the Bathurst Experiment Farm.

Danthonia Richardsonii, n. sp. Culmi 60-70 cm. alti, robusti; laminae foliorum 20-30 cm. longae, angustae, glabrae; panicula densa, 8-12 cm. longa, 2½-3 cm. lata, circa 70-spiculata, ramis erectis, inferioribus 1-4 cm. longis fere usque ad basin spiculis vestitis; spiculae 4-5-flores; glumae exteriores latae, 11-14 mm. longae; pars basilaris glumae floriferae 4 mm. longa, pilis subsparsis vel in seriebus verticalibus potius quam transversis, lobis lateralibus 4 mm. longis lanceolatis et brevissime aristatis; arista centralis 8 mm. longa, pallida, infra geniculum tantum semel torta; palea 4 mm. longa, obtusa, oblonga-cuneata, dorso glabra, laciniis villosa.

Werribee, Victoria.

Differs from *D. semiannularis* in the broader, denser panicle, the much shorter, pale-coloured and only once-twisted central awn, the shorter lateral lobes, and the scattered hairs of the flowering glume. Named after Dr. A. E. V. Richardson, first Director of the Waite Agricultural Research Institute.

English description in Comm. Aus. C.S.I.R. Bull., 69 (1932).

A REVISION OF THE EURYMELINI (HOMOPTERA, BYTHOSCOPIDAE).

BY *J. W. EVANS, M.A., F.R.E.S.*

Summary

Insects of the Eurymelini division of the Eurymelinae have attracted the notice of collectors in Australia since the earliest days of settlement, and for upwards of a century specimens have been sent to Museums in Europe for description by entomologists. Many of the descriptions were made from single specimens, with the result that synonyms are abundant, since the specific descriptions were largely based on colour characteristics, and with the majority of the known species the colouration is extremely variable.

A REVISION OF THE EURYMELINI (HOMOPTERA, BYTHOSCOPIDAE).

By J. W. Evans, M.A., F.R.E.S.
(Division of Economic Entomology, Council for Scientific and Industrial Research.)

[Read June 8, 1933.]

Introduction.

Insects of the Eurymelini division of the Eurymelinae have attracted the notice of collectors in Australia since the earliest days of settlement, and for upwards of a century specimens have been sent to Museums in Europe for description by entomologists. Many of the descriptions were made from single specimens, with the result that synonyms are abundant, since the specific descriptions were largely based on colour characteristics, and with the majority of the known species the colouration is extremely variable.

Up to the present it has been the custom to place large individuals in the genus *Eurymela* Le P. & S. and the small ones in the genus *Eurymeloides* auctt., but for a long time it has been apparent that the classification of the group was in need of revision. The late Professor C. F. Baker had intended undertaking this work, and went so far as to prepare a tentative classification; this was never published. The revision presented here is based on a study of material examined in the collections of the British Museum; the Australian Museum, Sydney; the National Museum, Melbourne; the South Australian Museum; the Macleay Collection of the University of Sydney; the Froggatt Collection at Canberra, and the author's private collection. In addition, material has been lent by the Queensland Museum, and five paratypes of species described by Kirkaldy have been lent to the author by Mr. O. H. Swezey of the Hawaiian Sugar Planters' Association. The author is indebted to the authorities of these institutions for permitting him to examine the collections in their care. He also particularly wishes to acknowledge his indebtedness to Mr. W. E. China, of the British Museum, without whose ever ready help and advice he would have been unable to carry out this work. Mr. China permitted full use to be made of a tentative key to the Eurymelinae genera, (MSS.), prepared by him in 1926, and also furnished descriptions and drawings of type material in the British Museum collection.

Systematics.

The Eurymelinae are considered to be a division of the Bythoscopidae on account of the facial position of the ocelli. Further research may show that they merit elevation to family rank. In a paper published in 1926, China(1) considered the Pogonoscopini as a sub-family; here they are classed as a tribe. In addition to insects allied to *Pogonoscopus* spp. and *Eurymela* spp., there exist in Australia a number of genera similar to those mentioned above in having the ocelli facially placed. They also resemble them in habits and general appearance, but they lack the typical Eurymeloid colour pattern and differ in the structure of the genitalia. These insects are provisionally placed in the Ipoini. The three tribes of the sub-family Eurymelinae may be separated by means of the following key:—

(1) China, W. E., Trans. Ent. Soc., London, 1926 (2), 289.

1. Tegmina, a shiny blue, black, or brown colour, with or without white or coloured fasciae; sub-genital plates broad and flap-like, with styles. 2
Tegmina, hyaline or more or less transparent; if coloured brown or black, then without definite fasciae, and lacking the typical Eurymeloid colour-pattern; sub-genital plates long and narrow, without styles. .. .. IPOINI
2. Head, including the eyes, narrower than the pronotum at the base; hind-tibiae rounded in section with the outer sides flattened, and bearing a regular armature of spines arising direct from the tibiae themselves. .. .. POGONOSCOPINI
Head, including the eyes, wider than the pronotum at the base; hind tibiae quadrilateral in section, bearing distinct spurs with modified spines at their apices. .. EURYMELINI

This paper is concerned only with the Eurymelini; the Ipoini will be dealt with at a future date. The Pogonoscopini(2) have already been revised by China (1926). Among the Eurymelini examined were many single specimens representative of new species. These will not be described until further material is available.

KEY TO THE GENERA OF THE EURYMELINI.

1. Tegmen with four or five large and distinct apical cells; appendix well developed: hind tibial armature variable. 5
Tegmen without distinct apical cells, usually reticulate apically, or with eight or nine apical cells partially developed; appendix small; hind tibiae with one to three distinct spurs(3) 2
2. Head in profile evenly convexly rounded or globose. 3
Head in profile not evenly convexly rounded or globose, the frons being produced into a transverse spade-shaped process in the middle, which is concave dorsally.
EURYMELOPS Kirkaldy
Genotype *Eurymela rubrovittata* A. & S.
3. Head in profile evenly convexly rounded, not globose; tegmina, when closed, strongly tectiform 4
Head in profile strongly globosely convex; tegmina when closed not strongly tectiform, the clavus more or less horizontal and in the same plane as the pronotum and scutellum. .. .. PLATYEURYMELA, gen. nov.
Genotype *Eurymela semifascia* Walker
4. Tegmina, black or brown with or without whitish fasciae; femora of fore legs with four to six pairs of short blunt spurs on their interior margins; hind tibiae with one spur. .. .. EURYMELA Le P. & S.
Genotype *Eurymela fenestrata* Le P. & S.
Tegmina, black with one or two whitish fasciae, if two, the anterior one very large and the posterior one small, usually reticulate apically, occasionally with large apical cells; femora of fore legs spurless; hind tibiae with two, occasionally three spurs.
PAUROEURYMELA, gen. nov.
Genotype *Eurymela amplicincta* Walker
5. Front and middle femora spineless; hind tibiae with three to five distinct spurs decreasing in size from the apex of the tibiae to the base. 6
Front and middle femora with strong outwardly-curved spines (front with one, middle with three spines); hind tibiae with two distinct spurs on the apical half, and several feeble ones towards the base. .. .. EURYMELITA, gen. nov.
Genotype *Eurymela terminalis* Walker
6. Hind tibiae with three to five distinct spurs; sub genital plates with distinct styles.
EURYMELOIDES Kirkaldy
Genotype *Eurymela bicincta* Erichs.
Hind tibiae with two distinct spurs and numerous spines; sub-genital plates with only a very slight development of a style .. .. EURYMELESSA, gen. nov.
Genotype *Eurymeloides moruyana* Distant

(2) All the representatives of this tribe, so far described, have been collected in Western Australia. In the South Australian Museum are specimens from Kangaroo Island, South Australia, and Victoria.

(3) These spurs are not homologous with those that occur on the hind tibiae of the Cercopidae, but are actually the enlarged bases of mobile spines.

EURYMELA Le Pelletier and Serville.

Encyc. Meth. 10; 604, 1825.
Signoret, Ann. Soc. Ent. Fr. (2) viii.; 503, 1850.

Signoret divided this genus into two sections, but did not name them. Since the genus as it now stands comprises only a few of the many species originally included in it, a redescription is given below.

Wedge-shaped insects, 6-14 mm. in length (from the apex of the head to the tip of the folded tegmina). The general colouration is brown or purplish-black, and the head in profile is evenly convexly rounded (fig. C, fig. 5). The venation of the tegmina is reticulate apically, and the hind tibiae have one distinct spur.

Twelve species have been described belonging to this genus as now defined; only three of these are recognised here, the others being considered as local races that differ in colour pattern and occasionally in size, but not in structure. One new species is described.

EURYMELA FENESTRATA Le P. & S. (Genotype).

**Eurymela fenestrata* Le P. & S., Encyc. Meth. 10; 604, 1825. **Eurymela ruficollis* Burm., Genera Insectorum, 1838-45. **Eurymela discoidalis* Sign., Ann. Soc. Ent. Fr. (2) viii.; 505, 1850. *Eurymela distincta* Sign., Ann. Soc. Ent. Fr. (2) viii.; 506, 1850. *Eurymela vicina* Sign., Ann. Soc. Ent. Fr. (2) viii.; 506, 1850. **Eurymela suffusa* Walk., List Homoptera iii.; 640, 1851. *Eurymela speculum* Walk., List Homoptera iii.; 641, 1851. **Eurymela plebeia* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 355, 1906. *Eurymela lubra* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 355, 1906. **Eurymela subnigricans* Dist., Ann. Soc. Ent. Belg. 52; 105, 1908.

A great number of varieties of this species exist, many of which have been given specific names. These varieties can be divided into two groups. One group comprises individuals in which the general colouration is bronze or brown; in the other group the predominating colour is black. Since no morphological differences can be discovered between the many varieties of both groups, and intergrades exist between them, they are best considered as comprising one species. There is, however, no doubt that *Eurymela fenestrata* as defined here contains a number of incipient species, any one of which, if isolated for a sufficiently long period, would probably acquire distinct structural characters. Separate descriptions for the two groups are given below. The synonyms marked * belong to the brown group, the remainder to the black group. Figure A is a diagrammatic representation of the tegmina of some of the varieties of the brown group. Although these forms are well established and not chance varieties, it is felt that it would only confuse their identification to give them specific rank, especially as there are certainly many more colour combinations than those figured here. The figures are drawn from individuals examined by the author, and were selected as showing the range of variation, and not as representing named varieties.

BROWN GROUP.

Description.—Length, 10 mm. (from the apex of the head to the tip of the folded tegmina). Head, entirely orange-rufous or very dark brown, or marked with a pattern containing both colours; maxillary plates always cream coloured. Pronotum and scutellum entirely apricot orange, orange rufous or dark purplish-brown, or marked with a pattern of orange and brown. Tegmen, with the anterior costal margin always rufous or yellowish, the rest of the tegmen dark brown or very dark purplish-brown, except for whitish fasciae which may be present; these vary in number from one to three, and though constant in position and size as far as the varieties are concerned, present numerous combinations within the group and may be entirely absent (fig. A). Legs, coxae, and femora concolorous with the thorax; tibiae and tarsi black, excepting the proximal tarsal segment of the hind legs, which is white. Abdomen, ventral surface pale or dark ochreous; genital segments variable in colour, the lobes of the last ventral segment in the female long and narrow (fig. C, fig. 3). Male genitalia, sub-genital plates large and boat-shaped, having a long narrow style lying along the interior margin of the plate; the base of the style is attached to the thickened edge of the ventral margin of the plate; aedeagus as in figure (fig. B, fig. 1; fig. C, fig. 8).

Distribution.[4]—Queensland, New South Wales, Victoria and South Australia.

BLACK GROUP.

Description.—Length, 10-14 mm. Head, black, but for the maxillary plates, which are white or cream. Pronotum and scutellum, black. Tegmen, bluish or purplish-black, usually with one, two or three whitish fasciae; these, though constant in size and position as far as the varieties are concerned, present numerous combinations within the group and may be entirely absent; costal margin always black, never rufous or yellow. Legs, coxae, and proximal halves of femora scarlet (some museum specimens have yellow abdomens, it is not known whether this was their original colour); male and female genital segments black.

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

NOTE.—There is a transitional form between the two groups which has all the colour characteristics of the black group, excepting that the anterior portion of the costal margin of the tegmen is rufous.

EURYMELA ERYTHROCNEMIS Burmeister.

Eurymela erythrocnemis Burm., Genera Insectorum, 1838-45.

Description.—Length, 8-9 mm. Head, black, maxillary plates broadly white. Pronotum, black, posterior margin white. Scutellum, black with apex rufous. Tegmen, black with the costal and claval margins broadly fulvous. Two white fasciae; anterior fascia strongly widened towards clavus across which it extends half way; posterior fascia arcuate, more or less parallel-sided, not much wider at costal margin than at apex of clavus. Legs, front and middle legs with coxae and proximal halves of the femora reddish, distal halves of the femora and tarsi black; hind coxae, femora and tibiae red, apices of tibiae and last two tarsal segments black, first tarsal segment white. Abdomen, ventral surface black, with a pallid spot in the middle of the last ventrite, and a small pale spot on the middle of each of the sub-genital plates (♂). Male genitalia, aedeagus as in fig. B, fig. 2.

Distribution.—New South Wales.

EURYMELA RUBROLIMBATA Kirkaldy.

Eurymela rubrolimbata Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 354, 1906.

Description.—Length, 9 mm. Head, black, but for a narrow white border to the maxillary plates. Pronotum, either entirely black, or with the posterior half dull olive; the band of this colour being widest in the middle of the pronotum. Scutellum, black. Tegmen, bluish or bronzy black with the costal and claval margins fulvous; there are two whitish fasciae, the anterior irregular in shape, often narrow and transverse, the posterior transverse and always wider at the costal than at the hind margin of the tegmen. Legs, front legs, coxae, and proximal halves of femora reddish, distal halves of the femora, tibiae and tarsi black; middle legs entirely reddish but for the tarsi, and the distal halves of the

(4) Distribution records refer to insects examined and do not necessarily indicate the limits of any species.

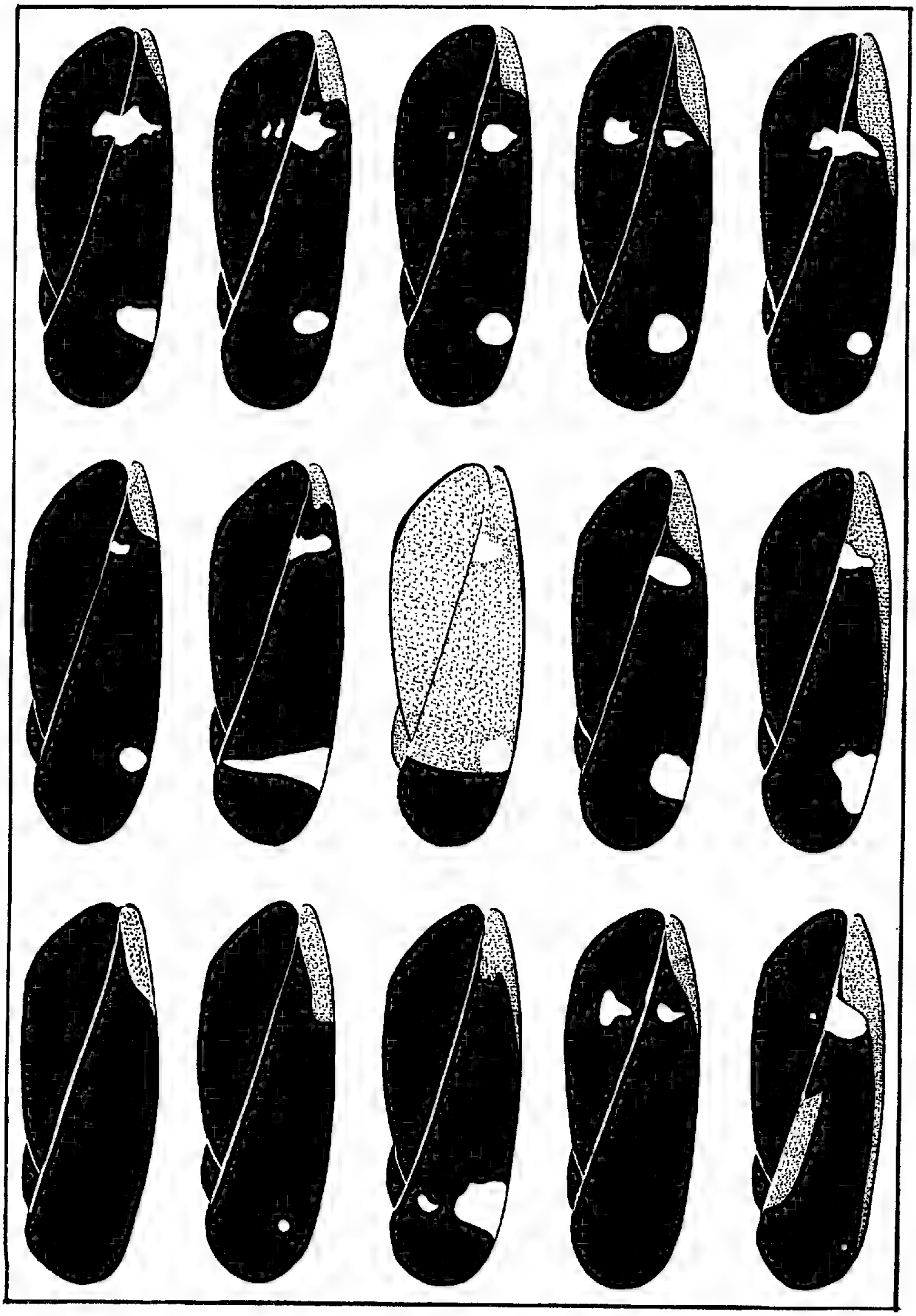

Fig. A.

Diagrammatic figures of the tegmina of insects belonging to the brown division of *Eurymela fenestrata*, to show the range of variation.

femora, which are black; hind legs entirely reddish, but for the distal quarters of the tibiae, which are black, and the first tarsal segment which is white. Abdomen, ventral surface black. Male Genitalia, aedeagus, as in fig. B, fig. 3.

Distribution.—New South Wales.

Eurymela bakeri, n. sp.

Description.—Length, 6-7 mm. Head, black, maxillary plates white. Pronotum, black, frequently the posterior margin is white. Scutellum, black. Tegmen, black, with the costal and claval margins fulvous, and having two white or grey fasciae; the anterior fascia is irregular in shape, frequently extending into the clavus, the posterior lunate, reaching transversely right across the tegmen, much wider at the costa than at the clavus. Legs, front and middle legs with the coxae and proximal halves of the femora reddish, distal halves of the femora, tibiae and tarsi black; hind legs entirely reddish-brown, but for the apex of the tibia which is black, and the first tarsal segment which is white. Abdomen, ventral surface black. Male genitalia, similar to those of *E. erythrocnemis*, the ventral outgrowth from the base of the aedeagus, differently shaped (fig. B, fig. 4).

Distribution.—New South Wales.

Type ♂ from Canberra, F. C. T., (12/30), in the collection of the Division of Economic Entomology, Council for Scientific and Industrial Research at Canberra. Described from a long series of males and females.

Platyeurymela, gen. nov.

Insects comprised in this genus may at once be recognised by being almost oval in outline when viewed from above (fig. C, fig. 1), and not wedge-shaped like those of related genera.

The head is globosely convex. The tegmina, which have their venation reticulate apically, are not strongly tectiform, but have the clavus more or less on a plane with the pronotum. The hind tibiae have one spur, and the front femora five or six pairs of very small spurs on the inner edge.

PLATYEURYMELA SEMIFASCIA Walker (Genotype).

Eurymela semifascia Walk., List Homoptera iii.; 643, 1851.

Eurymela tasmani Dist., Ann. Soc. Ent. Belg. 52; 106, 1908.

Description.—Length, 8 mm. Head, black, maxillary plates entirely black. Pronotum, black, hind margin narrowly white. Scutellum, black. Tegmen, black, costal and claval margins narrowly reddish; two narrow white fasciae, the anterior one on a level with the middle of the clavus and extending from very near the costal margin to the claval commisure; the posterior one on a level with the apex of the clavus and extending thence to the costal margin. Legs, fore and middle coxae, extreme base of anterior femora and proximal halves of middle femora, reddish-brown; anterior femora except base, distal halves of middle femora, tibiae and tarsi, black; hind legs with coxae and proximal halves of femora reddish, distal halves of femora, bases of tibiae and ultimate tarsal segment, black; tibiae except bases reddish, first two tarsal segments brownish-yellow. Abdomen, ventral surface black; posterior margin of penultimate segment, a spot on the middle of the two previous segments, and the ovipositor sheath, fulvous yellow. Male genitalia, aedeagus with the ventral lobe developed, the gonopore opening at the side (fig. B, fig. 5).

Distribution.—New South Wales, Victoria, and South Australia.

Var. *tasmani* Distant.

Similar to the typical form, but the anterior white fascia on the tegmen broadened, and the inner half of the corium between the fasciae entirely white. The maxillary plates are entirely black as in *semifascia*. The male genitalia show slight differences, such as a narrower and more apically rounded ventral lobe of the aedeagus.

Distribution.—Tasmania.

PLATYEURYMELA ATRA Walker (fig. C, fig. 1).

Eurymela atra Walk., List Homoptera iii.; 645, 1851.

Description.—Length, 8 mm. Head, black, with a narrow white margin to the maxillary plates. Pronotum, black, with the hind margin narrowly white. Scutellum, black. Tegmen, dark brown, shading to black at the apex and the base of the clavus. Legs, fore and middle coxae and proximal halves of femora reddish-brown; distal halves of the femora, tibiae and tarsi, black; hind legs with coxae and proximal halves of the femora red, distal halves of the femora and the ultimate tarsal segment black; tibiae and the first two tarsal segments reddish-brown. Abdomen, ventral surface black, each segment having a brown posterior margin; sub-genital plates fulvous. Male genitalia, similar to those of *P. semifascia*, but with the apex of the aedeagus much broader, and the ventral process with a distinct bump on the side (fig. B, fig. 6).

Distribution.—Tasmania and South Australia.

Pauroeurymela, gen. nov.

This genus contains small species from four to six millimetres in length. The head in profile is evenly convexly rounded. The tegmina, while usually having the venation reticulate apically, occasionally have large distinct apical cells. The fore femora are spurless, and the hind tibiae bear from two to three spurs.

PAUROEURYMELA AMPLICINCTA Walker (Genotype).

Eurymela amplicincta Walk., Ins. Saund. Homopt. 84, 1858.

Description.—Length, 4-6 mm. Head, black, maxillary plates white. Pronotum, either black with the posterior margin narrowly white or olive, or entirely dull olive. Scutellum, black. Tegmen, black with a narrow fulvous margin; there are two transverse grey or pale yellowish-brown fasciae, the anterior very much larger than the posterior; the fasciae converge towards each other, being much closer together at the hind margin than at the costal margin of the tegmen. Legs, front and middle legs with the coxae and proximal halves of the femora red, distal halves of the femora, tibiae and tarsi, black; hind legs entirely red, but for the distal tarsal segment, which is black. Abdomen, ventral surface black. Male genitalia, the sub-genital plates are more or less rectangular; the opening of the gonopore is at the extremity of the aedeagus, not at the side; there is a spine at the posterior edge, and the anterior ventral process arising from the base of the aedeagus, is present (fig. B, fig. 11).

Distribution.—New South Wales.

Pauroeurymela parva, n. sp. (fig. C, fig. 2).

Description.—Length, 7-8 mm. Head, black, eyes dull brown; the vertex seen from above is angular. Pronotum, black, the posterior margin very narrowly reddish. Scutellum, black. Tegmen, black with a narrow fulvous edge to the costal and claval margins; there are two pale yellowish-brown fasciae, the anterior transverse and wide, narrower at the costal than at the hind margin of the tegmen

(When the tegmina are closed these two fasciae form a band right across the dorsal surface of the insect.) Posterior fascia, a very small triangular pale area lying against the costal margin of the tegmen. Legs, reddish, but for the fore tibiae, fore tarsi, tarsi of the middle pair of legs, and the distal tarsal segment of the hind legs, which are black. Abdomen, ventral surface black. Male genitalia, aedeagus with no anterior ventral process developed, but similar to that of the genotype in having a spine present on the posterior margin, and the opening of the gonopore at the extremity of the aedeagus (fig. B, fig. 12).

Distribution.—New South Wales.

Type ♂ from Katoomba, New South Wales (October 3, 1926); paratypes, two females from the same locality; type and one of the paratypes in the collection of the Australian Museum, Sydney.

EURYMELOPS Kirkaldy.

H.S.P.A. Exp. Sta. Bull. 1 (9); 350, 1906.

Kirkaldy defined *Eurymelops* as a sub-genus, it is here given generic rank. This genus comprises insects eleven to fourteen millimetres in length, which are brightly coloured, red being the predominant colour. The frons is produced into a transverse spade-shaped process; this process is concave dorsally, and hence the eyes from above appear very prominent (fig. C, fig. 6). The venation of the tegmen is reticulate apically, and the hind tibiae have two, occasionally three, spurs.

EURYMELOPS RUBROVITTATA Amyot & Serville (Genotype).

Eurymela rubrovittata A. & S., Hist. Nat. des Ins. Hemip., 555, 1843. *Eurymela rubrofasciata* Stal, Ofv. Vet.-Ak. Förh. 22; 156, 1865. *Eurymelops rubrovitta* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 354, 1906.

Description.—Length, 14 mm. Head, black, excepting the maxillary plates and a narrow band between the eyes, which are red. Pronotum, black, posterior margin red. Scutellum, black. Tegmen, small area along the anterior edge of

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DESCRIPTION OF FIGURE B.

Figure	1	.. ..	Aedeagus	of *Eurymela fenestrata.*
„	2	.. ..	„	„ *Eurymela erythrocnemis.*
„	3	.. ..	„	„ *Eurymela rubrolimbata.*
„	4	.. ..	„	„ *Eurymela bakeri.*
„	5	.. ..	„	„ *Platyeurymela semifascia.*
„	6	.. ..	„	„ *Platyeurymela atra.*
„	7	.. ..	„	„ *Eurymelops bicolor.*
„	8	.. ..	„	„ *Eurymelops rubrovittata.*
„	9	.. ..	„	„ *Eurymelops latifascia.*
„	10	.. ..	„	„ *Eurymelops generosa.*
„	11	.. ..	„	„ *Pauroeurymela amplicincta.*
„	12	.. ..	„	„ *Pauroeurymela parva.*
„	13	.. ..	„	„ *Eurymeloides pulchra.*
„	14	.. ..	„	„ *Eurymeloides bicincta.*
„	15	.. ..	„	„ *Eurymeloides marmorata.*
„	16	.. ..	„	„ *Eurymeloides punctata.*
„	17	.. ..	„	„ *Eurymeloides lineata.*
„	18	.. ..	„	„ *Eurymeloides walkeri.*
„	19	.. ..	„	„ *Eurymeloides minutum.*
„	20	.. ..	„	„ *Eurymeloides perpusilla.*
„	21	.. ..	„	„ *Eurymeloides adspersa.*
„	22	.. ..	„	„ *Eurymelessa moruyana.*
„	23	.. ..	„	„ *Eurymelessa froggatti.*
„	24	.. ..	„	„ *Eurymelita terminalis.*
„	25	.. ..	„	„ Sub-genital plates, styles (s) and parameres (p.), of *E. terminalis.*

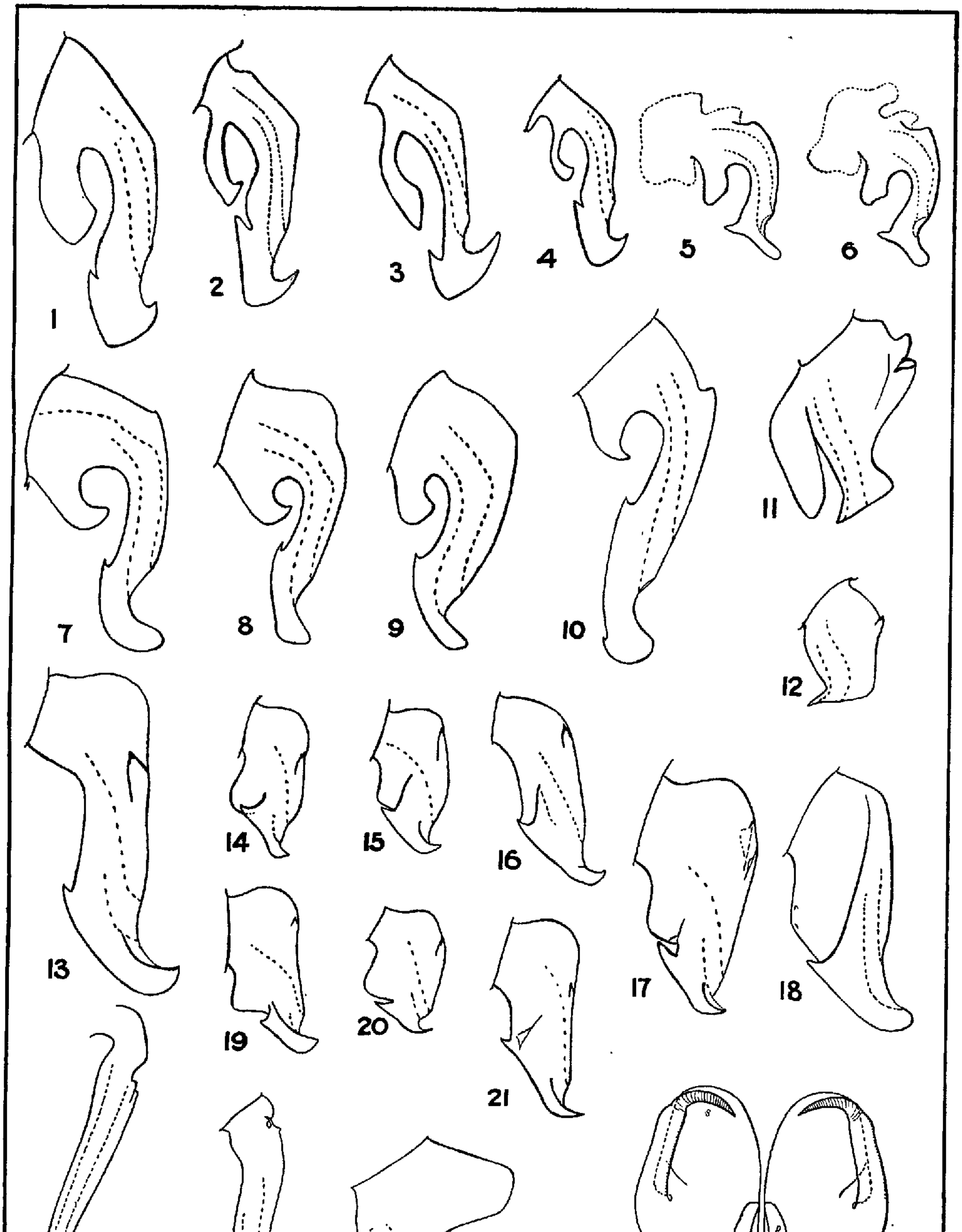


Fig. B.
[For description see opposite page]

the costal margin, and two transverse fasciae, red; the anterior fascia is sinuate; the rest of the tegmen is black, including the costal margin between the two fascia. Legs, coxae and proximal halves of the femora red; distal halves of the femora, tibiae and tarsi, black, excepting the first tarsal segment of the hind legs, which is white. Abdomen, red, genital segments black; the flap on the last ventral segment of the female, short and broad (fig. C, fig. 4). Male genitalia, sub-genital plates and parameres similar to those of *Eurymela* spp., aedeagus as in figure (fig. B, fig. 8).

Distribution.—New South Wales and Victoria.

EURYMELOPS BICOLOR Burmeister.

Eurymela bicolor Burm., Genera Insectorum, 1838-45. *Eurymela basalis* Walk., List Homoptera iii.; 640, 1851.

Description.—Length, 14 mm. Head, metallic blue or greenish-black, with the maxillary plates and the dorsal margin of the frons red, or the whole head entirely red. Pronotum, either entirely bluish or greenish-black, or black with the posterior margin red. Scutellum, bluish or greenish-black; in some specimens there is a red spot in the middle. Tegmen, entirely a metallic greenish or bluish-black with the anterior costal area red, or all the anterior half of the tegmen, but for a black spot on the clavus, red, and the posterior half metallic blue. These are the two commonest combinations of red and blue found in this species, but there are many others. Legs, usually entirely black, coxae and anterior halves of femora of fore legs occasionally red. Abdomen, ventral surface red. Male genitalia, aedeagus as in figure (fig. B, fig. 7).

Distribution. -Queensland, New South Wales, Victoria, and South Australia.

EURYMELOPS LATIFASCIA Walker.

Eurymela latifascia Walk., List Homoptera iii.; 639, 1851. *Eurymela pascoei* Dist., Ann. Soc. Ent. Belg. 52; 106, 1908.

Description.—Length, 11 mm. Head, ochreous, frequently with a black area in the middle of the frons, and another between the eyes. Pronotum, entirely black, black with a reddish posterior margin, or pale or dark ochreous, with an oval-shaped black area in each anterior corner. Scutellum, black. Tegmen, black, a basal area of varying extent ochreous, and with two red or reddish transverse fasciae which are joined along the costal margin of the tegmen by a narrow reddish or ochreous band, which widens anteriorly; the anterior fascia is the same width at both ends, while the posterior fascia is wider at the costal than at the hind margin of the tegmen. (The basal ochreous area is always connected to the anterior fascia along the fore border of the tegmen; the connecting red area may be narrow or wide.) Legs, coxae and proximal halves of femora ochreous; distal halves of femora, tibiae and tarsi, black. Abdomen, ochreous, frequently suffused with black. Male genitalia, aedeagus as in figure (fig. B, fig. 9).

Distribution.—Western Australia and South Australia.

EURYMELOPS GENEROSA Stal.

Eurymela generosa Stål, Ofv. Vet.-Ak. Förh. 22; 156, 1865. *Eurymela bunda* Dist., Ann. Soc. Ent. Belg. 52; 106, 1908.

Description.—Length, 14 mm. Head, entirely ochreous or reddish-testaceous, with bluish-black irregular markings on the frons and vertex. Pronotum and scutellum, bluish-black or testaceous, or marked with a combination of both colours. Tegmen, reddish-testaceous, with two transverse bluish-black fasciae that extend from the hind margin of the tegmen to close to the costal margin; these fasciae may be broken up into small irregular black areas, not forming a band; apical area of the tegmen, a hyaline brownish-ochreous. Legs, coxae and proximal halves of femora red; distal halves of femora, tibiae and tarsi, black. Abdomen, ventral surface, reddish-testaceous; genital and anal segments black; sub-genital plates in the male with an oblique yellow stripe. Male genitalia, aedeagus as in figure (fig. B, fig. 10).

Distribution.—Western Australia.

EURYMELOIDES Kirkaldy.

H.S.P.A. Exp. Sta. Bull. 1(9); 354, 1906.

Eurymelias Kirk., H.S.P.A. Exp. Sta. Bull. 3; 29, 1907.

Eurymeloides Ashmead (Ent. Amer. 5; 126, 1889), is invalid, since it was described without reference to a species. By his action in fixing *E. bicincta* Erichs. as genotype (1906), Kirkaldy validated the genus, which should thus be attributed to Kirkaldy and not to Ashmead. The establishment by Kirkaldy of a new genus *Eurymelias* with type *E. hyacinthus* was therefore unnecessary, and *Eurymelias* automatically becomes a synonym *Eurymeloides*, since *bicincta* and *hyacinthus* are generically identical.

This genus contains a larger number of species than the other genera, and comprises insects ranging in size from five to eleven millimetres. The head in profile is slightly convexly rounded, in some species almost flat, and the vertex seen from above is angular. The tegmen has distinct apical cells and a well-developed appendix. The hind tibiae have three to five distinct spurs decreasing in size from the apex of the tibia to the base. The male genitalia have large, broad sub-genital plates, with distinct curved styles, that lie along the ventral external margin of the plates, but are not covered by them. The aedeagus invariably has one or two spines on the side of the posterior edge, and no anterior ventral process.

EURYMELOIDES BICINCTA Erichson (Genotype).

Eurymela bicincta Erichs., Beitrag zür fauna v. V. D. L., Archiv. Naturgesch. 286, 1842. *Eurymeloides bicinctellus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 352, 1906.

Description.—Length, 7 mm. Head, fuscous mottled with straminaceous, the vertex mostly black, or head entirely black. Pronotum, brown or black, with a narrow white posterior margin. Scutellum, brown or black. Tegmen, shiny black with two narrow white fasciae, the anterior stretching from the middle of the costa to just anterior to the apex of the scutellum (when the tegmina are folded); the posterior transverse and widest at the costal margin; in addition to the fasciae there may be some small white spots on the tegmina. Legs, coxae, femora, and first tarsal joint of hind legs, white, the rest black; hind tibiae with three spurs. Abdomen, ♂ ventral surface black, but for the posterior margin of each segment, which is white; ♀ ventral surface white, genital segments black. (There is a variety with the abdomen, coxae, and femora, scarlet.) Male genitalia, aedeagus as in figure (fig. B, fig. 14).

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

EURYMELOIDES PULCHRA Signoret.

Eurymela pulchra Sign., Ann. Soc. Ent. Fr. (2) viii.; 508, 1850. *Eurymela discifera* Walk., List Homoptera iii.; 641, 1851. *Eurymeloides hyacinthus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 351, 1906.

Description. Length, 11 mm. Head, clypeus and vertex black, the latter with a median orange stripe; maxillary plates and lorae pale straminaceous; frons pale rose with a median black stripe; eyes orange-red. Pronotum, black, with two more or less oval orange areas; entirely black, or entirely orange. Scutellum, orange, with a round black spot lying against the anterior margin. Tegmen, black, with two yellow, pink or whitish transverse fasciae; the anterior fascia is made up of two distinct pale areas that meet at the claval suture; these two anterior fasciae may be quite separate or absent altogether; posterior fascia narrowly wedge-shaped. Legs, coxae and proximal halves of femora pale rose, distal halves of the femora, tibiae and tarsi, black, but for the first tarsal segment of the hind legs, which is white; hind tibiae with five spurs decreasing in size from the apex of the tibia to its base, and numerous spines. Abdomen, pale greenish-yellow; genital segments, black. Male genitalia, aedeagus as in figure (fig. B, fig. 13).

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

EURYMELOIDES LINEATA Signoret.

Eurymela lineata Sign., Ann. Soc. Ent. Fr. (2) viii.; 509, 1850. *Eurymela livida* Walk., List Homoptera iii.; 642, 1851. *Eurymela decisa* Walk., List Homoptera iii.; 643, 1851.

Description.—Length, 8-9 mm. Head, Black, external border of the lorae straminaceous; frons red, with a central longitudinal black stripe; eyes ferrugineous. (The head may be entirely yellow but for a black posterior border.) Pronotum, black, with a narrow white posterior margin, or almost entirely red. Scutellum, either all black, or black with a red apex. Tegmen, black, purplish-black or purplish-brown, with a posterior transverse wedge-shaped fascia, widest against the anterior border of the tegmen; veins anterior to the fascia, pale yellow, posterior to the fascia, black. (The veins may be faintly pale or black, and the fascia divided into two areas, a broad triangular area against the costal margin of the tegmen, and a small irregular area against the hind margin; the latter may be absent; the tegmina in some specimens are entirely black with no pale markings.) Legs, coxae and the proximal halves of the femora red; distal halves of the femora, tibiae and tarsi, black; hind tibiae with three spurs and numerous spines. Abdomen, ventral surface red, genital segments, bluish-black. Male genitalia, aedeagus as in figure (fig. B, fig. 17).

Distribution.—New South Wales, Victoria and South Australia.

EURYMELOIDES PUNCTATA Signoret.

Eurymela punctata Sign., Ann. Soc. Ent. Fr. (2) viii.; 511, 1850. *Eurymela trifasciata* Sign., Ann. Soc. Ent. Fr. (2) viii.; 512, 1850. *Eurymela ocellata* Sign., Ann. Soc. Ent. Fr. (2) viii.; 511, 1850. *Eurymela varia* Walk., List Homoptera iii.; 644, 1851. *Eurymeloides cumulosus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 351, 1906. *Eurymeloides ornatus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 352.

DESCRIPTION OF FIGURE C.

Figure 1 .. *Platyeurymela atra.*
„ 2 .. *Paurocurymela parva.*
„ 3 .. *Eurymela fenestrata,* ventral view of apex of abdomen of female, to show overlapping lobes of last segment.
„ 4 .. *Eurymelops rubrovittata,* ventral view of apex of abdomen of female.
„ 5 .. *Eurymela fenestrata,* head in profile.
„ 6 .. *Eurymelops rubrovittata,* head in profile.
„ 7 .. *Eurymeloides nigra,* hind tibia.
„ 8 .. *Eurymela fenestrata,* lateral view of male genitalia; sp., sub-genital plate; p., paramere; a., aedeagus; s., style.
„ 9 .. *Eurymelita terminalis,* lateral view of male genitalia; lettering as in fig. 8.
„ 10 .. *Pogonoscopus myrmex,* lateral view of male genitalia; lettering as in fig. 8.
„ 11 .. *Eurymeloides rubrivenosus* of Kirkaldy, aedeagus.
„ 12 .. *Eurymeloides rubrivenosus* of Kirkaldy, sub-genital plate and paramere, (p.).
„ 13 .. *Eurymeloides froggatti,* sub-genital plate, style (s.) and paramere (p.).
„ 14 .. *Ipo pellucida,* sub-genital plate and paramere (p.).
„ 15 .. *Ipo pellucida,* aedeagus.
„ 16 .. *Lasioscopus acmaeops,* sub-genital plate, style, (s.) and paramere, (p.).

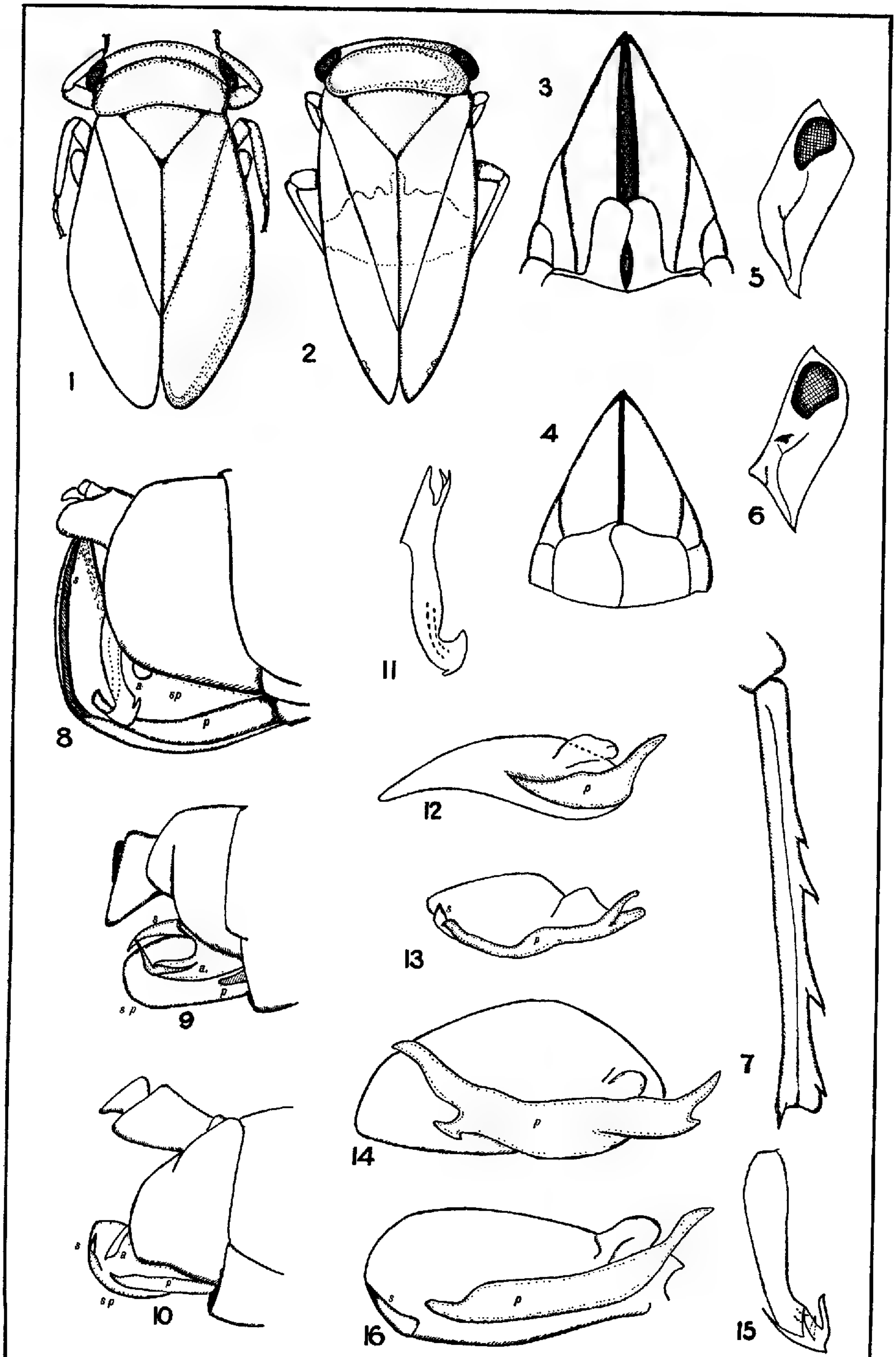


Fig. C.
[For description see opposite page]

1906. *Eurymeloides testaceus* Dist., Ann. Soc. Ent. Belg. 52; 101, 1908. *Eurymeloides atromaculatus* Dist., Ann. Soc. Ent. Belg. 52; 103, 1908.

This species, as the synonymy suggests, is a very variable one, and were it not for the large amount of material examined which showed transitional forms between the named varieties, would have been treated as several species. From the material available, forty-four specimens were selected, of which no two were identical; the genitalia of a number of these were examined, but no appreciable differences discovered.

Description.—Length, 6-8 mm. Head and pronotum, black mottled with yellow, pale brown mottled with yellow, or dark brown mottled with white; eyes reddish-brown. Scutellum, similar to pronotum, or with black or brown markings, or all black or all brown. Tegmen, usually black, but may be pale or dark brown; there may be two complete whitish fasciae, the anterior oblique and the posterior transverse; either of the fasciae may be incomplete, and have black or brown areas of varying shape in the middle of them; there may be a third transverse fascia between the other two; the fasciae may be an opaque white or merely semi-transparent areas of the tegmen; in nearly all the varieties examined the distal termination of the two anal veins have been white; the clavus may be dotted with white or light brown spots. Legs, coxae and femora light brown; tibiae and tarsi dark brown, excepting the first tarsal segment of the hind legs, which is white, and the spurs and spines on the hind tibiae which are white or yellow; hind tibiae with five spurs. Abdomen, ventral surface very pale brown or yellow, occasionally scarlet (this latter colour is found in aberrant forms of many species); genital segments dark brown or black. Male genitalia, aedeagus as in figure (fig. B, fig. 16).

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

EURYMELOIDES PERPUSILLA Walker.

Eurymela perpusilla Walk., Ins. Saund. Homopt. 83, 1858.

Description.—Length, 6 mm. Head, maxillary plates and lorae yellow; the clypeus, frons and vertex, black; eyes, greyish-yellow. Pronotum and scutellum, black mottled with yellow. Tegmen, black with two bright yellow fasciae; the anterior extending from the base of the tegmen to beyond the middle of the costal margin (not transverse but longitudinal), the posterior transverse and widest against the costal margin. In addition to two distinct fasciae there may be a number of yellowish or whitish spots on the tegmen, and the posterior fascia may be broken up into a number of irregular pale areas. Legs, coxae and proximal halves of the femora yellow, distal halves of femora and tarsi black; tibiae black with yellow spines; hind tibiae with three spurs. Abdomen, ventral surface black. Male genitalia, aedeagus as in figure (fig. B, fig. 20).

Distribution.—Queensland and New South Wales.

EURYMELOIDES MARMORATA Burmeister.

Eurymela marmorata Burm., Genera Insectorum, 1838-45. *Bythoscopus nigro-aeneus* Walk., List Homoptera iii.; 867, 1851. *Eurymeloides zonatus* Dist., Ann. Soc. Ent. Belg. 52; 104, 1908.

Description.—Length, 7 mm. Head, black, mottled with light or dark brown. Pronotum, light brown mottled with black and dark brown. Scutellum, black, frequently with pale markings on the posterior half. Tegmen, black or brown, with two indistinct yellowish or reddish transverse fasciae; in addition there may be a number of small pale markings between and on both sides of the fasciae; these may be so numerous that much less than half the total area of the tegmen is black or brown. Legs, coxae and femora yellowish or reddish-brown; tibiae dark brown with pale spots, hind tibiae with three spurs. Abdomen, ventral surface pale brown or reddish-brown; genital segments pale brown. Male genitalia, aedeagus as in figure (fig. B, fig. 15).

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

Eurymeloides adspersa Signoret.

Eurymela adspersa Sign., Ann. Soc. Ent. Fr. (2) viii.; 510, 1850.

Description.—Length, 9 mm. Head, pronotum, and scutellum, black, mottled with reddish-brown and yellow; eyes greyish-brown. Tegmen, black with yellowish and whitish irregular markings arranged in the form of three indistinct fasciae; the claval area dotted with white spots. Legs, coxae and femora pale brown; tibiae dark brown with yellowish spots; hind tibiae with three spurs. Abdomen, ventral surface yellow; genital segments very dark brown. Male genitalia, aedeagus as in figure (fig. B, fig. 21).

Distribution.—Tasmania and Victoria.

Eurymeloides walkeri Distant.

Eurymeloides walkeri Dist., Ann. Soc. Ent. Belg. 52; 102, 1908.

Description.—Length, 7·5 mm. Head, bright egg-yellow, vertex largely black except for the lateral margins; a median longitudinal stripe and a small spot on each side near the edge of the pronotum, which are bright yellow; middle of frons and clypeus black. Pronotum, bright yellow, with a large black spot behind each eye and a pair of longitudinal black stripes in the middle. Scutellum, black with the apex and markings on the disc yellow. Tegmen, shiny black, with an irregular arcuate spot on the corium anteriorly, a wedge-shaped white spot on the costa posteriorly extending half-way to the apex of the clavus, and a pair of small white spots between the apex of the wedge-shaped spot and the apex of the clavus; claval suture with a long percurrent white stripe, a small arcuate white band extending from the claval suture inwards towards the apex of the scutellum at a level slightly anterior to the fascia on the corium; three small white spots on the clavus, one at the apex of each of the claval veins, the other slightly beyond the inner end of the claval fascia, on a level with the apex of the scutellum. Legs, coxae, basal halves of femora, and apices of hind femora, yellow, the rest of the legs black, except for the first segment of the hind tarsi, a row of spots down the outer edges of the tibiae and the bases of the hind tibial spines, which are yellowish-white. Abdomen, ventral surface bright yellow, sub-genital plates in male shining black; sides of the ninth segment in the female black; disc of penultimate segments in both sexes somewhat infuscate. Male genitalia, aedeagus as in figure (fig. B, fig. 18).

Distribution.—Western Australia (Albany).

Eurymeloides minutum, n. sp.

Description.—Length, 5 mm. Head, black, mottled with yellow and brown; vertex as seen from above convex, not angular. Pronotum, black, with a few scattered small yellow spots. Scutellum, entirely black. Tegmen, hyaline, very dark shiny brown in colour with two white fasciae, the anterior divided into two more or less oval parts, both lying in the costal area; the posterior, an irregular transverse fascia, interrupted near the middle; it is wider at the anterior than at the posterior border of the tegmen; the claval area has a number of small yellow spots on it, and there are a few larger round yellow spots along the costal margin. Legs, coxae and femora pale yellowish-brown; tibiae and tarsi dark brown with white spots at the bases of the spines; proximal tarsal segments of hind legs, white; hind tibiae with three spurs. Abdomen, very dark brown; genital segments of female pale brown, of male dark brown. Male genitalia, aedeagus as in figure (fig. B, fig. 19).

Type, ♀ from Matcham, near Gosford, New South Wales (March 27, 1924), paratype ♂ from the same locality; both specimens in the collection of the Australian Museum, Sydney.

Eurymeloides nigra, n. sp.

Description.—Length, 10 mm. Head, black, but for the external margins of the lorae, the external borders of the maxillary plates and the sides of the frons, which are white; eyes, scarlet. Pronotum and scutellum, black. Tegmen, black, with a single transverse posterior wedge-shaped white fascia, widest at the costal margin. (Paratype, with a small circular anterior fascia.) Legs, black, hind tibiae with three spurs (fig. C, fig. 7). Abdomen, ventral surface, the anterior three visible segments black anteriorly, pale brown posteriorly, the remaining segments black.

Distribution.—New Guinea.

Type, ♀ from Bisiatabu, Port Moresby, New Guinea. Paratype ♀ from the same locality. Both specimens in the collection of the South Australian Museum.

Eurymelessa, gen. nov.

This genus can be separated from Eurymeloides, which it somewhat resembles, principally by the characters of the male genitalia. The styles on the sub-genital plates are rudimentary (fig. C, fig. 13), and the aedeagus is longer and narrower than those of Eurymeloides spp. (fig. B, figs. 22 and 23). The head is slightly sub-angularly produced, and is inclined at a steep angle to the rest of the body, the maxillary plates are very broad. The venation of the tegmina is not reticulate apically, and the appendix is well developed. The hind tibiae have two spurs and numerous spines.

EURYMELESSA MORUYANA Distant (Genotype).

Eurymeloides moruyana Dist., Ann. Nat. Hist. 20; 188, 1917.

Description.—Length, 6·5-7 mm. Head, black with the posterior margin of the vertex moderately pale brown. Pronotum, entirely pale brown. Scutellum, black. Tegmen, dark brown shading to black apically; an oblique stripe across the middle of the corium from the claval suture to the costa; the costal edge, most anterior, and apices of the two anal veins, yellow or white; two apical white spots on the corium, one at the apex of the clavus, the other on the costal margin, at the same level; clavus sometimes entirely pale yellow. Legs, brown, last segment of the hind tarsi fuscous. Abdomen, ventral surface yellow. Male genitalia, sub-genital plates with rudimentary styles (fig. C, fig. 13); aedeagus long and narrow (fig. B, fig. 22).

Distribution.—Queensland and New South Wales.

Eurymelessa froggatti, n. sp.

Description.—Length, 6 mm. Head, black, or black with a pale brown crown; eyes, reddish-brown. Pronotum, either entirely pale brown, or entirely black. Scutellum, black. Tegmen, with one incomplete whitish apical fascia, or a number of small white apical spots; clavus and claval border of the corium, often largely dirty yellow. Legs, brown, last segment of hind tarsi black. Abdomen, ventral surface black, with the posterior margins of the segments narrowly pale brown. Male genitalia, aedeagus as in figure (fig. B, fig. 23).

Distribution.—Queensland, New South Wales, and Victoria.

Type, ♂ in the collection of the South Australian Museum. Described from a long series of males and females.

Eurymelita, gen. nov.

This genus contains a species very similar in general appearance to insects belonging to the genus Eurymeloides. The head, in profile, is almost flat. The tegmina have large, distinct apical cells and a well-developed appendix, and the front and middle femora have strong outwardly curved spines, the front with one and the middle with three spines. The hind tibiae have two distinct spurs on the apical half and several feeble ones towards the base. The male genitalia have very short parameres, and the sub-genital plates have a style arising from the dorsal edge, and not from the ventral edge as in all previous genera. (Fig. B, fig. 25, and fig. C, fig. 9).

The species described below is variable in colouration. Two main varieties exist, one with black tegmina and narrow pinkish-coloured fasciae, the other with brown tegmina and whitish fasciae. These varieties are connected by a series of transitional forms, but no morphological differences have been discovered between any of the many specimens examined.

EURYMELITA TERMINALIS Walker.

Eurymela terminalis Walk., List Homoptera iii.; 642, 1851.

Description.—Length, 9 mm. Head, usually all black, but for the maxillary plates, which are whitish; the latter may be pale chocolate colour and the frons have red markings on it, or the head may be entirely brown. Pronotum and scutellum, black with the hind margins chocolate or rufous; sometimes the chocolate colouration extends right over these sclerites; they may also be pale brown. Tegmen, black with two narrow white, cream or dull pink fasciae; the anterior one where it meets the hind margin of the clavus extends anteriorly towards the head, so that when the tegmina are closed, the anterior fasciae form an X; posterior fascia wider at the costal than at the hind margin of the tegmen; in some specimens the area of the tegmen anterior to the proximal fascia, is chocolate in colour, in others the whole tegmen, other than the fasciae, is pale brown. Legs, coxae and proximal halves of femora reddish-brown, distal halves of femora, tibiae and tarsi, black. Abdomen, ventral surface red, genital segments black. Male genitalia, sub-genital plates, parameres and aedeagus as in fig. B, figs. 24 and 25, and fig. C, fig. 9.

Distribution.—Queensland, New South Wales, Victoria, and South Australia.

MISCELLANEOUS NOTES.

The insects described under the following names have not been included in this revision, since they belong to the Ipoini.

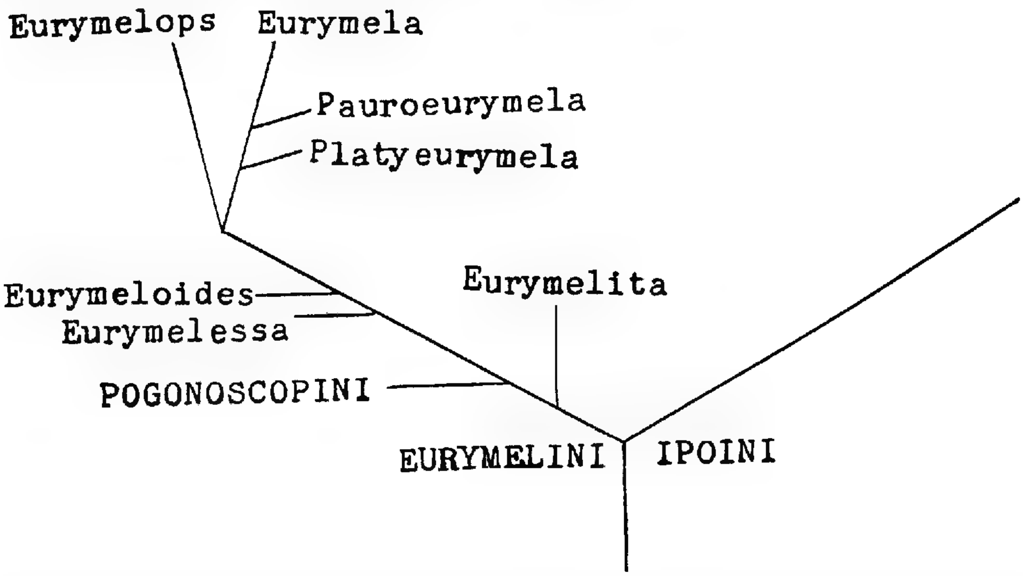
Eurymela porriginosa Sign., Ann. Soc. Ent. Fr. (2) viii.; 512, 1850. *Eurymela lignosa* Walk., Homopt. Ins. Suppl. 166, 1858. *Eurymeloides lentiginosus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 353, 1906. *Eurymeloides rubrivenosus* Kirk., H.S.P.A. Exp. Sta. Bull. 1 (9); 353, 1906. *Eurymeloides insignis* Dist., Ann. Soc. Ent. Belg. 52; 103; 1908.

The following were originally placed in the genus *Eurymeloides* by Jacobi: *Pogonoscopus lenis* Jacobi and *Lasioscopus acmaeops* Jacobi. (Jacobi, A., 1909, Faun. S.-W. Aust., Michaelsen u. Hartmeyer ii.; 340.) They were transferred by China (1926) to their present genera. Walker described two insects under the name of *Eurymela suffusa,* one in 1851 (= *fenestrata* Le. P. & S.), the other in 1858 (Ins. Saund. Homopt. 83); the last-named description is vague and the type is lost, consequently this species cannot be identified with any certainty. In addition to the above, two other insects have at some time been referred to the genus *Eurymela;* one is *Olonia maura* F. (Ent. Syst. iv.; 40, 1794), which apparently both Signoret and Distant understood to be a *Eurymela* sp.; the other is *Dardus abbreviatus* Guer., of which a synonym was described under the name of *Eurybrachys laeta* White (Eyre Exped. 1; 433, 1845), and subsequently this name was quoted by Kirkaldy (H.S.P.A. Exp. Sta. Bull. 1 (9); 356, 1906), as being that of a *Eurymela* sp.

Conclusions.

This paper has dealt only with the Eurymelini, which is a natural tribe and not an artificial grouping of unrelated genera. The Ipoini, on the other hand, will probably have to be split up into three or four divisions, since as at present defined, it contains a diverse assemblage of forms. Whilst as far as it is known, the Eurymelini are confined to trees of the genus *Eucalyptus*, the Ipoini are found on a wide range of trees and shrubs, including Casuarinas and Melaleucas, as well as Eucalypts.

Below is given a chart showing the possible relationships of the three tribes of the Eurymelinae, and the genera of the Eurymelini. The genera *Eurymelita* and *Eurymeloides*, while resembling each other superficially, are not actually closely related, hence in the chart, the former is shown as branching away from the main stem before the Pogonoscopini. It is considered that the original stem from which all three tribes arose, comprised insects with narrow sub-genital plates without any development of a style. While on one hand *Eurymelita terminalis* has developed styles arising from the dorsal edge of the sub-genital plates, the rest of the Eurymelini and the Pogonoscopini bear styles that arise from the ventral edge of the sub-genital plates.



For the purpose of comparison with the genitalia of the Eurymelini, figures are given of the male genitalia of certain of the Pogonoscopini and the Ipoini. Fig. C, figs. 11 and 12, show the aedeagus, sub-genital plates and parameres of *Eurymeloides rubrivenosus* of Kirkaldy (= *E. lentiginosus* of Kirkaldy). Not only is there no style, but the plate itself is narrow, and very dissimilar to those of the Eurymelini.

Figures 14 and 15 (fig. C) represent the aedeagus, sub-genital plates and parameres of *Ipo pellucida* F, and figures 10 and 16 (fig. C,) are of the male genitalia of *Pogonoscopus myrmex* China and *Lasioscopus acmaeops* Jacobi. With the two last-named species, which both belong to the Pogonoscopini, while the sub-genital plates are broad like those of *Eurymela* spp., the style is shorter and the aedeagus is a much simpler structure. The biology and general morphology of the Eurymelinae have been dealt with in an earlier paper by the present author. (Proc. Linn. Soc., N.S.W., 56 (3); 210-226, 1931.)

NOTES ON THE FLORA OF SOUTH AUSTRALIA-NO. 1

BY ERNEST H. ISING

Summary

During a trip to the Far North of our State and to Central Australia in August and September of 1931 and 1932, I collected specimens of native plants in various localities. The following places were visited and collections made :- *Central Australia:* Horse Shoe Bend, August 22 to 25, 1931 ; Rumbalara, August 25, 1931 ; Finke Railway Station, August 22 and 25, 1931 ; Coglin and Wall Creeks, August 26, 1931 ; *South Australia:* Abminga, 9 miles from the border of Central Australia and on the Abminga Creek, August 26 to 31, 1931; Pedirka, on the Hamilton River, August 22, 1931, and August 30, 1932, to September 6, 1932; Hamilton Bore, August 28, 1932; Snake Gully, 16 miles south of Pedirka, September 1, 1932 ; Stevenson River, September 2, 1932; Blood's Creek, September 3, 1932; Dalhousie Springs, September 5 and 6, 1932; Macumba Head Station, September 1 to 6, 1931 ; and Oodnadatta, August 6 to 8, 1931.

NOTES ON THE FLORA OF SOUTH AUSTRALIA—No. 1

(With a description of a new species)

By Ernest H. Ising.

[Read June 8, 1933.]

During a trip to the Far North of our State and to Central Australia in August and September of 1931 and 1932, I collected specimens of native plants in various localities. The following places were visited and collections made:— *Central Australia:* Horse Shoe Bend, August 22 to 25, 1931; Rumbalara, August 25, 1931; Finke Railway Station, August 22 and 25, 1931; Coglin and Wall Creeks, August 26, 1931; *South Australia:* Abminga, 9 miles from the border of Central Australia and on the Abminga Creek, August 26 to 31, 1931; Pedirka, on the Hamilton River, August 22, 1931, and August 30, 1932, to September 6, 1932; Hamilton Bore, August 28, 1932; Snake Gully, 16 miles south of Pedirka, September 1, 1932; Stevenson River, September 2, 1932; Blood's Creek, September 3, 1932; Dalhousie Springs, September 5 and 6, 1932; Macumba Head Station, September 1 to 6, 1931; and Oodnadatta, August 6 to 8, 1931.

The 1931 season was a very good one in the Far North, resulting in a profusion of wild flowers in most of the places visited; 1932 season was not so good from a botanical point of view. Mr. J. M. Black is reporting on the grasses and the species of *Swainsona* (Leguminosae) collected. A number of very interesting specimens were gathered, including a new species of *Bassia (B. Blackiana).* Additional information is given on a number of other species which are imperfectly known.

CHENOPODIACEAE.

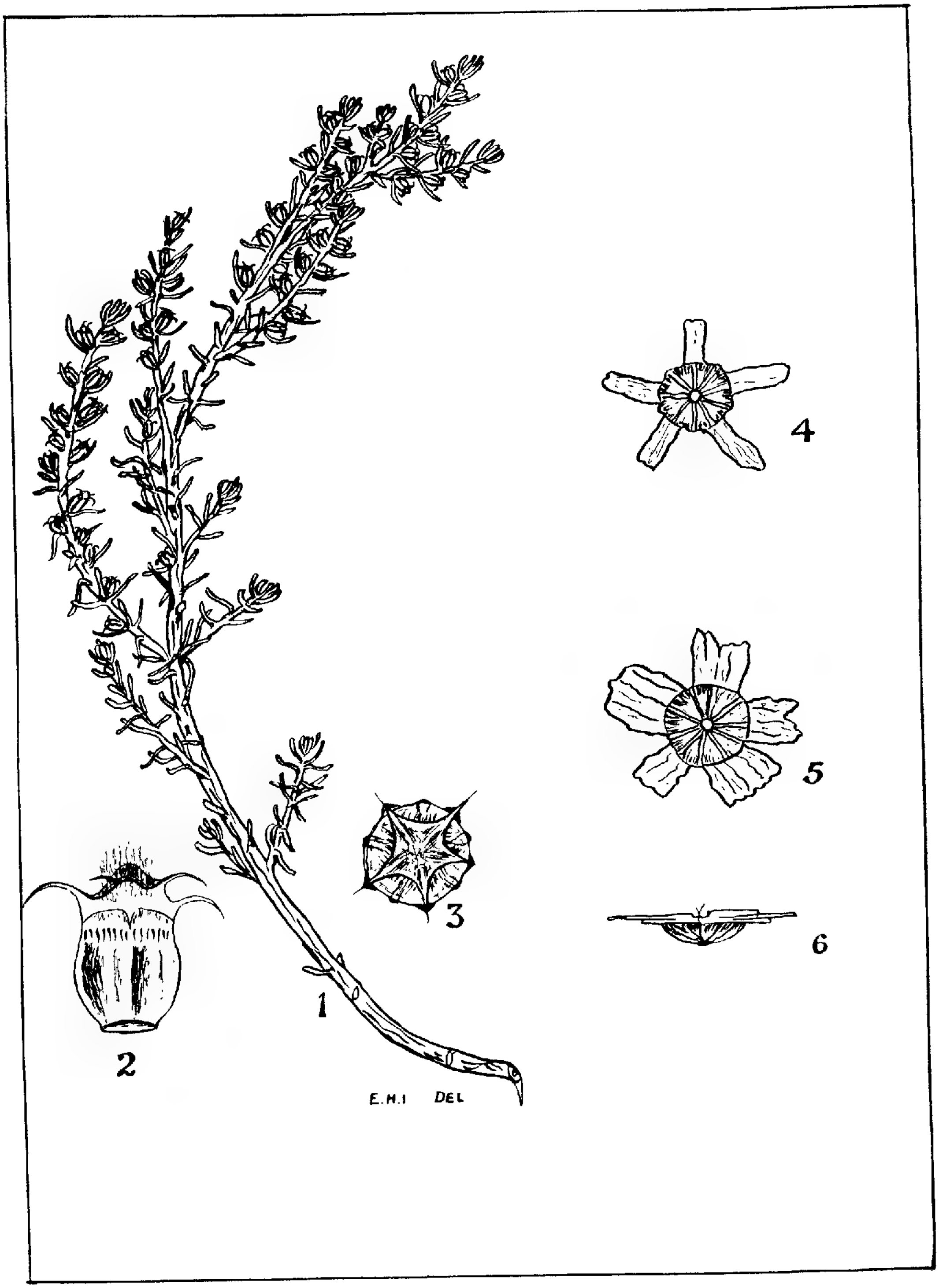
Bassia Blackiana, n. sp. Fruticulus ramosus, ramis rigidis albo-lanosis; folia erecto-patentia, saepius incurva, subteretia, 3-10 mm. longa, 1 mm. lata, hirsuta; flores solitarii in axillis superioribus conferti; perianthium fructiferum urceolatum, tubo globoso glabro circ. 2 mm. dia., 5-costato, areolâ orbiculari, planâ, omnino basilari, limbo erecto puberulo 1 mm. longo, spinis 5, recurvatis, inaequalibus, ½-1½ mm. longis glabris; semen oblique horizontale. (Figs. 1, 2 et 3, p. 92.)

Plant diffuse, 15 to 20 cm. high, branches ascending, numerous, woolly; leaves 3 to 10 mm. long by 1 mm. wide, subcylindrical but flat at base, hirsute when young and hairs tufted around the base; flowers solitary, axillary, densely placed; styles 2; fruiting perianth urceolate, glabrous, 2 mm. long x 2 mm. wide, often with 5 main longitudinal ribs formed by the decurrent bases of the spines and 5 other ribs alternating with them; base circular, very slightly oblique, about 1 mm. diameter; limb erect, conical, 1 mm. long, pubescent, with 5 ridges opposite to and extending to the spines; spines 5, irregular in length, the longest 1½ mm., 3 about 1 mm. long, the fifth ½ mm. long, recurved, reddish and glabrous; seed obliquely horizontal.

Oodnadatta, September 7, 1931. Type (No. 2,670) in author's collection.

This species differs from all others in the shape of the fruiting perianth. It appears to be nearest to *B. recurvicuspis* W. V. Fitzg., but this species only has 4 spines (occasionally 5, two of which are opposite one another) and the tube is cylindrical and smooth. *B. costata* R. H. Anderson has an obconical tube, as also has *B. parviflora* R. H. Anderson, which has 6 straight spines.

Named in honour of Mr. J. M. Black, A.L.S., author of "The Flora of South Australia" and "Naturalised Flora of South Australia." Mr. Black has been



DESCRIPTION OF FIGURE.

1, 2, 3. *Bassia Blackiana*, n. sp. 1. Fruiting branch; nat. size. 2. Fruiting perianth; x 10. 3. View of fruiting perianth from above showing position of spines; x 10. Oodnadatta, September, 1931. Collector, E. H. Ising, No. 2,670.

4, 5, 6. *Kochia scleroptera* J. M. Black. 4 and 5. View of a fruit from below after removal of hairs; x 6. 6. Side view of No. 5; x 6. Coglin Creek, C. Aust., August, 1931. Collector, E. H. Ising, No. 2,713.

a most energetic worker in systematic botany for many years and has named and described 3 new genera, 170 new species and over 70 new varieties of the flora of our State. Only one other plant has been named after Mr. Black and that is a grass *(Stipa Blackii)*, described by C. E. Hubbard of Kew Gardens, England.

B. ventricosa J. M. Black. The fruiting perianth sometimes has about 12 longitudinal ribs hidden by the vestiture, which is pilose to villous. The longest spines are up to 6 mm. long.

B. lanicuspis F. v. M. The leaves are up to 24 mm. long in a specimen from Abminga. The perianth is always densely hirsute and the base small and circular. Far North and Coglin Creek, Central Australia.

B. uniflora (R. Br.) F. v. M. Additional localities are:—*Central Australia:* Horse Shoe Bend and Coglin Creek.

B. intricata R. H. Anderson. The 5 spines, in a specimen (No. 2,663) from Wangiana, are strongly recurved. One from Macumba (No. 2,672) has the 5 spines more or less recurved, while No. 2,671, from the same locality, has straight spines which are practically horizontal.

B. eriacantha (F. v. M.) R. H. Anderson. Specimens from Abminga sometimes have the hairs on the fruits and leaves of a rusty colour.

B. echinopsila F. v. M. The leaves and stems, in a specimen from Oodnadatta, are sparsely pubescent while the perianth tube is glabrous, spines 6 with two of them joined at the base and mostly spreading.

B. Tatei F. v. M. Some specimens collected at Oodnadatta now take the known range of this species about 300 miles further north. The oblique base is often produced as high as the limb. This is an endemic species.

B. bicornis (Lindl.) F. v. M. This species was collected at Wall Creek, Central Australia, having fruits with 4 spines. The specimen collected had 38 fruits, 3 of which had 4 spines, 15 had 3 spines each and the remainder had the normal 2 spines each. This is the first record of fruits being discovered with 4 spines.

B. convexula R. H. Anderson. This species is now recorded from Central Australia, having been found at Horse Shoe Bend.

Kochia scleroptera J. M. Black. As no illustration of this species has previously been published, one is given on p. 92, figs. 4 to 6. The horizontal wings are completely hidden by the dense woolly vestiture of the fruit. The hairs have been removed from the fruits illustrated. An examination of the fruits has revealed a considerable variation in the size and shape of the individual wings which are always hard and rigid. The base of the fruit has 10 prominent longitudinal ribs. The species was described by Mr. Black in 1922 (These Trans., vol. xlvi., 568) and the localities given are all in our Far North. I have now to record the species from Central Australia as it was collected by myself at Coglin Creek close to our border.

DISTRIBUTION OF MYOPORACEAE IN CENTRAL AUSTRALIA.

BY T. T. COLQUHOUN, M. SC.

Summary

This list makes no claim to being a complete digest of the *Myoporaceae,* either in species occurring in this region or their distribution, Professor J. B. Cleland, on his various trips to this area, collected many specimens of members of this family and suggested that I should identify and catalogue them. The present paper is the outcome of that suggestion. I wish to record my thanks to Professor Cleland for the use) of his specimens; to Mr. J. M. Black for his help in establishing a new variety; and to the staff of the National Herbarium, Melbourne, for their aid and the specimens they placed at my disposal.

DISTRIBUTION OF MYOPORACEAE IN CENTRAL AUSTRALIA.

By T. T. Colquhoun, M. Sc., University of Adelaide.

[Read July 13, 1933.]

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The following is a list of species and their distribution:—

MYOPORACEAE Benth. et Hook.

I. Myoporum Banks et Sol.—*M. montanum* R. Br.: Mount Ultim, Brinkley's Bluff, Palm Valley (Finke River), Hermannsburg. *M. deserti* A. Cunn.: Glen Helen (McDonnell Ranges).

II. Eremophila R. Br.—*E. Sturtii* R. Br.: Cockatoo Creek. *E. Latrobei* F. v. M.: Railway bridge over Finke River, between Hann's Range and Prowse's Gap, Cockatoo Creek, Mount Liebig. *E. Gilesii* F. v. M.: North of Burt Well, north of Hann's Range, Haast's Bluff. *E. longifolia* (R. Br.) F. v. M.: Bundey Creek, Fraser River, Hamilton Creek, Mount Hay, Brooke's Soak (30 miles east of Cockatoo Creek), Cockatoo Creek, Mount Liebig. *E. Battii* (1) F. v. M. var. *major* J. M. B.: Railway bridge over Finke River. *E. Freelingii* F. v. M.: Junction of Bundey Creek and Fraser River, Palm Valley, Hermannsburg, Mount Liebig. *E. Duttonii* F. v. M.: Fraser River, Burt Well, north of Woodforde Well, Brooke's Soak. *E. maculata* (Ker.) F. v. M.: Kerr's (on Bundey Creek), Claraville, Burt Well. *E. Dalyana* F. v. M.: Fraser River. *E. Christophori* F. v. M.: 40 miles north of Arltunga. *E. McDonnellii* F. v. M.: Rumbalare.

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(1) At the time of reading this paper, Mr. Black had not published a description of *E. Battii* var. *major;* but had intentions of doing so in the near future.

CONTRIBUTIONS TO THE ORCHIDOLOGY OF AUSTRALIA

BY R. S. ROGERS, M.A., M.D., F.L.S.

Summary

Planta pusilla. Rhizoma repens breve, radicibus fibrosis. Pseudobulbi utriculiformes, lateribus vix compressi, circa 9mm. longi, 5-6 in serie. Folium singulare, planiusculum, subsessile, oblongo-ellipticum, glabrum, coriaceum, *c.* 1.5-2-5 cm. longum, 4-6 mm. latum, apice obtusum, marginibus integris, costa media prominente. Inflorescentiae ad basin pseudobulborum, pedunculo brevi. Flos solitarius, majiusculus, pedicello gracili c. 1 cm. longo.

CONTRIBUTIONS TO THE ORCHIDOLOGY OF AUSTRALIA.

By R. S. Rogers, M.A., M.D., F.L.S.

[Read August 10, 1933.]

Bulbophyllum Weinthalii, Rogers, sp. nov.

Planta pusilla. Rhizoma repens breve, radicibus fibrosis. Pseudobulbi utriculiformes, lateribus vix compressi, circa 9 mm. longi, 5-6 in serie. Folium singulare, planiusculum, subsessile, oblongo-ellipticum, glabrum, coriaceum, c. 1·5-2·5 cm. longum, 4-6 mm. latum, apice obtusum, marginibus integris, costa media prominente. Inflorescentiae ad basin pseudobulborum, pedunculo brevi. Flos solitarius, majiusculus, pedicello gracili c. 1 cm. longo. Segmenta perianthii alba vel subviridia, notationibus porphyreis vel purpureis instructa. Sepalum dorsale late lanceolatum, erecto-incurvum, concavum, c. 9 mm. longum, 5 mm. latum, apice acuta vel leviter apiculata. Sepala lateralia oblique falco-triangularia, semi-patentia, sepalo dorsali aequantia vel paulum breviora, apice falcata, margine anteriore lunato, basibus pede columnae adnatis cum eo saccum vel humilem fossam formantibus. Petala erecta vel leviter divergentia oblongo-ovalia, apicibus obtusissimis, 3-nervia, c. 6 mm. longa, 3 mm. lata. Labellum mobile, linguiforme, magnum, conspicuum, carnosum, atropurpureum, cum apice pedis columnae articulatum, inferne ad pedem columnae reflexum, deinde valderecurvum; trilobatum, lobis lateralibus minutissimis dentiformibus, lobo medio obtusissimo marginibus revolutis; lamina in medio concava, callis duo latis longitudinaliter parallelis confluentibus prope apicem instructa. Columna brevis, alis membranaceis quadratis. Pes gynostemii elongatus, c. 1 cm. longus, gracilis, linearis, basibus sepalorum lateralium adnatus. Anthera opercularis; pollinia 4.

A diminutive plant with a short creeping rhizome and fibrous roots. Pseudobulbs flask-shaped, wrinkled, scarcely compressed laterally, about 6 in a row, 9 mm. high. Leaf apical on pseudobulb, single, rather flat, coriaceous, oblong-elliptical, subsessile, glabrous, margins entire, about 1·5-2·5 cm. long, 4-6 cm. wide, obtuse at apex, with very conspicuous midrib. Flower single, relatively large for size of plant; ovary-pedicel slender, about 1·0-1·1 cm. long; peduncle short. Perianth segments white or pale greenish, dotted or splashed with reddish-brown or magenta markings. Dorsal sepal rather widely lanceolate, erecto-incurved over the column, concave, apex acute or slightly apiculate, about 9 mm. long, 5 mm. wide; lateral sepals semi-patent, acutely falcate at the apex, obliquely falco-triangular, about equal to or a little shorter than the dorsal sepal; anterior margin crescentic; adnate throughout their entire base to the foot of the column for a distance of about 1·0 cm., forming with it a shallow pouch or trough. Petals erect or slightly divergent, oblong-oval, apices very blunt, 3-nerved, about 6 mm. long, 3 mm. wide. Labellum movable, articulated to the apex of the column-foot, large, linguiform, conspicuous, fleshy, dark purple, the lower part reflexed against the column-foot, then markedly recurved upwards and forwards; trilobed; the lateral lobes dentate, very minute; middle lobe very obtuse, with revolute margins; lamina dotted, concave in the middle, traversed by two wide parallel longitudinal calli coalescing near the apex. Column short and stout, with quadrate membranous wings; produced at the base into an elongated slender linear foot about 1·0 cm. long, adnate to the bases of the lateral sepals. Anther opercular, pollinia 4.

New South Wales. Dorrigo, Mr. F. A. Weinthal. Bloomed in cultivation, April, 1932. It was found growing "on the high branches and tops of pine trees."

This little plant would appear to be most closely related to *B. Baileyi,* F. v. M., which it nearly resembles in colour and shape of flowers. Mueller's plant, however, is enormously larger in all its parts and with very differently shaped leaves. The type description gives the measurements of the latter as 3-4 inches long and 1½-2 inches wide; the rhizome up to 6 feet long. Apart from the disparities referred to, the new species has an extraordinary long, slender linear column-foot. It is at least twice as long as the column proper. In Fitzgerald's drawing of *B. Baileyi* the foot is shown as rather stout and hardly as long as the column. It has been suggested that the plant under consideration is the southerly representative of the Queensland species, but the distinctions enunciated seem sufficient to dispose of this theory.

A PRELIMINARY ACCOUNT OF THE BDELLIDAE (SNOUT MITES) OF AUSTRALIA

BY H. WOMERSLEY, A.L.S., F.R.E.S.

Summary

While investigating the possibility of biological control of the Clover Springtail *(Sminthurus viridis* L.) in Western Australia during 1931-32 on behalf of the Commonwealth Council for Scientific and Industrial Research, the writer was successful in finding a species of Bdellid mite *(Biscirus lapidarius* Kramer) which, while occuring locally in a few districts, was present in such numbers as to be rapidly cleaning up the Sminthurids in those areas.

Besides this particular species of Bdellid many others were found in various parts, and while these did not appear to have any controlling effect on the Collembola, yet the family as a whole is well known to be predatory. The important discovery that at least one species may be of use in biological control has led the author, therefore, to make a thorough systematic study of the Australian species. In addition to his own captures he has had invaluable help from many other enthusiastic collectors in other parts of the country. To all these, and in particular to Mr. L. J. Newman, Government Entomologist of Western Australia. Mr. V. V. Hickman of the University of Tasmania, Hobart, and to Mr. D. C. Swan of the Waite Institute, Adelaide, he tenders his deepest thanks.

The result of the study of *Biscirus lapidarius* and its practical effect in controlling *Sminthurns* has been reported and discussed elsewhere (Jour. C.S.I.R., May, 1933). This paper deals with the specific and generic characters of all species now known to occur in Australia, and is intended to assist State Entomologists and others to recognise the individual species and so be able to distinguish the useful one. It should be borne in mind, however, that all species are predatory, and that under suitable conditions any of them may prove to be of value.

Hitherto, only *Bdella (Scirus) hospita* Banks has been recorded from Australia and described from specimens found in ants' nests in Victoria and Tasmania by Mr. A. M. Lea. Later on it is shown that this species is synonymous with *Biscirus symmetricus* Kramer.

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[Read August 10, 1933]

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General Description.

The mites belonging to this family of the Acarina are small, reddish to blackish, elongate, pear-shaped creatures, with a very pronounced beak and the body divided by a distinct separation into cephalothorax and abdomen. They are placed in the suborder Prostigmata because of the opening of the stigmata at the base of the mandibles. The mouth-parts consist of a cone-shaped rostrum furnished ventrally with a number of hairs, and a pair of dorsal mandibles, each of which carries a terminal pair of shears and dorsally one or more long hairs. The shears of the mandibles may or may not be armed internally with teeth. Immediately below the base of the mandibles arises a pair of five-segmented palpi. These are generally long and the second and fifth segments are usually much longer than the rest. The fifth segment may be parallel-sided or may be widened apically. At the apex of the terminal segment are to be found two or three long hairs, possibly of a sensory nature. The cephalothorax is trapezoidal in shape and dorsally carries 2, 4, or 5 eyes (seldom none), 4 characteristic long sensory hairs ("Pseudostigmalorgane"), 0, 2 or 4 other hairs and often subcutaneous shields or lines. Ventrally are attached the front two pairs of epimera, and there are a few short hairs. The abdomen is approximately egg-shaped and is furnished dorsally with several rows of from 2 to 4 hairs or setae. Ventrally it carries the two posterior pairs of epimera, an anterior genital opening with hairs and three pairs of discs ("inneren Genitalnäpfen"), and a posterior anal opening.

There are four pairs (three in larva) of six-segmented legs, each tarsus being furnished with two strong claws and a medial hairy empodial appendage. On the tibia and tarsus are usually one or two long sensory setae. The hairs of the legs are of two kinds, simple and feathered.

The colour of the animals is generally reddish but sometimes varies to blackish. The pigment is entirely subcutaneous. The cuticle is very finely striated, striations being generally transverse but sometimes circular or zig-zag. Cross striations occur on the legs and palpi.

The sexes differ mainly in the structure of the genital organs, but occasionally differences are to be found in the relative lengths of the palpal segments, etc.

The immature stages are but little known and have been described for only a few species. The eggs are slightly elliptical and furnished with a number of clavate chitinous spines. They are brownish and laid on the ground or decaying vegetable fibres. The larvae much resemble the adults, except that they have only three pairs of legs and no genital organs. The nymphs are even more like the adults although still lacking the genitalia.

Australian Species.

Of the many species known to science, mainly from the temperate parts of the world, the following only have as yet been found in Australia:—

Cyta latirostris (Herman); *Bdella lignicola* Can.; *Scirus longirostris* Herman; *Scirus dubitatus*, n. sp.; *Biscirus (Biscirus) lapidarius* (Kramer); *B. (B.) sylvaticus* (Kramer); *B. (B.) intermedius* Sig. Thor.; *B. (B.) symmetricus* (Kramer); *B. (B.) uncinnatus* (Kramer); *B. (B.) australicus*, n. sp.; *B. (B.)*

Description of Figure A.

Fig. 1.	*Cyta latisrostris* (Herm.).	Mandibles and palp (after Berlese).
„ 2.	„ „ „	Dorsal view of animal (after Berlese).
„ 3.	*Bdella lignicola* Can.	Rostrum, ventral view.
„ 4.	„ „ „	Palp.
„ 5.	„ „ „	Dorsal view of entire animal.
„ 6.	„ „ „	Mandible
„ 7.	„ „ „	Cephalothorax from above.
„ 8.	„ „ „	Tarsus.
„ 9.	*Scirus longirostris* Herm.	Mandible.
„ 10.	„ „ „	Palp.
„ 11.	„ „ „	Tibia and tarsus.
„ 12.	„ *dubitatus*, n. sp.	Mandible.
„ 13.	„ „ „ „	Subcutaneous shield of cephalothorax.
„ 14.	„ „ „ „	Palp.
„ 15.	„ „ „ „	Tarsus.
„ 16.	*Biscirus hickmani*, n. sp.	Cephalothorax.
„ 17.	„ „ „ „	Mandible.
„ 18.	„ „ „ „	Tarsus.
„ 19.	„ „ „ „	Palp.
„ 20.	„ „ „ „	Tip of tarsus and claw.
„ 21.	„ *lapidarius* (Kramer).	Dorsal view.
„ 22.	„ „ „	Female genital organ, exserted.
„ 23.	„ „ „	„ „ „ withdrawn.
„ 24.	„ „ „	Genital organ, male.
„ 25.	„ „ „	Larva, dorsal view.
„ 26.	„ „ „	Rostrum of larva.
„ 27.	„ „ „	Mandible of larva.

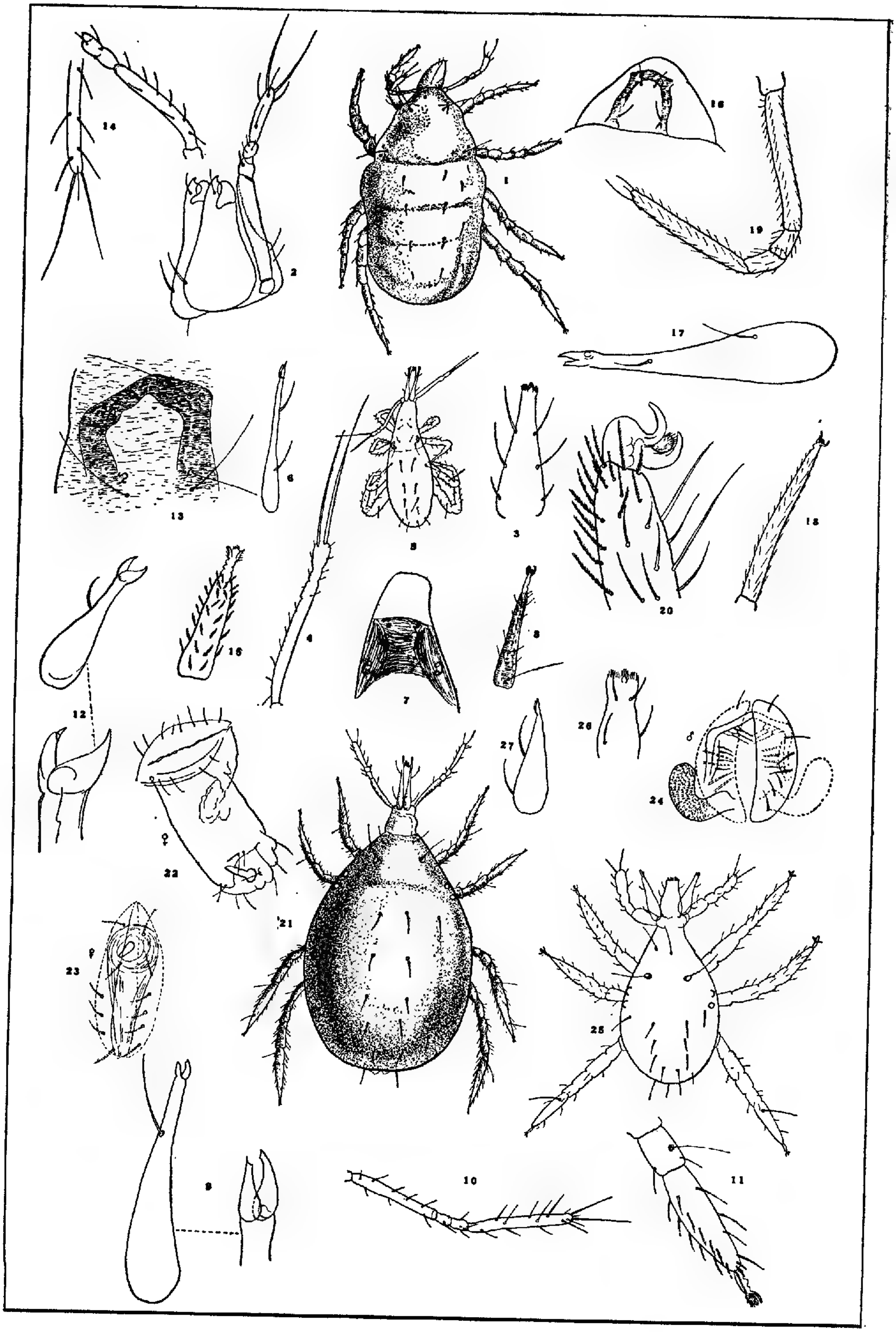

Fig. A. For description see opposite page.

thori, n. sp.; *B. (B.) hickmani*, n. sp.; *B. (Odontoscirus) virgulatus* (Can. et Fanz.).

Of these 13 species, 4 are new to science, the remainder being indistinguishable from European forms. The genera *Trachymolgus* and *Spinibdella* are as yet unknown from this continent, and the genus *Bdella* is only represented by one species. The last genus, however, may be largely increased, both by native and introduced forms.

In working up the systematics (as shown below) of this family, and especially in the identifications, the writer has received invaluable help from Dr. Sig. Thor, of Oslo, to whom he is deeply indebted.

Suborder PROSTIGMATA Kramer, 1877.

Family BDELLIDAE Koch, 1842.

Synopsis of Genera (after Sig. Thor).

1. Segment V. of palp shortened and apically broadened, with 2 or 3 long apical hairs. Mandibles each with two dorsal hairs. Thorax with 2 pairs of hairs and usually 2 narrow longitudinal chitinous shields, these seldom absent. 2

   Segment V. of palp relatively long, cylindrical. Mandibular hairs 1, 2 or many. Thorax with only 2 or 3 pairs of hairs. No chitinous shields on shoulders, seldom a broad chitinous plate. 5

2. An unpaired median frontal eye and two pairs of lateral eyes. Rostrum and mandibles short and thick. The two longitudinal shoulder shields bound anteriorly by a transverse chitinous line. Genus *Cyta* Heyden, 1826.

   Only the lateral eyes present. Mandibles and rostrum long and narrow. Dorsal shields separated, indistinct or absent. 3

3. Cuticle thick, patterned. No thoracic shields. Genus *Trachymolgus* Berlese, 1923

   Cuticle thin and finely striated. Thorax with longitudinal shields or shorter lines. 4

4. Two longitudinal, relatively distinct thoracic shields. Rostrum and mandibles of normal width. Two long mandibular hairs, one more basal, the other in the middle. Genus *Bdella* Latreille, 1795.

   Two short chitinous stripes with a pair of humps. Rostrum and mandibles very narrow, almost needle-like. Both mandibular hairs very small and placed beyond the middle. Genus *Spinibdella* Sig. Thor, 1930.

5. Both apical hairs of fifth palpal segment very long. Mandibles with 1 or 2 hairs. 6

   Both apical hairs of fifth palpal segment not or only slightly lengthened. Mandibles with many hairs (5-24). Three pairs of dorsal thoracic hairs. Genus *Molgus* (Dujardin, 1842) Trouessart, 1894.

6. Each mandible with only one hair. No thoracic shields. Genus *Scirus* Herman, 1804.

7. Each mandible with two hairs. Generally 2 (seldom 3) dorsal thoracic hairs. Distally on thorax a very fine subcutaneous line. Genus *Biscirus* Sig. Thor, 1913.

Genus Cyta Heyden, 1826.

Cyta latirostris (Herman), 1804.

Fig. A, figs. 1-2.

This very small red species is widely distributed in Western Australia. It occurs under bark, etc., where it is probably predaceous on Psocids and other small insects. Apart from its size it is easily recognised by its characteristic shape and by its mandibles. It is a well-known species in Europe and has also been recorded from Northern Africa. A second European species is known, *C. coerulipes*

(Dug.), which differs in having more elongate mandibles and blue legs. This species has not yet been found in Australia.

Localities.—Perth, W. Aust., May 4, 1931 and onwards, (H. W.); Gooseberry Hill, W. Aust., June 2, 1932 (G. E. N.); Donnybrook, W. Aust., June 29, 1932 (E. M.); Denmark, W. Aust., July 5, 1932 (H. W.); Glen Osmond, S. Aust., June, 1933 (H. W.).

Genus Bdella Latreille, 1795.

Bdella lignicola Can., 1885.

Fig. A, figs. 3-8.

Length to 900 μ. Colour pinkish. Mandibles long and slender with two long hairs; width 25 μ. at widest part; jaws small. Rostrum 200 μ. with three pairs of hairs on ventral surface, the basal pair much smaller and finer than the others. Palpi reaching slightly beyond the tip of the mandible; ratio of lengths of segments I. : II. : III. : IV. : V. = 15 μ. : 160 μ. : 30 μ. : 22 μ. : 35 μ., total 262 μ., segment II. with 7 hairs, III. with 1, IV. with 4, and V. with 4, apical setae of segment V. long, the longer one almost as long as the palp, the shorter one two-thirds of the longer. Cephalothorax with the usual arrangement of hairs. Eyes two on each side almost touching, less than a diameter apart. Striation of thorax as figured. Abdomen with five rows of hairs, 4, 2, 2, 2, 4. Legs normally haired.

Specimens of this species have been found by the writer at Glen Osmond, South Australia, in March, 1933, and also in moss from the higher reaches of Waterfall Gully, South Australia, May, 1933.

Genus Scirus Herman, 1804.

Sig. Thor (1931) gives only 3 valid and 3 incertain species as belonging to this genus. Only one of the valid species has so far been found to occur in Australia, but a new species, *Scirus dubitatus*, n. sp., is here brought forward from Tasmania.

The four species may be separated by the following key:—

1. Palpi of moderate length, segments III. and IV. subequal, V. at least thrice as long as III. and IV. together. 3

   Palpi very long, IV. much longer than III., V. at most twice as long as III. and IV. together. 2

2. Palpi long (1,200 μ.) and strong. Segment IV. of palp twice as long as III., V. one and a half times as long as III. and IV. together, II. longer than two-thirds the rostrum. Length to 1,800 μ.

   S. porrectus (Kramer).

   Palpi extraordinarily long and thin (2,000 μ.). Segment IV. half as long again as III., V. twice as long as III. and IV. together. Length (without rostrum), 2,600 μ.

   S. exilicornis (Berlese).

3. Mandibles short and stout, width at widest part not less than one-third the length. Thorax with a very distinct subcutaneous shield, widely bridged anteriorly. Length, 1,625 μ.

   S. dubitatus, n sp.

4. Mandibles more slender, at least four times longer than broad. No thoracic shield. Palp V. slightly shorter than II., apical setae about two-thirds the length of apical segment, segment II. with 10-15 hairs. Jaws of mandible with inner distal tooth.

   S. longirostris Herman.

Scirus longirostris Herman, 1804.

Fig. A, figs. 9-11.

This common and widely distributed species has been on several occasions observed feeding upon *Sminthurus viridis* and other Collembola, but does not appear to occur in the density necessary for effective biological control. It may possibly be an introduction from Europe.

Localities.—Rottnest Island, W. Aust., January 31, 1931 (H. W.); Perth, W. Aust., May 4, 1931 (H. W.); Waite Institute, Adelaide, S. Aust., May 12, 1930 (?); Guildford, W. Aust., 1931 (H. W.); Busselton, W. Aust., 1931 (H. W.); Waite Institute, Adelaide, S. Aust., June, 1931 (D. C. S.); Middle Swan, W. Aust., June 5, 1932 (H. W.); Bridgewater, S. Aust., June 6, 1932 (D. C. S.); Crawley, W. Aust., June 30, 1932 (H. W.); Sassafras, Vict., December, 1931 (H. G. A.); Muresk, W. Aust., August 5, 1932 (H. G. A.).

Scirus dubitatus, n. sp.

Fig. A, figs. 12-15.

Diagnosis.—Length 1,625 μ. Rostrum 270 μ. with 5 pairs of ventral hairs. Mandibles 300 μ. long, very broad basally, 95 μ. wide with a single hair 135 μ. from apex and 78 μ. long. Palpi 360 μ. long, segments II. : III. : IV. : V. = 180 μ. : 30 μ. : 25 μ. : 157 μ. with respectively 8 : 1 : 3 : 9 hairs, apical setae of segment V. subequal 157 μ. and 152 μ. long. Thorax with a very distinct subcutaneous shield on each shoulder and broadly bridged anteriorly, with three pairs of long sensory setae (cf. fig. A, fig. 13). Body setae normal, 65 μ. long. Tarsus as in figure.

Locality.—Under stones on Mount Nelson, Tasmania, September 2, 1932 (V. V. H.). One specimen.

Remarks.—This is a particularly interesting species in that it has such a distinct thoracic shield and three pairs of thoracic hairs. These characters would place it in the genus *Molgus,* but the single mandibular hair and the long apical setae of the palpi are diagnostic of *Scirus.* In view of difficulties like this one can be pardoned for questioning the justification of such generic characters.

Genus Biscirus Sig. Thor, 1913.

This genus is divided by Sig. Thor into two subgenera *Odontoscirus* S. T. in which the jaws of the mandibles are toothed, and *Biscirus* s. str. in which they are without dentitions.

As no fewer than nine of the thirteen species of Bdellidae here listed for Australia belong to this genus, the following key is given for all known valid species based on that of Sig. Thor (1931):—

1. Mandibles with teeth to jaws. Subgen. *Odontoscirus* Sig. Thor, 1913

   Rostrum 300-420 μ. Mandibles 6-7 times as long as broad, both hairs about 75 μ. apart, distal 180 μ. from tip, proximal 165 μ. from base. Jaws of mandibles of equal length, fixed arm with 2 small teeth, movable arm with 4-5 median teeth (3 in var. *dentata* Sig. Thor, 1931). Rostrum ventrally with 6 pairs of hairs. Palpal segments I. : II. : III. : IV. : V. = 25 μ. : 300 μ. : 45 μ. : 38 μ. : 250 μ., II. with 6 hairs, V. with 6-9 hairs. Apical setae of V. 220 μ. Length of animal without rostrum, 2,000 μ. *B. (O.) virgulatus* (Can. et Fanz., 1876).

   Mandibles without teeth. Subgen. *Biscirus* s. str. Sig. Thor, 1913. 2

   3

2. Both mandibular hairs in close proximity. 4

   Mandibular hairs widely separated.

3. Large species 1,700-2,000 μ. Rostrum 660 μ., ventrally with 5-7 pairs of hairs. Mandibles 600 μ. with 2 adjacent hairs about the middle and 230-260 μ. long. Palpi 1,000 μ., segments I. : II. : II. : III. : IV. : V. = 25 μ. : 460 μ. : 88 μ. : 135 μ. : 330 μ., II. with 4 hairs, III. with 1, IV. with 3, and V. with 7. Apical setae of palpi relatively short, 340 μ. and 290 μ. *B. (B.) norvegicus* Sig. Thor, 1905 (Europe).

   Small species 1,100 μ. Rostrum 250 μ., ventrally with 7 pairs of short hairs. Mandibles 220 μ. long, 90 μ. broad at base, as in preceding species but shorter. Hairs of mandibles (65 and 75 μ.) close together in middle. Palpi more like those of *lapidarius* than *norvegicus,* segments I. : II. : III. : IV. : V. = 22 μ. : 110 μ. : 30 μ. : 33 μ. : 105 μ., II. with 3 hairs, V. with 6 hairs with two others near to the apical setae and relatively long as in *norvegicus.* *B. (B.) meridionalis* Sig. Thor, 1931 (N. Africa).

4. The proximal mandibular hair very much reduced, distal hair normal. Rostrum 405 μ. long with 5 pairs of ventral hairs. Mandibles 470 μ., proximal hair 145 μ from base, 24 μ. long in female, 6-8 μ. long in male, distal hair 160 μ. from proximal and the same distance from tip, 90-110 μ. long. Segments of palpi, I. : II. : III. : IV. : V. = 30 μ. : 370 μ. : 65 μ. : 65 μ. female, 85 μ. male : 360 μ. Apical setae of palpi 175 and 150 μ. long. *B. (B.) intermedius* Sig. Thor, 1928.

Both mandibular hairs normally developed. 5

5. Segment V. of palp only two-thirds the length of II. 6

Segment V. of palp equal to II. 7

6. Palp V. long and thin. Rostrum with 6-7 pairs of ventral hairs. Length of animal to 1,580 μ. Mandibles 400 μ., proximal hair 178 μ. from distal, this 126 μ. from tip. Palpi 580 μ. long, segments I. : II. : III. : IV. : V. = 30 μ. : 258 μ. : 40 μ. : 32 μ. : 180 μ., II. with 5 hairs, III. with 1, IV. with 2, and V. with 9 hairs. Apical setae of V. 232 and 174 μ. long. Mandibular hairs 90 and 120 μ. long. *B. (B.) australicus*, n. sp.

Palp relatively shorter and thicker. Rostrum ventrally with only 2-3 pairs of hairs. Length of animal to 2,000 μ. long. Mandibles 500 μ. long, proximal hair 155 μ. from base, distal hair 120 μ. from tip, these hairs only 50-75 μ. long. Palp V. with only 4 hairs, II. with only 2 hairs, one proximal and one distal. *B. (B.) silvaticus* (Kramer), 1881.

7. Segment IV. of palps longer than III. 8

Segment IV. approximately equal to III. 11

8. Segment IV. of palps only one and a half as long as III. 9

Segment IV. three times as long as III. 10

9. Palpi and legs with numerous simple and fine short hairs. Length of body 3,000 μ. Mandibles 615 μ., proximal hair 186 μ. from distal, this 186 μ. from apex, these hairs 145 μ. long. Palpi 2,430 μ. long, segments I. : II. : III. : IV. : V. = 214 μ. : 858 μ. : 143 μ. : 214 μ. : 1,000 μ., apical setae of V. 256 μ. only a little longer than the rest. *B. (B.) hickmani*, n. sp.

Palpi and legs normally haired. Length of body 1,400 μ. Mandibles 500 μ., hairs as in *B. (B.) lapidarius*. Palpi 900 μ. long, segments II. : III. : IV. : V. = 350 μ. : 70 μ. : 110 μ. : 300 μ., II. with 2 (?) distal hairs, IV. with 4 distal and V. with 11 hairs. Apical setae of V. long. *B. (B.) uncinnatus* (Kramer), 1898.

10. Palp V. twice as long as IV. Serrated hairs for some distance along tarsi? Rostrum 420 μ. long. Palp V. entirely over-reaching tip of rostrum, II. : III. : IV. : V. = 270 μ. : 40 μ. : 110 μ. : 220 μ. Length of body 1,250 μ. *B. (B.) anomalicornis* (Berlese), 1916.

Palp V. only one-third as long again as IV. Tarsi with only 2-3 serrated setae at tip. Rostrum 640 μ. long. Palpi with the whole of V. and half of IV. over-reaching tip of rostrum, II. : III. : IV. : V. = 450 μ. : 90 μ. : 260 μ. : 350 μ., II. with 2 hairs, one distal and one basal, III. with 1 hair, IV. with 2 distal hairs and V. with 4. Apical setae of palps equal, 270 μ. long. Mandibles 670 μ. long, proximal hair 239 μ. from distal, distal 180 μ. from tip, these hairs 92 and 120 μ. long, respectively. Rostrum ventrally with two pairs of hairs. Length of body, 3,500 μ. *B. (B.) thori*, n. sp.

11. Palpi relatively short and thick, especially segment V. Rostrum 360 μ. long, ventrally with 6 pairs of short hairs. Mandibles with long hairs, the distal one placed about the middle, 120 μ. long, the proximal one 108 μ. long. Palpi 435 μ. long, segments I. : II. : III. : IV. : V. = 24 μ. : 180 μ. : 43 μ. : 48 μ. : 154 μ., II. with 5 hairs, V. with 8-10 hairs, apical setae 185 μ. and 170 μ. *B. (B.) lapidarius* (Kramer), 1881.

Palpi comparatively longer and thinner. 12

12. Legs slender and sparsely haired. Claws very thick. Palp V. shorter than II. Length, 1,250 μ. *B. (B.) splendidus* (Stoll), 1887.

Legs and claws normal. Palp V. equal to II. Rostrum 500 μ., ventrally with 5 pairs of hairs. Palpi 800 μ. long, II. : III. : IV. : V. = 340 μ. : 60 μ. : 60 μ. : 340 μ., II. with 6-7 hairs, IV. with 3-4, and V. with 9-10, apical setae two-thirds the length of V. *B. (B.) symmetricus* (Kramer), 1898.

Biscirus (Odontoscirus) virgulatus (Can. et Fanz.), 1876.

Fig. B, figs. 29-31.

This species is very local and has only been taken in one locality in Western Australia. It is well known in Europe, and the writer has also found it on the Cape Flats, in South Africa, in 1930.

Locality.—Pelican Point, Perth, W. Aust., June 2, 1932 (H. W.).

Biscirus (Biscirus) intermedius Sig. Thor, 1928.

Fig. B, figs. 14-15.

This species, hitherto only known from Norway, is apparently widely distributed in Australia. Sig. Thor (1931 a) gives the length of the proximal mandibular hairs as from 15-25 μ. In the Australian specimens this hair varies in length according to the sex; in the female it is about 24 μ. long corresponding to Sig. Thor's measurements, in the male it is much shorter only varying from 6-8 μ. Segments III. and IV. of the palps also show a difference in the relative lengths. In the female sex these two segments are subequal, in the male IV. is one-third longer than III.

Localities.—Beverley, W. Aust., June 4, 1931 (H. W.); Waroona, W. Aust., August 6, 1931 (H. W.); Busselton, W. Aust., August 26, 1931 (H. W.); Mullewa, W. Aust., September, 1931 (H. W.); Cascades, Tasm., June 11, 1932 (V. V. H.); St. Ronan's Well, W. Aust., June 1, 1932 (G. E. N.); Denmark, W. Aust., July 5, 1932 (H. W.); Muresk, W. Aust., August 4, 1932 (H. G. A.).

Description of Figure B.

Fig. 1.	*Biscirus*	*lapidarius*	(Kramer).	Cephalothorax of adult.
„ 2.	„	„	„	Palp of adult.
„ 3.	„	„	„	Mandible of adult.
„ 4.	„	„	„	Tibia and tarsus of adult.
„ 5.	„	„	„	A dorsal seta.
„ 6.	„	*thori,*	n. sp.	Rostrum.
„ 7.	„	„	„ „	Mandible.
„ 8.	„	„	„ „	Palp.
„ 9.	„	„	„ „	Tip of tarsus and claws.
„ 10.	„	„	„ „	Mandibular shears.
„ 11.	„	*australicus,*	n. sp.	Mandible.
„ 12.	„	„	„ „	Palp.
„ 13.	„	„	„ „	Rostrum, ventral.
„ 14.	„	*intermedius*	Sig. Thor.	Palp and mandible of male.
„ 15.	„	„	„ „	Base of female mandible.
„ 16.	„	*silvaticus*	(Kram.).	Palp.
„ 17.	„	„	„	Mandible.
„ 18.	„	„	„	Rostrum, ventral.
„ 19.	„	„	„	Tibia and tarsus.
„ 20.	„	*symmetricus*	(Kram.).	Left eyes (from remounted co-types).
„ 21.	„	„	„	Mandible „ „ „
„ 22.	„	„	„	Rostrum from side. (Ditto.)
„ 23.	„	„	„	„ ventral (from other specimens).
„ 24.	„	„	„	Mandible (from other specimens).
„ 25.	„	„	„	Cephalothorax (from other specimens).
„ 26.	„	„	„	Palp.
„ 27.	„	*uncinnatus*	(Kram.).	Palp.
„ 28.	„	„	„	Mandible.
„ 29.	„	*(Odontoscirus) virgulatus*	(C. & F.).	Palp.
„ 30.	„	„ „	„ „	Mandible.
„ 31.	„	„ „	„ „	Tibia and tarsus.

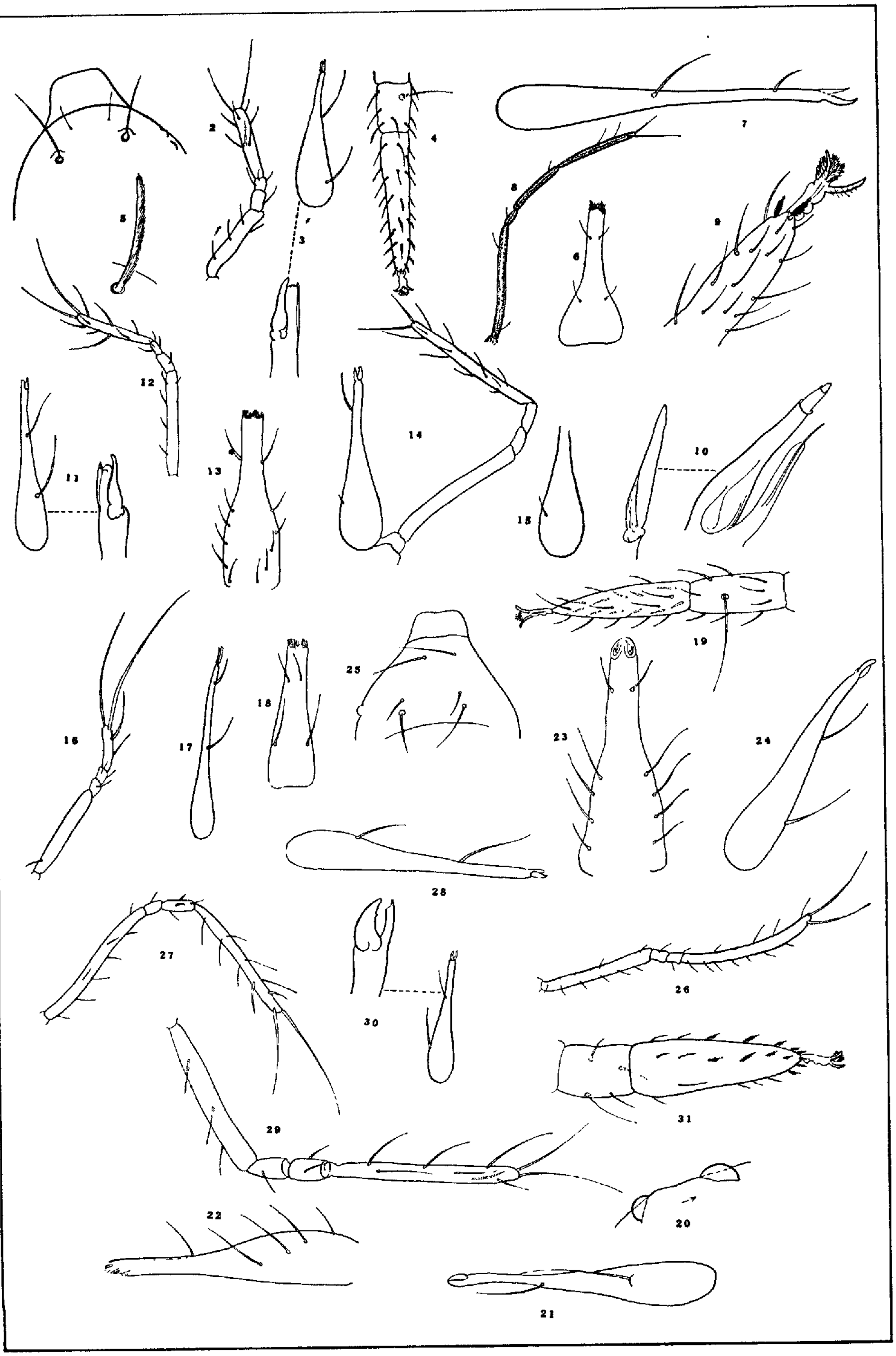

Fig. B. For description see opposite page.

Biscirus (Biscirus) uncinnatus (Kramer), 1898.

Fig. B, figs. 27-28.

This is apparently a rare species in Australia. The material examined agrees entirely with the details given by Sig. Thor, except that in his figure of the palp (after Kramer) he shows only two distal hairs on segment II. In the Australian material there are at least 8 hairs more or less evenly distributed. This species has previously been recorded from America.

Localities.—National Park, Tasm., August 22, 1932 (V. V. H.); Denmark, W. Aust., July 5, 1932 (H. W.).

Biscirus (Biscirus) silvaticus (Kramer), 1881.

Fig. B, figs. 16-19.

This well-known European species has only once been found in Western Australia. The determination was confirmed by Dr. Sig. Thor.
Locality.—Perth, W. Aust., May 5, 1931 (H. W.).

Biscirus (Biscirus) thori, n. sp.

Fig. B, figs. 6-10.

This is a large and local species the specific characters of which have been given in the key. It is named after Dr. Sig. Thor as a slight mark of esteem.
Localities.—Beverley, W. Aust., June 4. 1931 (H. W.); Muresk, W. Aust., June 6, 1932 (H. G. A.).

Biscirus (Biscirus) lapidarius (Kramer), 1881.

Fig. A, figs. 21-27; Fig. B, figs. 1-5.

This is a well-known species in Europe and has also been recorded from North Africa. In Western Australia it is widely distributed although rather local. A full description of this species and its possible value as an agent of biological control of the Lucerne Flea (*Sminthurus viridis* L.) have been given elsewhere (J. C. S. I. R., May, 1933). It can be distinguished from its allies by the above key.

Localities. — Waroona, W. Aust., 1931 onwards (H. W.); Denmark, W. Aust., 1931 onwards (H. W.); Burekup, W. Aust., 1931 (H. W.); Benger, W. Aust., 1932 (E. M.); Donnybrook, W. Aust., 1932 (E. M.); Cannington, W. Aust., 1932 (H. W.).

Biscirus (Biscirus) symmetricus (Kramer), 1898.

Fig. B, figs. 20-26.

A generally widespread species in Australia south of the Tropics but previously only known from South America. The identification of this species has been confirmed by Dr. Sig. Thor.

In 1916 Banks described *Bdella (Scirus) hospita* from specimens taken in ant nests in Victoria and Tasmania by the late Mr. A. M. Lea. In the South Australian Museum are three co-types of Banks' material. As these were mounted in Canada Balsam it was not possible to make out details sufficient to verify the diagnosis. The writer, however, has remounted the specimens and can now state that they are identical with *Biscirus symmetricus* (Kramer). All three specimens, unfortunately, lack palpi, but the drawing given by Banks fits in with Kramer's species. Banks, however, describes them as having only one eye on each side. This is erroneous for there are distinctly two as shown in a figure of the remounted material.

Whether the specimens were really myrmecophilous is extremely doubtful. Their occurrence in the nests of ants was more probably accidental.

Localities.—Lal Lal, Vict., date ?, A. M. Lea, with ? *Polyrachis hexacantha;* Chudleigh, Tasm., date ?, A. M. Lea, with ? *Iridomyrmex.* In W. Aust. at Muresk, Denmark, Busselton, Mullewa and Albany, 1931-2; Trevallyn, Tasm., August 17, 1929 (V. V. H.); Launceston, Tasm., June 27, 1931 (V. V. H.); National Park, Tasm., March 27, 1932 (V. V. H.); Brown Hill Creek, S. Aust., June 25, 1932 (D. C. S.).

Biscirus (Biscirus) hickmani, n. sp.

Fig. A, figs. 16-20.

This is a very large and striking form, of which only two specimens have so far been collected. In the short terminal setae of the palpi it shows some relationship to the genus *Molgus.* The details of specific value are fully given in the key and amplified by the figures. It is named in honour of its discoverer.

Locality.—Under stones, National Park, Tasm., March 27, 1932 (V. V. H.).

Biscirus (Biscirus) australicus, n. sp.

Fig. B, figs. 11-13.

This species is very closely related to *B. (B.) silvaticus* Kramer but is quite distinct in the length of the palpi and the hairs on the ventral surface of the rostrum, as well as the other characters given in the key.

It has only been found, so far, at Waroona, W. Aust., August 6, 1931 (H. W.), and at Waite Institute, Glen Osmond, S. Aust., June, 1933 (D. C. S.).

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ON SOME ACARINA FROM AUSTRALIA AND SOUTH AFRICA

BY H. WOMERSLEY, F.R.E.S., A.L.S.

Summary

South Africa, to study the occurrence there of the pest known in Western Australia as the Red-legged Earth Mite, and which was the same as Black Sand Mite or "aardvloei" of the Cape. In the district within about 30 miles of Cape Town this mite is a serious pest on the market garden crops, but as the country is not given over to large pastures as in Australia the distribution and abundance is not so large. As the mite had first been described from Cape Province several years before it was noticed in Western Australia and not from elsewhere, it had been concluded that South Africa was its home. The possibility, therefore, that in Cape Province, if anywhere, might be found some natural control, led to the writer's visit under the auspices of the Commonwealth Council for Scientific and Industrial Research.

The correct nomenclature of this species of mite, and also a closely related form, has hitherto been somewhat uncertain to entomologists, and the aim of this paper is mainly to clear this up. In addition, the opportunity is taken to record several other species of Acarina occurring in South Africa and Australia.

ON SOME ACARINA FROM AUSTRALIA AND SOUTH AFRICA.

By H. Womersley, F.R.E.S., A.L.S., Entomologist, South Australian Museum.

[Read September 14, 1933.]

During September, 1930, the writer spent some weeks in Cape Province, South Africa, to study the occurrence there of the pest known in Western Australia as the Red-legged Earth Mite, and which was the same as Black Sand Mite or "aardvloei" of the Cape. In the district within about 30 miles of Cape Town this mite is a serious pest on the market garden crops, but as the country is not given over to large pastures as in Australia the distribution and abundance is not so large. As the mite had first been described from Cape Province several years before it was noticed in Western Australia and not from elsewhere, it had been concluded that South Africa was its home. The possibility, therefore, that in Cape Province, if anywhere, might be found some natural control, led to the writer's visit under the auspices of the Commonwealth Council for Scientific and Industrial Research.

The correct nomenclature of this species of mite, and also a closely related form, has hitherto been somewhat uncertain to entomologists, and the aim of this paper is mainly to clear this up. In addition, the opportunity is taken to record several other species of Acarina occurring in South Africa and Australia.

Family PENTHALEIDAE Oudemans, 1931.

This family, as defined by Dr. A. C. Oudemans, contains only two genera, *Halotydeus*, in which the anal opening is situated terminally, and *Penthaleus* with a dorsal anus.

Genus Halotydeus Berlese, 1903.

Syn. *Penthaleus* Koch, 1838 (in part).

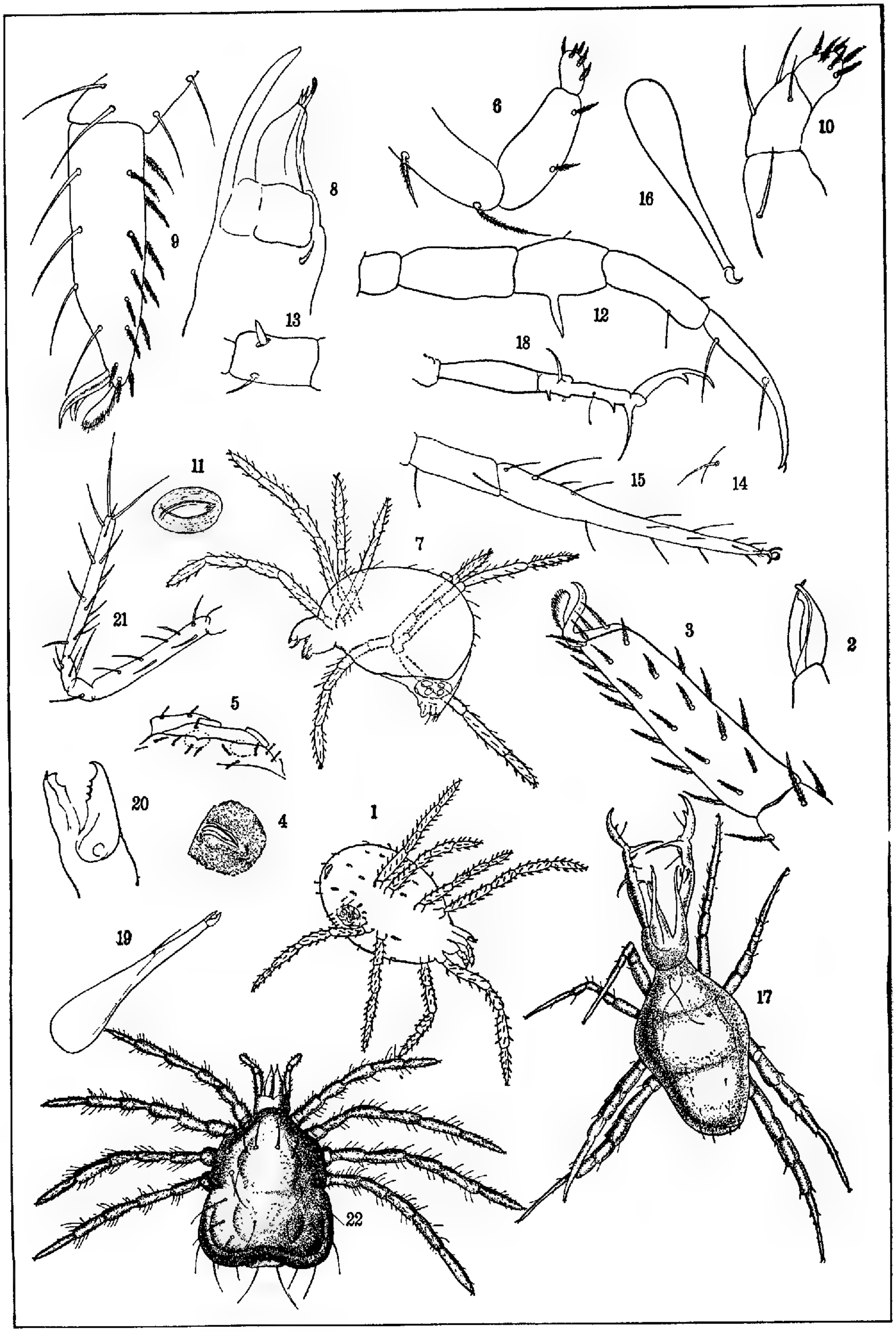
Halotydeus destructor (Jack), 1908.

Figs 1-6.

This mite was first recorded as the Black Sand Mite from Cape Province, South Africa, by Jack in 1908 under the name of *Penthaleus destructor*. Not until 1925, however, was it described in detail, when R. E. Tucker published his memoir. In 1923 it was recorded from Western Australia by L. J. Newman as *Notophallus bicolor* Froggatt, a name given two years earlier to an allied species occurring in New South Wales. Shortly after the publication of Tucker's paper the leaflet of the Western Australian Department of Agriculture was revised, the name being changed to *Penthaleus destructor*.

As recorded by Jack and by Tucker, this mite is very abundant and a serious pest in South Africa on market garden crops such as lettuce. In Western Australia it is widely distributed in almost unbelievable numbers on Subterranean Clover, Cape Weed and many other plants. It also occurs similarly in South Australia, and the writer has had specimens for identification from Victoria, New South Wales, Tasmania and Federal Territory.

In South Africa, in seeking a possible natural control, the writer paid particular attention to two localities. At the Marsh Memorial Homes, Rondebosch, suspicions were directed to a predatious mite belonging to the Bdellidae *(Odontoscirus virgulatus* Can.) which was present in considerable numbers along with the Sand Mite. In the field, observations failed to show any cases of the Bdellid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attacking the Sand Mite, although various small Collembola and Psocids were often attacked. In captivity no evidence could be obtained.

It is the writer's considered opinion that as both this and the next species to be discussed occur together in both countries, and that as one of them may possibly be synonymous with a European species, they are probably introductions to both continents. The European species, which may be the same as the next one to be discussed, has been recorded occasionally to reach pest numbers in France, and it would seem that France and the Southern Mediterranean Region may be their native home and furnish some controlling agency.

The figures given in the plate illustrate the microscopic characters by which this species can be distinguished from its ally. In the field it is not so globose and does not have the dorsal red spot characteristic of the next form. It is entirely black with red legs, which just after an ecdysis are whitish. Occasionally a form is found in which the dorsum is uniformly brown and sharply marked off from the black venter. No morphological differences could be found between this form and the normal.

Genus PENTHALEUS Koch, 1838.

Syn. *Notophallus* R. M. Can., 1886.

PENTHALEUS BICOLOR Froggatt, 1921.

Syn. ? *Penthaleus major* (A. Duges, 1834).
? *Penthaleus haematopus* Koch, 1835.
? *Penthaleus insulanus* Thorell, 1872.

Figs. 7-11.

This species was first described in a very insufficient manner by Froggatt in 1921 as the Blue Oat Mite *(Notophallus bicolor)* from New South Wales. The writer first met with it in South Africa, where it was previously unknown, in all localities where the previous species was to be found. In Western Australia it is similarly to be found, although not in such immense numbers. In certain parts of South Australia it can be considered a minor pest, and in New South Wales has been regarded as serious. It has also been received from Victoria and Federal Territory.

Although no recent detailed descriptions of the European *Penthaleus major* or *haematopus* have been published, it does appear to the writer that there is a possibility that our Australian form may be the same.

Description.—Size to 1·0 mm. rather larger than the preceding species. Colour black with a red dorsal patch surrounding the anus. Legs red, brighter than in preceding. Venter and sometimes the back of the cephalothorax reddish. The palpi are short, three segmented, and the segments relatively shorter and broader than in *H. destructor*. The mandibles are short with the movable finger of practically uniform width, whereas in the previous species it is truncate just before the apex and ends in a fine point. Only the apical segment of the palpi has serrated or feathered setae. The body is more globular than in *Halotydeus* and has the anus situated dorsally. The genital organ on the venter has the usual two pairs of suckers. The first and fourth pairs of legs are the longer and the tarsi end in a pair of strong claws and median pulvillus. The setae on the body and the legs are all strong and simple, except on the under-surface of the tarsi where they are serrated. In *H. destructor* all the setae on the tarsi are serrated.

Neither in this nor the preceding species have males yet been discovered, and both would appear to be largely parthenogenetic as suggested by Tucker for *H. destructor.*

Family BDELLIDAE Duges, 1834.

Genus BISCIRUS Sig. Thor, 1913.

Subgenus ODONTOSCIRUS Sig. Thor, 1913.

ODONTOSCIRUS VIRGULATUS Can. et Fanz.

This species was abundant along with *Halotydeus destructor* (Jack) in many market garden areas around Rondebosch and Stellenbosch, Cape Province, South Africa, in 1930. It is almost world-wide in its distribution, and has recently been recorded from Northern Africa and Australia.

Genus SCIRUS Herman, 1804.

Scirus hessei, n. sp.

Figs 19-21.

Description.—Length, 2·1 mm. Rostrum with 5 pairs of ventral hairs. Mandibles long, reaching tip of rostrum, 430 μ., with a single hair 125 μ. from the tip and 65 μ. in length. Palpi 725 μ., segments II. : III. : IV. : V. = 300 μ. : 50 μ. : 50 μ. : 310 μ.; apical setae of V. 110 μ. and 100 μ.; segment II. with 7-8 hairs, III. with 1, IV. with 4, and V. with 12 hairs. Jaws of mandibles dentate, fixed finger with 2 teeth, movable finger with a strong apical tooth and four smaller median teeth. Eyes, two on each side. Legs and body normally haired.

This species, which the writer has much pleasure in naming after his friend, Dr. Hesse, of the Cape Town Museum, was present in small numbers in a tube of Collembola collected by Dr. Hesse at Stellenbosch C.P., South Africa, August 28, 1927.

The species is very close to *Odontoscirus virgulatus,* but belongs definitely to *Scirus* in having only a single mandibular hair. In its dentate mandibles it occupies a similar position to typical species of *Scirus* that *O. virgulatus* does to typical *Biscirus.*

Family CUNAXIDAE Sig. Thor, 1902.

Genus CUNAXA v. Heyden, 1826.

CUNAXA SETIROSTRIS (Herman, 1804).

Figs. 12-16.

This is a very small scarlet mite found commonly under loose bark on fallen twigs in many parts of Western Australia, from Perth southwards. It occurs along with *Cyta latirostris* but is very much smaller and more brilliant in colour. It is easily distinguished by its shape and the extraordinary palpi. It is a well-known species in Europe, and Dr. Sig. Thor has kindly confirmed my identification of specimens from Perth. It also occurs in South Australia, in the Adelaide district.

CUNAZA TAURUS.

Figs. 17-18.

This species occurred with the preceding in the Perth area during 1931-2. It is also a European species, and can be distinguished by the palpal structure.

Family ANYSTIDAE Oudemans, 1902.

Genus ANYSTIS v. Heyden, 1826.

ANYSTIS BACCARUM (Linnè, 1758).

Fig. 22.

This is a reddish mite of a characteristic square or trapezoidal shape which often occurs in considerable numbers on low herbage. It is predatious in habit and has been observed feeding upon Collembola, Thrips and other soft-bodied insects. Its movements consist of a series of circles. It occurs commonly in the country around Cape Town, South Africa, and the writer has identified it from most areas in Western Australia, south of Geraldton, and from Victoria, South Australia, and New South Wales. It is probably an introduction from Europe.

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EXPLANATION OF FIGURE.

Fig. 1. *Halotydeus destructor* (Jack). Entire mite, from below.
" 2. " " " Mandible.
" 3. " " " Tarsus.
" 4. " " " Anus.
" 5. " " " Genital opening.
" 6. " " " Palp.
" 7. *Penthaleus bicolor* (Froggatt). Entire mite.
" 8. " " " Mandible
" 9. " " " Tarsus.
" 10. " " " Palp.
" 11. " " " Anus.
" 12. *Cunaxa setirostris* (Herman). Palp.
" 13. " " " Segment of palp.
" 14. " " " Dorsal seta.
" 15. " " " Tibia and tarsus.
" 16. " " " Mandible.
" 17. " *taurus*. Entire mite.
" 18. " " Palp.
" 19. *Scirus hessei*, n. sp. Mandible.
" 20. " " " " Jaws of mandible.
" 21. " " " " Palp.
" 22. *Anystis baccarum* (Linnè). Entire mite.

THE ECOLOGY OF THE ABORIGINES OF CENTRAL AUSTRALIA; BOTANIC NOTES

BY PROFESSORS J. B. CLELAND AND T. HARVEY JOHNSTON

Summary

In August, 1932, an expedition organised by the Board for Anthropological Research of the University of Adelaide, in conjunction with the South Australian Museum, and financed in great part by a grant from the Rockefeller Foundation administered by the Australian National Research Council, paid a visit to Mount Liebig, almost due west from Alice Springs and distant 200 miles by road, though only about 142 miles as the crow flies. Mount Liebig is on the route to Ilbilla, some 47 miles further on, which latter place is about 78 miles from the Western Australian border. The country passed through on the way to Mount Liebig, and the immediate surroundings of Mount Liebig itself, give a good idea of the type of country in general and of the facilities for the natives to obtain their various kinds of foods.

THE ECOLOGY OF THE ABORIGINES OF CENTRAL AUSTRALIA; BOTANICAL NOTES.

By Professors J. B. Cleland and T. Harvey Johnston,
University of Adelaide.

[Read September 14, 1933.]

Plate V.

In August, 1932, an expedition organised by the Board for Anthropological Research of the University of Adelaide, in conjunction with the South Australian Museum, and financed in great part by a grant from the Rockefeller Foundation administered by the Australian National Research Council, paid a visit to Mount Liebig, almost due west from Alice Springs and distant 200 miles by road, though only about 142 miles as the crow flies. Mount Liebig is on the route to Ilbilla, some 47 miles further on, which latter place is about 78 miles from the Western Australian border. The country passed through on the way to Mount Liebig, and the immediate surroundings of Mount Liebig itself, give a good idea of the type of country in general and of the facilities for the natives to obtain their various kinds of foods.

Mount Liebig is reached by travelling from Alice Springs 12 miles north over the ranges and then westerly over extensive plains, following closely the northern fringe of the MacDonnell Ranges and skirting outliers of these. The MacDonnells form a series running more or less parallel with each other over a strip of country some 20 or 30 miles wide. Some members of the series are for many miles impassable barriers; others are more or less broken up into separate groups. As one passes westward these separate mountain masses become more prominent and spectacular; several show a striking bluff-like appearance at one end, a mountain range stretching east or west behind this. These mountains and hills extend as far as Mount Liebig, which is their western limit. From the latter one can look in various directions over extensive plains, and observe at varying distances further bold and isolated mountain masses. Ilbilla can be seen to the west; Central Mount Wedge forms a prominent mass to the north-east, some 40 miles away. Between Mount Liebig and Mount Wedge are a series of red sandhills of low elevation with flats between them. The appearance of these parallel ridges running east and west, as viewed from the mountain summit, and as remarked on by Gosse, resembles that of a ploughed field. The various mountain masses are often exceedingly steep, very rocky, and most of them are covered by porcupine grass *(Triodia,* sp.). Amongst these rocks wallabies are to be found, a source of native food, and under their shelter, in some situations, a *Nicotiana,* probably *N. Gossei* Domin, grows luxuriantly, and is much sought after for chewing purposes as a narcotic.

The plains are covered by mulga to varying extents. Another common shrub is known as witchetty bush *(Acacia Kempeana).* Various under-shrubs and herbs grow between and under the mulga, especially where there are more open glades. The sandhill country has a vegetation of its own; a striking feature, in places, is the desert oak *(Casuarina Decaisneana);* while yams *(Ipomoea)* grow here, as well as a porcupine grass used by the natives for obtaining gum.

In such surroundings the native has to find his food supplies. As regards the larger animal foods, these at one time necessarily consisted of the native mammals, birds, and lizards. The rabbit has now extended probably throughout Central Australia and can supply the natives with an abundance of food without great exertion on their part. They are readily dug out by the women by means of a yam stick. This animal has probably solved one of the difficulties in connection with the food supply of the natives on various reserves. As we passed along the western fringes of the MacDonnell Ranges on our return to Alice Springs we were able to observe towards evening how abundant the rabbits had become, the various warrens passed being well populated by them. The native, when he has to obtain his own food, is probably one of the greatest controlling influences on the multiplication of the rabbit in Central Australia. The only other factors to be considered, besides drought and disease, seem to be eagles and hawks, dingoes and wild dogs, feral cats, and *Varanus* lizards. There have been good seasons recently in Central Australia and the rabbit has multiplied correspondingly. Bad years must be expected, and then rabbits may be serious competitors for the available grass and herbage. They will, under these circumstances, compete with the marsupials, and both may suffer. In the settled parts the rabbits must also be competitors with man's cattle and horses. Unfortunately, in the case of the rabbit, experience elsewhere shows that the harm does not stop here; when food is getting scarce the rabbits turn to other sources than their ordinary food supplies; young bushes and shrubs are eaten; finally the bark may be gnawed from the stems of shrubs and trees to reduce the pangs of hunger, and then these perish as well as the rabbits. As yet, in Central Australia, such destruction by these animals does not seem to have occurred during the recent drought, though apparently rabbits were very greatly reduced in many parts.

The fox is slowly spreading over Australia, following the dispersion of the rabbit. It does not seem yet to have reached north of the MacDonnell Ranges. Feral domestic cats have now wandered far from the immediate neighbourhood of stations; a litter of kittens was found and eaten by the natives during our visit to Cockatoo Creek in 1931. The cats often live in rabbit warrens and probably exercise a considerable control, but doubtless they also destroy many native animals and birds.

At Haast's Bluff, about 50 miles east of Mount Liebig, wild horses were being mustered. These animals do not seem to do much harm to the native pastures and herbage. The skeleton of one that had wandered to the foot of Mount Liebig was found during our stay. At Mount Liebig no cattle, camels, goats, horses or donkeys were observed, except such as were in use for transport or food purposes. As yet in the Mount Liebig district, then, with the exception of the rabbit and perhaps some feral cats and dogs, there are no mammals other than those native to the place. The only introduced animal that may be able to alter the appearance of the country or which has modified to any extent the native food supply is thus the rabbit, but the native himself is probably an important controller of it.

The native also exercises a good effect upon the vegetation in his search for witchetty grubs. Some of these are to be obtained in the branches of the gum trees, while others tunnel in the roots of shrubs, such as *Acacia Kempeana.* In both situations they do much damage, and the natives certainly reduce their numbers and minimise their depredations.

A detailed consideration may now be made of the flora from the anthropological aspect. We are indebted more particularly to Mr. J. M. Black and to the Director and staff of the Botanic Gardens, Sydney, for a number of identifications of plants in the following list, and to the Director of the Royal Botanic Gardens, Kew, and Mr. C. E. Hubbard for the identifications of the grasses.

THE USES MADE OF BOTANICAL SUBSTANCES BY THE NATIVES.

Food Substances.

Grass Seeds.

When at Mount Liebig in August, 1932, most of the grasses were dead, as the annuals come up after the summer rains. Doubtless, in suitable seasons, a number of grasses with grain suitable for winnowing occur in its neighbourhood, though the country cannot be considered as a good grass-bearing one. The only two species pointed out as yielding grain for grinding and making into a kind of damper were *Panicum decompositum* and *Dactyloctenium radulans.*

Other Seeds.

The minute but abundant seeds of *Amarantus Mitchelli* and *A. interruptus* are collected at Macdonald Downs, and probably here also, ground and eaten. The seeds of *Portulaca oleracea,* known in some places as manjeru (munyeroo), are also ground and made into a cake. The seeds of four species of Acacia, namely *A. notabilis,* dead finish, the witchetty bush and mulga, are crushed and eaten. The seeds of *Sida corrugata,* var. *goniocarpa,* are ground and cooked, and those of a Heliotrope are also used.

Tubers and Roots.

These comprise the nut grass or jelka (yelka—a sedge, *Cyperus rotundus),* of which the little rounded tubers are eaten; large yams *(Ipomoea calobra)* which probably yield a considerable amount of starchy food; and the somewhat succulent roots of *Boerhavia, Erythrina, Tribulus* and *Clerodendron.* During our stay at Mount Liebig we heard that there were some parties of natives in the sandhills many miles away busily engaged in digging up yams.

Fruits.

The small native fig is eaten raw, or when dried is ground between stones and made into a paste. The black fruit of *Santalum lanceolatum* is also eaten; the wood of this species, as found in Central Australia, lacks any sandalwood scent. The little fleshy fruits of *Enchylaena tomentosa,* the ruby salt-bush, are also used as food. The pulp and seed of the native orange, *Capparis Mitchelli,* are eaten. Several *Solanum* berries are used as food for man, and others not used by him are eaten by kangaroos and wallabies. *Solanum ellipticum* was quite abundant under the mulga, and its fruit was just becoming ripe during our stay; the berries are greenish white and somewhat marbled and have rather a bitter taste; we certainly wondered how the natives could relish them as they apparently did. The small currant-like fruits of *Carissa Brownii* are eaten.

Plants Eaten Green.

These included the parakilja (parakeelya), *Calandrinia balonnensis,* and the two Asclepiads *Cynanchum* and *Marsdenia.* The leaves of *Convolvulus erubescens* are cooked, or rather steamed.

Zygophyllum as a Source of Moisture for Steaming Purposes.—Under this species will be found a description of an ingenious method of steaming vegetable products, such as the cress *Lepidium papillosum* and *Convolvulus erubescens,* by means of hot stones and the juicy leaves of *Zygophyllum ammophilum.*

Gums.

The gums of *Acacia ligulata, A. notabilis* and *A. Kempeana,* as well as those of *Atalaya* and *Ventilago,* are used as food.

Nectar.

The racemes of flowers of the corkwoods *(Hakea)* and of *Grevillea juncifolia* contain much honey, which is extracted by drawing them sideways through the mouth. Nectar is also obtained by sucking the red flowers of *Eremophila Latrobei.* Sweet material is said to be sucked from the base of the old pods of *Crotalaria dissitiflora.*

Grubs.

Witchety grubs, the larvae of beetles or of moths, are a valuable source of food to the native. These creamy-white creatures vary in size up to the thickness and length of a large finger. Uncertainty will probably be experienced in identifying the species of insect to which they belong owing to difficulties in breeding them out. Witchetty grubs were sought for by the natives in the roots of *Salsola kali,* of the native poplar *(Codonocarpus),* of the witchetty bush *(Acacia Kempeana)* and of *Atalaya.* The large galls on the bloodwood, due to a brachyscelid coccid, are broken open and the juicy insect eaten.

Narcotics.

Pitjuri (Pituri).—This is a term now employed by white people for the narcotic used by the aborigines in Central Australia, and obtained from species of *Nicotiana.* The Aranda name is ingulba. Two kinds are recognised at Mount Liebig. The rock ingulba, which is obtained from *N. Gossei* (probably), and is considered the better, grows as tall as four feet in protected positions on the sides of mountains. A smaller *Nicotiana,* probably a new species, growing on the sandhill country, is also used but is considered inferior. The sticky *Nicotiana suaveolens,* which is often common, coming up under the shelter of fallen mulga branches, is not used. The leaves, stems and roots of ingulba are all used, being dried and ground up on a stone. They are preferably mixed with the ashes of the leaves and twigs of certain trees or shrubs, especially mulga *(Acacia aneura)* and *Acacia ligulata,* after a preliminary moistening in the mouth, and then made into a ball or roll. We also saw many natives using the greenish leaves themselves without their having undergone a preliminary drying. These seemed still damp; mulga ashes were mixed with them and the mass prepared for chewing. This quid is usually carried behind the ear (when not being chewed). In other cases it may be stuck under a head-band or hair string. Chewing ingulba is said to assist the natives during long, dry marches, probably partly by causing salivation. When two natives meet after having been separated, the first greeting, if one of them is without any ingulba, is for the other to give him his quid to chew; it is afterwards put back behind the owner's ear. It may also be used as an overture in love-making, the lover giving the woman some of his ingulba to chew.

Duboisia Hopwoodii (Aranda name, monunga) grows on the sandhill country. It is not used as a narcotic by the natives, but is employed as an emu poison. The leaves and branches are dried in the sun and then pounded with a stone. The poison is then added to rock-holes containing about three or four gallons of water where the emus drink. Some emus are said actually to die beside the water, and others may wander away for a distance of two hundred yards. Most accounts indicate that the birds are merely stupefied.

Aromas used for various purposes.

The burnt leaves and twigs of the native pine are used by some mothers, as the fragrant smell is thought to be pleasant and good for babies. The somewhat aromatic scent of a small blue-flowered *Eremophila Freelingii* is used as a pillow for natives suffering from headache. The sticky aromatic plants *Stemodia viscosa* and *Pterocaulon* are used as remedies for colds.

Woods used for weapons, implements, etc.

The best wood for making spears is considered to be that of *Tecoma.* Smaller and rather heavier spears are made from the branches of *Acacia Kempeana.* Those made from ordinary mulga are considered rather too heavy. Small spears are made from the stem of the supple jack *(Ventilago).* The "spinifex" gum, that is used for such purposes as fixing a stone into the end of an adze or a spear-thrower, is obtained from a species of porcupine grass *(Triodia,* sp.) that grows on rocky ground. Pitjis (pitchis), receptacles for carrying food or water, are made from the light wood of the bean tree *(Erythrina),* while smaller ones, used largely as implements for scooping and digging, are manufactured from red-gum.

Plants used for decorative purposes.

The red seeds of the bean tree *(Erythrina)* are used in necklaces. The capsules of the bloodwood *(Eucalyptus dimorphophloia)* were seen threaded into and hanging from the ends of the locks of hair of one woman. The pretty yellow flowers of *Cassia Sturtii* and *C. artemesoides,* the blue flower of *Eremophila Freelingii,* and the pink flowers of *Helichrysum Cassinianum* are used for sticking under the hair-band or sometimes through the pierced septum of the nose—as the natives say in pidgin English, "to make 'em flash." The milky juice of *Euphorbia eremophila* is used for dotting out designs on the body. The purple spores of the stalked puff-ball *Podaxon* are used for smearing over the face. The milky juice of *Sarcostemma* is applied to the nipple to imitate milk when the breasts are well developed, after puberty but before pregnancy has occurred.

Various purposes

Kangaroo Grass *(Themeda australis)* is used to form break-winds, as also is mulga. The grass, *Pappophorum Lindleyanum,* is placed in water that is being carried in a coolamon to prevent the water spilling, or it may be used as a strainer when the water is thick with scum or leaves and débris. The aromatic *Stemodia* is also used for this latter purpose.

PLANTS USED BY THE NATIVES, ARRANGED BOTANICALLY ACCORDING TO THEIR FAMILIES, WITH NATIVE NAMES AND USES.

(Abbreviations: A. = Aranda; L. = Luritja; P = Pintubi; N= Ngalia; Y = Yumu.)

[Note.—It is possible that some of the native names here given may mean not the particular name of a species but a more general term *(e.g.,* an equivalent of our "weed") or even an attribute *(e.g.,* "no good").]

Pinaceae:—

Callitris robusta R. Br., var. *microcarpa.* (Native Pine).—Alknarda (A.). Leaves and twigs used green or dried and burnt to make a pleasant odour for babies.

Gramineae:—

Themeda australis Stapf. (Kangaroo Grass).—Arara (A.). Seed not used. Flower stalks used as a breakwind.

Tragus racemosus All.—Seed not used.

Panicum decompositum R. Br.—Eltjurta (A.). Seeds collected, rubbed by hand (not with the feet), winnowed, ground and made into a damper.

Digitaria Brownei Hughes.—Inama (A.). Seed not used.

Brachiaria distachya (L.) A. Camus.—Ituta (A.). Julumburu (P.).

Aristida arenaria Gaud.—Inturkara (A.). Tjipiri (P.).

Eriachne, sp.—Seed not used.

Pappophorum avenaceum Lindl.—Eratja'ratja (A.).

P. Lindleyanum Domin.—Unama kwatjanambelumba (A.). The plants are used to prevent the spilling of water out of a coolamon or pitchi when it is being carried, or as a strainer for débris, such as a scum or leaves, before drinking.

Triodia, sp. (Aff. *T. Mitchelli* Benth. and *T. Basedowii* E. Pritzel). The common "hill-spinifex" or porcupine grass.—Tjuta or tjurta (A.). Undija (L.). Indolkantji (N.). The seed, ubalabala (A.) or opalapala (A.), is eaten by euros and kangaroos. This species does not yield an adhesive gum.

Triodia, sp.—Tjalanga (A.). Leaves only of a *Triodia,* gathered from rocky ground at Allala (the name of a district), were brought in. The species could not be identified. On some of the leaves were small granular masses of a "gummy" nature resembling fragments of brown sand glued together or part of a termitarium. We were informed that these masses were the materials which supplied the "gum" used for fixing "flints" to the ends of womerahs and adzes. As coccids were present in the adjacent in-rolled margins of the knitting-needle-like leaves, it seems possible that the natural resinous secretion round the leaf sheaths may be increased in amount by the activities of the coccids and so collect in these granular masses loosely enveloping some of the leaf-blades. The plants are collected and hit with a stick over hot sand. The gum is then separated, and while warm mixed with the dung of euro, wallaby or kangaroo, or with some grass, to act as a binding material, and made into flat cakes.

Triodia, sp. Used as a source of "gum." Perhaps the same species as the preceding. Tjalanga (A.). Kiti (L.).

Eragrostis laniflora Benth. Dehusked with the feet in a hole. Entjura (A.). Nantjuri (L.). Wonguna (P.).

Dactyloctenium radulans P. Beauv.—Wanja wanja (A.). The heads are placed in a pitchi, rubbed between the hands, and the seeds winnowed and then ground up and made into a damper.

CYPERACEAE:—

Cyperus rotundus L. (Nut grass or yelka). The underground "tubers," found on the flooded land near the banks of water-courses, are dug up and eaten, after removal of the husk-like covering.

Mariscus Cunninghamii C. B. Clarke (formerly placed under *Cyperus Gunnii* Hook). Viscid.—Angurankura (A.). Ilarapilara (L.).

MORACEAE:—

Ficus platypoda Cunn.—Tjurka. The fruit tjurka an-nga. The fresh fruit is eaten raw. When the fig has dried, it is ground between stones, made into a paste by adding water, and then eaten without being cooked.

PROTEACEAE:—

Hakea lorea R. Br. (Corkwood)—Indjuja (A.). Pūrūa (N.). The honey (judja or tulada, N.) is sucked from the racemes of yellowish-white flowers by drawing these sideways through the mouth.

Grevillea juncifolia Hook.—Erolunga (A.). The large handsome orange-coloured raceme of flowers, ngwala erolunga (A.), are similarly sucked for the nectar.

G. Wickhami Meiss.—Araljukaljukua.

SANTALACEAE:—

Anthobolus exocarpoides ? F. v. M.—Ankarankara (A.). Urtawurta (L.).

Santalum lanceolatum R. Br.—Ilkulai-a (A.) or Arankia (A.). Arang-nurli (L.). The fruit is soaked in water and then eaten and the water drunk.

LORANTHACEAE :—

Loranthus Miquelii Lehm. (on Bloodwood, *Eucalyptus dimorphophloia)*—Immalla (A.).

L. gibberulus Tate (on *Grevillea)*—Immara (A.). Niëmkini (L.).

CHENOPODIACEAE :—

Chenopodium rhadinostachyum F. v. M. Not uncommon. The seeds are probably gathered here as elsewhere, winnowed and made into damper.

Bassia convexula R. H. Anders. Puka puka. The ancestral kangaroo man dragged his penis through this prickly plant and then went into the ground.

Salsola Kali (L.) (Rolly Poly, Buckbush).—Ilkala (A.) or lkala. Tjilkalla (L.) A grub, tjapa (A.); maku (L.), occurs in the stem and root of dead full-grown plants and is eaten.

Enchylaena tomentosa R. Br. (Ruby Saltbush). — Iwurta-wurta or i-wutti-wutta (A. and L.). The deep yellow fleshy "berry" is eaten fresh when ripe. The fruits here were yellow, but elsewhere ruby red fruits also occur.

AMARANTACEAE :—

Trichinium obovatum Gaudich.—Wurra-wurra or woraka lilja (A.). Kondoltja (L.). Mungu-mungurba (N.). Inbai-inbai (N.). The flower-head is used as an ornament.

T. obovatum, var. *grandiflorum* Benth.—Agardagarda (A.).. Talku-talku (L.).

T. exaltatum (Nees) Bent. and *T.* sp., hairy near *T. exaltatum.*—Warakalilja (A.). Albuda-buda (L.).

T. helipteroides F. v. M.—Kaputa-kaputa (A.). (This word itself means "head.") The flower-head is used as an ornament.

Amarantus Mitchelli Benth. and *A. interruptus* R. Br. are both found at Mount Liebig. The seed is collected elsewhere, and probably here also, and eaten.

Alternanthera nana R. Br.—Seeds eaten by rock pigeons [*Lophophaps plumifera* (Gould)].

NYCTAGINACEAE :—

Boerhavia diffusa L.—Wai-ipi (A.). Wai-ipa (L.). Root eaten.

PHYTOLACCACEAE :—

Codonocarpus cotinifolius (Des.) F. v. M. (Native Poplar).—Kalurta (A.). A witchety grub from the root is eaten. The fruit is eaten by white cockatoos.

PORTULACACEAE :—

Portulaca oleracea L. (Purslane, manjeru, munyeroo).—Ljana (A.). Wagati (L. and P.). Wakati-ina-i (N.). The seed is shaken out into a pitji, ground on a stone, soaked with water and eaten. The roots are cooked and eaten and the leaves and stems are boiled and eaten in good seasons, but not when rather dry.

Calandrinia balonnensis Lindl. (Paraki-lja.) Leaves eaten raw or cooked on the embers.

CAPPARIDACEAE :—

Capparis Mitchellii Lindl. (Native Orange.)—Mbultj-ada (A.). Pulp and seed eaten.

CRUCIFERAE :—

Lepidium papillosum F. v. M.—Inmurta or immota (A.). Eaten as a cress.
Stenopetalum nutans F. v. M.—Lei-glia or lei-klia (A.).

LEGUMINOSAE :—

Acacia ligulata A. Cunn.—Idurka (A.) or atarkuka or ataruka. Wadarka (L.) or wadruka (L.) or wádarúka (L.). The dried leaf and twig are burnt to obtain ash to mix with pituri. A witchety grub, found in the root when dry, is eaten. The gum is used as food. The seeds are not eaten.

A. notabilis F. v. M.—Tá-wa (A.). The gum is eaten. The seeds are ground between stones and eaten raw.

A. tetragonophylla F. v. M. (Dead Finish).—Wakalbi. The seed is eaten.

A. strongylophylla F. v. M. (prickly).—Parapara (A.). Abérabara (L.).

A. Kempeana F. v. M. (Witchety Bush.) — Tnimma (A.). Eripilli or marko (L.). The branches spread out fan-wise from the base and are moderately straight; they are used for making the smaller and rather heavy spears; south of Hermannsburg these were used for spearing fish. The seeds are picked up from the ground, crushed between mill-stones, freed from dirt by rocking in a pitji, mixed with water, made into a damper and cooked in the fire. The gum that exudes is eaten. Witchety grubs occur in the roots and are much sought after by rabbit-bandicoots, *Thalacomys lagotis*. These scratch the soil away from the roots, but they may be disturbed or may find the root containing the insects too difficult for their extraction. The natives, in searching for these grubs, look for places where marsupials have been burrowing. If they find the root has been gnawed through they proceed no further; but if the root is still intact, then they wrench it out and frequently find the insect. Apparently the rabbit-bandicoots know by the sense of smell which roots contain grubs. Witchety grubs of any kind are known as npi-anba (L.) and turata (P.).

A. aneura F. v. M. (Mulga). There are two varieties of mulga, one with slightly broader and shorter phyllodes (5 cm. x 2·5 mm. as against 7 cm. x 1 mm.), which are not distinguished by the natives.—Ititja (A.). Windalko (L.). Wannari (P.). The seeds (ititja mina, A.; windalko mi-i L.) of both kinds are eaten. Spears made from the wood are considered rather too heavy. The ash of the phyllodes and branchlets, sometimes burnt on a stone, is used to mix with the quid of ingulba *(Nicotiana)*.

Cassia pleurocarpa F. v. M.—Ilelara (A.). The leaves and flowers are eaten by emus.

C. Sturtii R. Br.—Inkutinkuta or ingodingoda (A.). Punti (P.). The yellow flowers are used for decorating the hair or placing in the perforation in the nasal septum.

C. artemesioides Gaudich.—Ingut-inguta (A.). Punti (L.). The flowers are similarly used.

Crotalaria dissitiflora Benth.—Ngilta-ngilta (A.) Sweet material is sucked from the base of the old pods.

Swainsona, sp., near *S. phacoides* Benth. (probably new).—No native name.

S. flavicarinata J. M. Black.—Nakurta (N.). Eaten by emus and kangaroos.

Glycine sericea F. v. M.—Walatjiti (N.). Not used.

Erythrina vespertilio Benth. (Bean-tree).—Innunda (A.). Inninti (L.). Innanti (N.). Young bean trees, only a foot high, have large thickened tap roots descending often a foot or more in carrot fashion. These roots are dug up, heated in a fire so as to loosen the bark which can then be readily peeled off the swollen root, the latter being chewed and the fibre eventually spat out. The seeds (munta-munta, N.)—a beautiful vermilion when fresh, though they soon fade—are used for necklets, and several of these were seen round the necks of children. The wood of the bean tree is very light and is readily worked and used for making shields and larger dishes used for carrying food, water or babies.

Vigna lanceolata Benth.—Alaitja (A.). Wapiti (L.). The long, swollen, somewhat moniliform tap root is eaten raw or cooked.

ZYGOPHYLLACEAE:—

Zygophyllum ammophilum F. v. M. (probably).—Ilknwalja or ilknoilja (A.). The *Zygophyllum* is used in cooking cress (*Lepidium papillosum*—inmurta) and other food plants, *e.g., Convolvulus erubescens* (itnalja, A.; unnilja, L.), but is not itself eaten. It is evidently employed for its moisture content, acting as a kind of steamer. The method of cooking is as follows:—A hole is made in the sand, then small sticks are placed across the hole so as to assume a radiate appearance. Small stones are arranged on the sticks and supported by them. The sticks are set alight, and thus the stones are heated and hot ashes are produced. The hot stones are transferred by the aid of two sticks to the side of the hole. The unburnt sticks are then rejected and the hot stones replaced. A layer of *Zygophyllum* is now placed on the hot stones, then the plants to be cooked, then another layer of *Zygophyllum,* then hot stones again, and finally all is covered with wet sand. When the sand shows a crack the natives know that the plants are cooked. The sand is then brushed aside with mulga leaves, the upper plants removed and the upper layer of *Zygophyllum* thrown away. The cooked plants are now allowed to become cold and are then eaten.

Tribulus occidentalis R. Br. (probably).—Tjilka-tjilka (L.). Tjilkala (N.). The swollen root is cooked and eaten by the natives. Kangaroos eat the plant.

EUPHORBIACEAE:—

Euphorbia Drummondii Boiss.—Murtera-murtera. Not utilised by the native.

E. Wheeleri Baill.—Urtungata (N.). Not used by the natives.

E. eremophila A. Cunn.—Kwarika lilja (A.). Murtu-murtu or mota-mota (N.). The milky juice is used to decorate the chest.

SAPINDACEAE:—

Atalaya hemiglauca F. v. M. (White-wood).—Ilbârâ (A.). The white gum [tung-alba (A.), maku or mako (L.)] is eaten. A witchety grub, which lives in the roots and kills the *Atalaya,* is eaten. The wood is used to obtain shavings, which are mixed with blood, for certain ceremonial purposes.

Ventilago viminalis Hook. (Supple-Jack.)—Kneira (A.). Small spears are made from the stem. The sweet gum is eaten.

MALVACEAE:—

Hibiscus, sp., probably new (with cleistogamous flowers).—Winga-winjamba or winju-winjanimba (N.). Eaten by rabbits and euros.

Sida corrugata Lindl., var. *goniocarpa* F. v. M.—Munta munta (N.). (The same word is apparently used for the seed of the bean-tree, *Erythrina.)* They grind the seeds of this small yellow-flowered mallow and make them into damper.

MYRTACEAE :—

Melaleuca glomerata F. v. M. Ilbilla. Presumably this plant grows in the watercourse at the place called Ilbilla, about 95 miles due west of Mount Liebig.

Eucalyptus dichromophloia F. v. M. (which seems to grade into *E. terminalis* F. v. M. and *E. pyrophora* Benth.). (Bloodwood.)—Arkunga (A.). Arkingi (L.). Many of the bloodwoods in Central Australia bear rough, woody, apple-shaped galls an inch or more in diameter. These are produced by gall-making coccids of the sub-family Brachyscelinae. All those examined during the last three expeditions have been old, and no example of the female coccid inhabiting them has been obtained for identification. It is either *Apiomorpha pomiformis* Froggatt, or else the gall-making coccid, referred to as coming from Tennant's Creek and producing a large gall, which Froggatt (Australian Insects, p. 382) says differs generically from *Apiomorpha.* These bloodwood galls are called araka ngunba or aika ngumba or ngargumba (A.) ; ngantjeri (L. and P.). The galls are collected, smashed open with a stone, and the grub-like female coccid, tjalpa or tjapa (A.), extracted from inside and eaten raw. The mistletoe *(Loranthus Miquelii* Lehm.) growing on the bloodwood is called immalla (A.).

OLEACEAE :—

Jasminum calcareum F. v. M.—Au-ulru au-ulru or olu-ulru-anulru. Not used by the natives.

APOCYNACEAE :—

Carissa lanceolata R. Br. *(C. Brownii* F. v. M.).—Inagitja (A.). Namunburu (L.). The fruit is cooked and eaten.

ASCLEPIADACEAE :—

Sarcostemma australe R. Br. (Milk Bush.)—Ibatji-ibatji or ipatji-ipatji (A.) (ibatja = breast or milk). Ibi-ibi (L.) (ipi, breast). The milk is applied to the nipple (to imitate milk) when the breasts are well developed (after puberty but before pregnancy).

Cynanchum floribundum R. Br.—The fruit and leaves are eaten.

Marsdenia australis (R. Br.) Black.—Altjia (A.). Un-nàla (L.). Ipalu (P.). The flowers, fruit, leaves and roots, but not the stems, are eaten raw or cooked.

CONVOLVULACEAE :—

Ipomoea calobra Hill et F. v. M. ?—Jala (L. and N.), or yala (N.). Two large sweet potatoes (yams) had been collected by Mr. T. Strehlow during his wanderings in the adjacent region and brought to the camp at Mount Liebig. They are probably the same as the yams at Macdonald Downs, whose flowers, collected by Miss Jess Chalmers, were identified by Mr. Bailey in the Botanic Gardens, Brisbane, as the above species. Miss Chalmers gives the native name at Macdonald Downs as anitetjia.

Convolvulus erubescens Sims.—Knelja or itnalja (A.). Anilja or unnilja (L.). The leaves are cooked along with *Zygophyllum* (which supplies the moisture).

BORRAGINACEAE :—

Heliotropium, near *H. tenuifolium* R. Br.—Tjurdi-tjurdi (N.). Seeds made into a damper.

VERBENACEAE :—

Clerodendron floribundum R. Br.—Eramata (A.). Irimati (L.). This plant survives through the droughts, and hence its value in such times. The root is cooked in hot sand which is then scraped off with a stick, the root beaten on a stone, the central fibrous or woody part thrown away, and the rest eaten.

SOLANACEAE :—

Solanum diversiflorum F. v. M. (apparently). (Undulate leaves, large, pale yellowish-green fruit nearly one inch in diameter, on rocky ground.)—Narkutja (A.). Kurra (L.). The outside of the fruits is eaten, the pulp and seeds thrown away.

S., sp. (White fruit.)—Kaitjeri (A.). Fruit eaten.

S., sp. (Very prickly stem, large leaves, and yellowish-green then yellow ovoid fruit).—Warra-kalla-kalu. Not used by man but eaten by euros, kangaroos and wallabies.

S. quadriloculatum F. v. M. (Yellow fruit.)—Uralpa-ralpa or walpa-ralpa (A.). Eaten by kangaroos, but not by man.

S. ellipticum R. Br. (Fruit greyish-green when ripe.)—Randa or ranto (A.). Wanji (L.). Walki (P. and Y.). Fruit eaten when ripe.

Nicotiana suaveolens Lehm.—Ngulbi-ngulga (A.) or ingulpi-ingulba. Resembles "pitjuri," but has sticky leaves and is not used.

N., sp.—What appears to be a new species of *Nicotiana* was brought in from the sandhills and is used for chewing, but is not considered as good as rock pitjuri *(N. Gossei ?).* It is smaller than the latter.

N. Gossei Domin (probably).—Ingulba (A.). Mangulba (L.). The leaves, stem and roots are used fresh or dried in the sun (the flowers not being used) and are ground up on a stone. They are moistened and then mixed with ashes to make a kind of paste, and the quid so formed is placed behind the ear, and chewed from time to time. The ash in which the moist leaves are rolled is obtained by burning twigs of mulga or some other small acacia, such as *A. ligulata.*

Duboisia Hopwoodii F. v. M.—Monunga (A.). Grows as a bush on the sandhills. Used as an emu poison (by being added to water) but not as a narcotic by the natives.

SCROPHULARIACEAE :—

Stemodia viscosa Roxb.—Kwatjinga unbunamba (A.) (kwatja = water, *i.e.,* water-drinking plant, probably from its growing in moist ground). Pénja-pénja (A. and L.). Added in a bunch to water and used as a strainer for leaves and débris to enable the water to be drunk. Bruised on a stone as a remedy for colds (evidently suggested by the aromatic odour).

BIGNONIACEAE :—

Tecoma doratoxylon J. M. Black.—Yinbara (A.). Winberri (L.) or winberu (L.) or winperi (L.). Grows amongst the rocks on the hills. The best wood for spears, being long and fairly light. The spears made from it are used for fighting and for hunting euros, kangaroos, etc.

Myoporaceae:—

Eremophila Latrobei F. v. M. (Red flowers.)—Ngeling-a or njilinga-a (A.). Minjunga (L.). Ja-njeling-a (N.). The nectar is sucked from the flower.

E. Freelingii F. v. M. (A blue-flowered shrub about 6 ft. high.)—Rutta (A.). On account of the somewhat aromatic scent, used as a pillow for a native with a "sick head" (not one with a "sick belly"). Sometimes placed in the perforation of the nasal septum.

E. longifolia (R. Br.) F. v. M.—Knurunga or narunga (A.). Toilpurpa (P.). Eaten by emus, not by natives.

Cucurbitaceae:—

Melothria maderaspatana (L.) Cogn.—Ilkurta-ilkurta. Eaten by emus, not by natives.

Compositae:—

Calotis hispidula F. v. M. (Bindyi.)—Tankara (A.).

Pterocaulon glandulosum (F. v. M.) Benth. et Hook.—Pénja-pénja (A. and L.). Given the same name as *Stemodia viscosa*, which it resembles in stickiness and in possessing an aromatic odour. Used, probably on the latter account, for colds.

Helipterum floribundum DC.—Albut albuta (N.).

Helichrysum Cassinianum Gaudich. (Pink.)—Tjinda-tjinda (A.). The flower is worn in the hair by males as an ornament.

Fungi-Basidiomycetes:—

Gastromycetales:—

Podaxon pistillaris L. (*P. aegyptiacus* Mont.).—Kopa kopa (A.). This stalked puff-ball has a stem two or three inches long and an elongated oval head which is covered by a shaggy cap which can be readily lifted off, disclosing a mass of purplish-black spores. Holding the base of the stalk in one hand, the cap is removed and the purplish powder is smeared under the nose and across the cheeks and forehead in a thick mass for decorative purposes. The puff-ball is drawn like a brush across the face and is not rubbed backward and forward.

DESCRIPTION OF PLATE V.

Fig. 1. Child wearing a necklace of beans from *Erythrina vespertilio*.

Fig. 2. Powdering the face with the dark spores of the puffball, *Podaxon pistillaris*. The cap of the fungus is being held in the left hand.

ON MASTACOMYS FUSCUS (THOMAS).

BY H. H. FINLAYSON

Summary

Since the original description[1] of this remarkable rodent, distinguished from all other Australian murids by peculiarities of its molar crown pattern and their great breadth, there have been few references to the genus in the literature.

ON MASTACOMYS FUSCUS (THOMAS).

By H. H. Finlayson,
Hon. Curator of Mammals, South Australian Museum.

[Read September 14, 1933.]

Plates VI. and VII.

Since the original description[1] of this remarkable rodent, distinguished from all other Australian murids by peculiarities of its molar crown pattern and their great breadth, there have been few references to the genus in the literature.

In 1885 Lyddeker[2] identified the remains of the type species in a collection from the Wellington Caves of New South Wales. In 1896 Waite[3] recorded what he considered to be another species of the genus from Central Australia, but subsequently withdrew[4] the record as a mistaken one, and Troughton[5] has now shown that the material which misled Waite is referable to *Pseudomys (gyomys) desertor,* a form of quite normal dentition.

In 1922 Professor Wood-Jones collected skull fragments from caves in the South-East of South Australia, which in their molars exhibited *Mastacomys* characters, but which proved to differ from the genotype and were subsequently described by O. Thomas[6] as a distinct species, *M. mordicus,* of inferior size to *fuscus.*[7]

The type of *M. fuscus* was obtained from an unspecified locality in Tasmania, and was acquired by the British Museum in 1852, and in the 80 years which have elapsed, no information has been forthcoming as to whether so remarkable a form survived there. The later records, while extending the range of the genus to the southern part of the mainland, have not been followed by any further information as to whether either of the species survives as a living species on the Continent, and fears have been expressed that *Mastacomys* has become extinct over the whole of its range.

The purpose of the present notice is to record the fact that *Mastacomys fuscus* is still extant in Tasmania, and to add some details of a series of specimens taken by the writer in 1931.

These were obtained in Cradle Valley, North-west Tasmania, at an altitude of about 3,000 feet. They were trapped in a complicated labyrinth of runaways in a matted undergrowth of "wire" grass, so dense that in many places the well-beaten pads were completely roofed over by the growth, forming tunnels of considerable extent. Apart from the "wire" grass, the meagre Alpine vegetation of the open heaths upon which the colonies are established, is chiefly comprised

(1) O. Thomas, Ann. Mag. Nat. Hist., ser. 5, vol. ix., p. 413 (1882).

(2) Brit. Mus. Cat. Fossil Mammalia, i., p. 227 (1885).

(3) Report of the Horn Expedition, Zoology, p. 406 (1896).

(4) Proc. Roy. Soc. Vict., pp. 127-128 (1898).

(5) Records Aust. Museum, p. 293 (1932).

(6) Ann. Mag. Nat. Hist., p. 550 (1922).

(7) The same paper contains a reference to an additional immature specimen of *fuscus,* from Victoria, the history and present location of which is not given. Enquiry at the National Museum, Melbourne, has not cleared the matter, but the search for the specimen has disclosed the presence there of a series of *Mastacomys,* from a Victorian locality. These will be dealt with later by Mr. Brazenor.

of two small boronias *(B. rhomboidea* and *B. citriodora)* and the well-known "button grass" *(Dactyloctenium aegyptium)* characteristic of the high glacial plains of the western parts of the Island. The site is an extraordinarily exposed and shelterless one, the timber line being a quarter of a mile away, and in winter the whole area is frequently covered by a snow-drift several feet deep. Even in mid-summer the climate is capricious and often severe, and sleet and icy rains drive up the valley from the west, so that the grass matt is always sodden and frequently awash.

The chief rat colonies of these grassy areas appear to be mixed communities of *Mastacomys* with a rufous heavy-coated highland race of *Rattus lutreola.* The two animals were trapped indifferently on the same runaways, and they are so alike that it was not until the whole series obtained was critically examined that it was seen to be heterogeneous, and examination of the skulls of individuals presenting external anomalies at once showed them to be identical with *Mastacomys.* Both rats are probably quite numerous, but the labyrinths are the chosen hunting grounds of *Dasyurus vivverinus,* and it was not until several days trapping had got rid of the latter that rats began to be caught. *Pseudomys higginsi* is also plentiful in the valley, but it frequents the beech and pine scrubs rather than the open heaths, and its feeding habits, judging by the relative success of varying baits, are quite different from those of the two larger rats.

The five specimens now available prove that the type, contrary to Thomas's statement, was immature, and in several respects the original description may be amended and amplified.

External Characters.

The rat is a large one (Table I.), and of very stout build with short, strong limbs and short tail.

The head is large and the profile strongly arched. The mysticial vibrissae are moderately developed, the longest member being about 45 mm. They are variably coloured, the smaller being wholly black or wholly white, while the larger are black basally and white tipped.

The ear is larger, somewhat broader and more widely spread than in *lutreola.* The marginal portions of both its surfaces are well clad with short adpressed, rich brown hairs (about Ridgway's Vandyke Brown), contrasting with the paler fur of the occiput and nape.

The manus is much as in *lutreola* but smaller, and its digits and palmar structures more delicate. It is clothed above with fine dusky grey-brown hairs, and on the inferior surface of the carpus is a rather conspicuous patch of shining greyish-white hairs. The palm is pinkish or slightly dark pigmented; lighter than the sole.

The pes above is clothed like the manus, but the naked sole is pale lead coloured, similar to, but lighter than, the sole in *lutreola.* The foot, moreover, is longer than in that species and more slender. Its length ranges up to 35 mm. as a maximum, whereas the highest value for the same measurement in a series of 20 *lutreolas* is only 30 mm. In *M. fuscus,* also, the outer interdigital sole pads are duplicated (pl. vi., fig. J).

The tail is short and rather sparsely clothed above with dark blackish brown hairs, and both colour and scutation are exactly as in *lutreola,* but below, contrary to the original description, it is distinctly lighter, the individual hairs being greyish-white. The degree of demarcation of the upper and lower surfaces varies in different individuals but is always apparent, and the feature affords a good distinction from *lutreola,* in which the tail is uniformly dark all round.

The coat is very handsome; long, dense, soft and rather delicately coloured. The general or composite dorsal colour, viewed from a little distance at right angles, is a dark sooty brown, varying in different individuals from Ridgway's "Natal Brown" to "olive brown." But the colour changes in a striking way with the line of vision, and in an oblique front view it appears darker and in an oblique rear view much brighter and yellower, the differences being due to the varying degrees in which the black contour hairs obscure the fulvous tips of the under-fur

The pelage is made up of a dense silky under-fur averaging 22 mm. long on the dorsum, where it is Ridgway's Blackish Slate for three-quarters of its length and then terminates in a bright yellowish tip, the colour of the terminal band varying from rich "cinnamon buff" to "isabella." The overlay of guard hairs is uniform on the dorsum and is comparatively sparse; they average 32 mm. long, the shaft for two-thirds its length being slate and then thickening to a shining black, tapering point. The lateral surfaces are similar to the dorsal, except that an increasing number of guard hairs are white tipped. The ventral surface is ashy grey externally, obscurely and irregularly tinged with yellow, chiefly at the insertion of the forelimb and on the midline. The ventral coat consists entirely of under-fur much shorter (12 mm.) and coarser than on the back. Basally it is a paler lead colour for two-thirds its length, and then terminates in an ashy grey tip. The external aspects of the limbs are like the sides, and the internal like the belly.

The immature example is more sombrely coloured, owing to the slight development of the yellow tips of the under-fur allowing the basal slate colour to show through. Thomas remarks on the very close similarity of the type specimen, externally, to his *Rattus velutinus*. No specimen of this has been available for comparison, but the immature example referred to above is indistinguishable by pelage characters from *Pseudomys higginsi*, and, as noted, the more rufous adult examples of *Mastacomys* are very close to the less rufous ones of *R. lutreola*. The coat of the latter, however, is distinctly harsher to the touch and shows also some zoning in the distribution of the colour, the head and shoulders being yellower and less rufous than the posterior back, whereas the whole dorsum in *Mastacomys* is very uniform.

Skull.

Three skulls have been examined, one at about the same dental stage as the type and the others much more advanced, but still by no means aged, judging by the condition of the molar crowns and the sutures. The younger skull, although exhibiting all the dental features on which the genus was founded, shows only imperfectly others which are quite marked and peculiar in the adults, and it is satisfactory to be able to add to the specialization of the molars some structural features as well, which assist in distinguishing the skull from that of all other Australian Muridae.

In proportion to the size of the rat the skull is very large and powerful and its substance dense, and the mandible is massive and strongly sculptured with muscular impressions. In the dorsal view the most notable features are the very large size of the lacrymals, the long parallel-sided and very strongly constricted interorbital region, which is markedly concave above, and the brain case. This is peculiarly shaped, being wide and globular with its anterior portion suddenly expanded and without the gentle tapering forward to the olfactory fossa, general in the Murinae. The temporal ridges are well developed but irregular, and they are not carried forward into the interorbital area in the form of an undercut beading or flange. The temporal slopes of the brain case are rugose, and in both the large examples distinct post-orbital crests are developed. The interparietal is a large element, sharply angulated posteriorly, where it overhangs the occiput as a lambdoid spur.

The general sculpturing of the interorbital and temporal regions is distinctly reminiscent of such Microtine genera as *Arvicola* (pl. vi., fig. C), and is, no doubt, a consequence of a similar enlargement of the masseteric musculature correlated with the specialization of the molars, and the assumption, as in *Arvicola,* of a coarse herbaceous diet of low nutritive value, tough consistence and large volume.[7]

The pterygoid region is generally similar to that of *Rattus;* the mesopterygoid fossa is deep and narrow, the endopterygoid plates bounding it being without curvature and diverging gently backwards. The parapterygoid fossae are wide and shallow but distinctly delimited externally. Their greatest diameter is nearly three times that of the mesopterygoid. The bullae are small, low, oval in outline and very obliquely set to the cranial axis.

The characters of the slightly-worn molars of the smallest skull are exactly as figured by Thomas. They are remarkable not only for their great breadth, but also for the marked obliquity of their laminae and the strong differentiation of the columns and of the cusps which surmount them. With progressive wear the crown pattern of the molars changes considerably, however. The posterior enamel margins of the cusps become less and less conspicuous and the anterior margins more and more so, until at last the tubercular character of the cusps is lost and the cutting structures of the crown partake increasingly of the character of sharp transverse crescentic folds, quite different from the blunted crowns of *Rattus, Pseudomys, Notomys,* etc., and making some approach to the condition in Microtine and Cricitine forms.

The writer regrets his inability to add any intimate details of the habits of this interesting rat, which appears to be filling in the Australian animal economy the niche occupied by the voles in the Holarctic lands. But even had its identity been suspected when the series was taken, the obscure way of life of all the local murids throws one back largely on conjecture. However, further information is much to be desired, and for the convenience of those field naturalists whose excursions may lead them into its habitat, the external features which serve best to distinguish it from the two other rats which are most likely to accompany it, may be thus summarised.

Immature examples resemble *Pseudomys higginsi* in coat colour, but are at once distinguished by their much shorter tails (see dimensions). Adults resemble *Rattus lutreola* in external characters, but are distinguished from that species by: (1) their larger body size, (2) their longer feet, (3) the tail being distinctly lighter below than above.

TABLE I.

Flesh dimensions of *Mastacomys fuscus* in mm., taken from freshly-killed animals.

	1 ♂	2 ♀	3 ♂	4 ♀	5 Im. ♂	"Type" ♀ Recalculated
Head and body	182	182	180	170	136	142
Tail	113	113	110	112	80	94
Pes	35	34	33·5	32	30	31
Ear	22 x 13	22 x 14	22 x 14	20 x 14	20 x 14	17·3* (?)
Rhinarium to eye	24	22	22	—	18	—
Eye to ear ..	19	19	18	—	16	—

*Doubtfully comparable.

[7] Thomas has already drawn attention to the presence of an enlarged caecum.

TABLE II.

Comparison of flesh dimensions of *Mastacomys fuscus, Rattus lutreola,* and *Pseudomys higginsi,* derived from largest individuals of both sexes obtained, and expressed as a percentage of the head and body length.

	Mastacomys fuscus.	*Rattus lutreola.*	*Pseudomys higginsi.*
Head and body	100	100	100
Tail	62	66	120
Pes	19	18	25
Ear	12 x 7	12·5 x 6·5	17 x 9
Rhinarium to eye	12·5	12	11·5
Eye to ear	10	10	9

TABLE III.

Skull dimensions of *Mastacomys fuscus* in mm.

	1 ♂	3 ♂	5 Im. ♂	(Recalculated) Type ♀
Great length	41·1	39·8	33·5	36·1
Basilar length	32 ca.	31·7	26·6	—
Zygomatic breadth ..	23·0	21·9	—	21·3
Breadth of brain case ..	16 ca.	16·5 ca.	—	—
Palatilar length	21·5	20·0	—	—
Palatal foramen	—	7·8	—	7·6
Nasals	16·3 x 5·3	15·0 x 5·0	12·1	12·9
Interorbital constriction	4·0	4·5	4·5	4·3
Upper molar series ..	9·9	9·8	8·6	9·9

EXPLANATION OF PLATES VI. AND VII.

PLATE VI.

Figs. A, D, E. Views of skull of *Mastacomys fuscus.* Adult ♂.

Fig. B. Dorsal view of skull of *Rattus lutreola* (Adult ♂) for comparison with Fig. A.

Fig. C. Dorsal view of skull of *Arvicola amphibius* (after Hinton). For comparison with Fig. A.

Figs. F, I, and J. Soft palate, right manus and pes, respectively, of *Mastacomys fuscus.* Adult ♀.

Figs. G and H. Right manus and pes, respectively, of *Rattus lutreola.* Adult ♂.

PLATE VII.

Cradle Valley, North-west Tasmania. A view from the north, showing features of the country in which *Mastacomys fuscus* still survives. Photo by H. H. F.

TANTANOOLA CAVES, SOUTH-EAST OF SOUTH AUSTRALIA: GEOLOGICAL AND PHYSIOGRAPHICAL NOTES.

BY NORMAN B. TINDALE, B.SC.

Summary

During May, 1931, Messrs. H. M. Hale (Director of the S.A. Museum), H. Condon (Museum Cadet), and the writer spent two weeks in an examination of the newly-opened scenic cave near Tantanoola (140° 29' east long. X 37° 43' south lat.; fig. 1) , from which various odd mammal bones had been recovered by previous visitors, notably by Dr. C. Fenner and Dr. T. D. Campbell. The objects of the visit were to obtain series of the fossils for study and to examine the field evidence as to the history of the site; the following account summarises the physiographical and geological notes made. Messrs. V. A. Cram (Manager) and C. Lane (Caretaker), of the caves, gave every assistance in the work of removing the fossil material, and we thank them for their courtesy and co-operation. Several caves were examined in detail. They were found to have been formed under widely varying conditions. Field symbols, A, B, etc., were arbitrarily given to the sites as work proceeded, and owing to the numerous specimens obtained in them, and so marked, it appears desirable to retain these indications.

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[Read September 14, 1933.]

Introduction.

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General Description of Caves.

Cave A, situated in the cliff at Up and Down Rocks (Section 213, Hundred of Hindmarsh), is a solution cavity in Tertiary dolomite limestone, and is abundantly supplied with stalactitic and stalagmitic deposits. The entrance to it has been recently artificially enlarged to permit of its exploitation as a tourist attraction. This solution cave is subsequent to and partly incorporates an earlier cave, formerly present in the same cliff face. The earlier cave was excavated horizontally by marine action and was then completely filled by a sequence of marine and shore deposits together with various bones, after which the whole became infiltrated with lime to such a degree as to resist solution even more than the surrounding dolomitic limestone.

The formation of the solution cave by the passage of waters from above is a distinct event, and the new cave developed for a long time with only meagre direct access to the atmosphere, thus pavement deposits beneath the stalagmitic floor consist of broken stalactites, red cave earth, and a few fossils and flint pebbles derived from the earlier bone deposits. Superficial traces of bats and opossums indicate that direct communication with the exterior has only relatively recently been established. This communication was, however, anterior to a period of volcanic activity in the neighbourhood, for there was a talus of volcanic ash at the entrance. The sketch section (fig. 2) summarizes the relationships between these two series of deposits, the details of which are given in the following paragraphs.

The Marine and Shore Deposits of Cave A.

Fig. 4 is a diagrammatic representation of a natural section of the marine and shore deposits revealed on the vertical south-western wall within cave A. It represents a completely filled cave some six feet high in which the following consolidated deposits are represented:—*(e)* Fine cemented wind-blown shell sand with numerous rodent and bat jaws; *(d)* Coarse wind-blown shell sand with

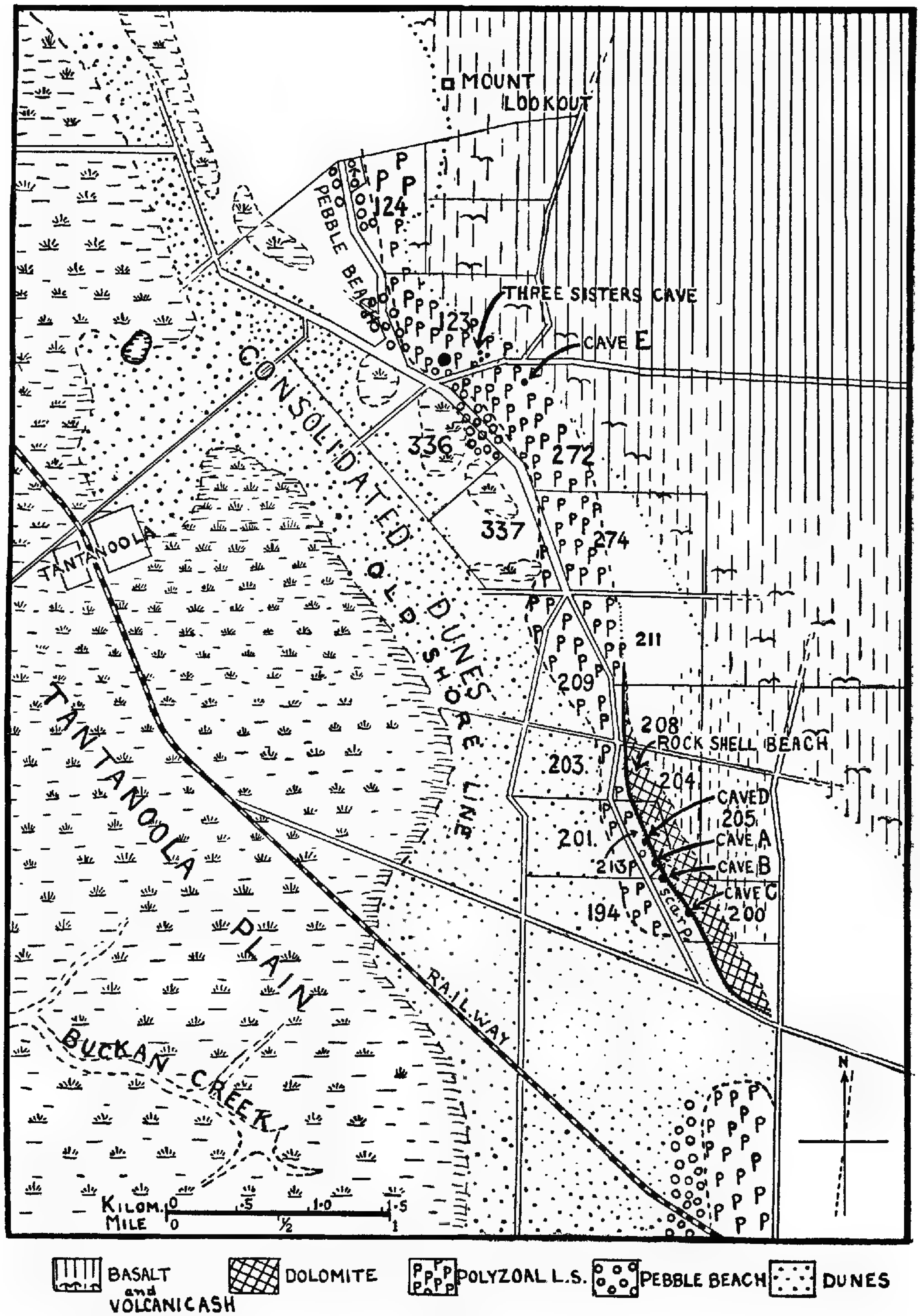


Fig. 1.

Sketch Map of portion of Hundred of Hindmarsh, South-East of South Australia.

occasional bones; *(c)* Bone breccia containing remains of giant kangaroos; *(b)* Beach sand with some clay, occasional large, rounded flint pebbles, fine gravel, shells, also teeth and other remains of seals; *(a)* Flint pebble bed.

The shell fauna represented includes identifiable examples of *Patella ustulata* and *Fusinus australis*.

The mammalian remains have been identified by Mr. H. H. Finlayson, who intends to give a further account of them in a separate paper. They are all mineralized and cemented in shell limestone. They include recognisable remains of;—*Macropus raechus* Owen, a giant kangaroo. *Sarcophilus? Arctocephalus. Phascolomys?* Ulna and part of tibia of a very large species. The small mammal fauna of the uppermost parts *(e)* of the bone breccia includes;—*Rattus, Hydromys, Trichosurus.*

Ramifications of this system of marine caves survive in all stages of dissection in various parts of the present cave, and have yielded much fragmentary bone material for our collection.

The Solution Cave Deposits of Cave A.

As already described, these consist of abundant stalagmitic floors containing red cave earth and superficial remains of mammals.

The larger stalactitic columns, some of which are up to four feet in least diameter, show healed fractures due to subsidence and to lateral movements of the order of six inches. There was a talus near the small original entrance consisting of volcanic ash, dust, guano, and the bones of small mammals, but this was largely disturbed during the opening up of the cave and is now buried under an artificial ramp and pavement which yields access to the floor of the main cave. A thorough examination of all accessible ramifications of this cave brought to light many examples of the recent fauna; in this search we were assisted by the caretaker's children, who nonchalantly crawled along low passages quite inaccessible to adults. The principal remains, as identified by Mr. H. H. Finlayson, are:—*Trichosurus, Isoodon, Phascolomys, Dasyurus,* and a large unidentified rodent. *Trichosurus, Dasyurus,* and *Isoodon* bones were also sieved from a part of the volcanic ash of the talus which had remained relatively undisturbed during the excavation of the artificial opening to the cave.

Site B.

This is situated some 30 yards further south-east along the Up and Down Cliff, approximately at the boundary of the Section. It consists of a small weathered seaward face of a debris-filled marine cave, similar to the one revealed in transverse section in cave A. A few fragments of fossil bone were recovered.

Site C.

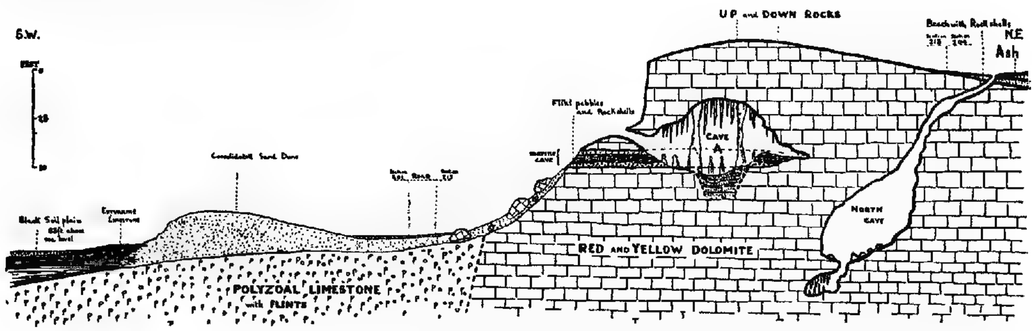
This is a superficial cavity in the face of the cliff situated some sixty yards south-east of site A (on Section 200). It is a hole extending down for twelve or fourteen feet at a steep angle. The entrance was artificially enlarged during a search for further exhibition caves. When first located it was completely filled, from floor to roof, with black volcanic ash, which, on sieving, has yielded a fair percentage of recent animal bones. These consist of *Sarcophilus, Phascolomys, Pseudochirus, Isoodon, Phascogale, Canis familiaris, cf. dingo.* In addition some very recent bones of *Macropus, Wallabia* and *Trichosurus* were present near the entrance. The bones were not confined to a particular layer but occurred at intervals through the ash. The question of direct volcanic deposition *versus* partial redeposition of the ash by water action is uncertain; probably both factors were at work. Some of the animals found in the ash are of burrowing habit.

Site D.

This is a low hole extending into the cliff for approximately four yards, at a point some fifty yards north-west of site A. It contained about a foot of dry dust, some ashes and charcoal and some mammalian remains, including dark-stained but apparently recent bones of *Canis familiaris dingo, Wallabia, Thylogale, Trichosurus, Pseudochirus, Dasyurus maculatus, Bettongia, Isoodon,* and *Phascolomys.* The site was evidently not suitable for native occupation, and the charcoal, etc., present may be the remains of fires employed in smoking out rock wallabies, etc.

North Cave.

The only other site examined in the immediate vicinity of the main cave is situated on the top of Up and Down Rocks. It is locally known as the North Cave. The entrance is a small hole no larger than a wombat burrow, situated on Section 204, within a few yards of the boundary with Section 213. At the surface is a broad expanse of consolidated lime-sand beach with rock shells overlain by a variable thickness of black volcanic ash soil which in places is up to ten feet in depth. A section of the ash beds is well shown in an excavated pit a few yards further to the north-east.



SKETCH SECTION - ½ mile - UP & DOWN ROCKS - SECT. 213 HINDMARSH
SHOWING VICINITY OF TANTANOOLA CAVES.

Fig. 2.

The entrance slopes steeply down for some twenty feet, after which it opens into a series of narrow chambers of great length and vertical height, containing masses of broken stalagmite. Access to the base is gained by precariously descending over masses of loose limestone which have been shed from the roof of the cave. Rough estimations suggest that the cave is over one hundred feet in depth. The walls, where sounded, proved to be composed of compact dolomitised limestone, reddish above, yellowish near the base. No significant bone specimens were secured, but the great local thickness of the dolomite was demonstrated.

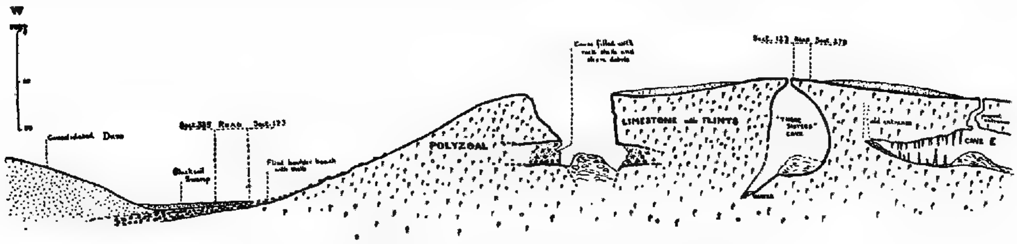
The Glencoe Road Sites.

Cave E.

This is a cave of relatively recent origin, excavated in a soft polyzoan limestone which contains flints. It is situated on Section 272, Hundred of Hindmarsh, within 20 yards of the main Glencoe Road (fig. 3). Although partly due to solution, the main ramifications run parallel to each other with rectangular connecting passages, in such a manner as to suggest solution along definite fracture planes. The present entrance is a circular trap hole two feet in diameter descending in spiral fashion for some fifteen feet. Bones of numerous recent animals, including those of sheep, are represented among the victims of the natural trap. The floor of the lower parts of the cave is wet, and bones lying there are heavily impregnated with carbonate of lime. Elsewhere the floor of the cave is covered with limestone pebbles, the nucleus of each of which is an animal jaw or other bone. The entrance is marked by a mound of black volcanic ash soil with fresh bones. Stalactitic growths are abundant but are all of comparatively small dimensions, confirming the general impression of youthfulness.

At the south-western extremity of the cave, where roots from trees on the surface pass through the cave, the floor is higher and dryer than elsewhere. A yellow sand talus exists here which has been derived from an entrance now sealed. The bones present in this sand are fresh in appearance but are evidently somewhat earlier in date than some of the others, because the talus includes no apparent traces of the volcanic ash which occurs in the talus beneath the present-day entrance. The remains in the earlier talus consist of *Perameles, Isoodon, Trichosurus, Dasyurus,* a very large *Rattus, Wallabia, Thylogale,* and *Macropus.*

The floor was sounded to a small depth at a spot five or six yards south-west of the present entrance, and bones of *Macropus, Wallabia, Trichosurus,* and *Thylogale* were then found under two layers of floor travertine. On various parts of the floor of the cave there were present *Wallabia, Isoodon,* a big rodent, *Bettongia, Phascogale, Potorous, Rattus, Trichosurus,* and *Dasyurus,* and remains of the lizard *Trachysaurus.* Where the bones were on moist pavements they were strongly impregnated with lime, elsewhere they were fresh-looking.



SKETCH SECTION - ½ mile - GLENCOE ROAD CAVES

SECTIONS 123, 272 HINDMARSH, SOUTH-EAST OF S. AUSTRALIA.

Fig. 3.

Highly calcified and corroded bones and bones in rounded nodules of limestone were found to include *Phascolomys, Sthenurus (?), Trichosurus vulpecula, Isoodon, Wallabia, Macropus ruficollis, Thylogale billardieri, Pseudochirus, Rattus, Petaurus (?),* and the lizard *Trachysaurus.*

Very recent material included *Dasyurus, Isoodon, Trichosurus, Bettongia (?), Perameles,* a large *Rattus* (predominant), a smaller rodent, *Macropus giganteus, Thylogale, Phascogale,* and *Wallabia.* Most of these, including the bones of a sheep, were found on the black soil talus at the entrance; other recently trapped animals had evidently wandered some distance before expiring, and account for fresh bones in places remote from the entrance.

Other Sites.

Two other caves exist in the vicinity. The Three Sisters Cave, situated alongside the road on Section 123, was not entered. It is a natural trap with three mouths. Entrance can only be gained by a 40-foot clamber down a rope ladder. One hundred yards further west there is a large circular pit, formed by the collapse of a cave of large dimensions. This is situated near the margin of the older seashore, and the breaking in of the cave has revealed sections of marine caves filled with rock shells and shore debris. This material can be definitely associated with the flint boulder beach with shells which occurs along the roadway between Sections 123 and 335. The mode of origin is similar to that of the marine caves at Up and Down Rocks, and is discussed in some of the following paragraphs.

Geological Notes.

The interpretation of the history of the Tantanoola caves necessitates some examination of the geology of the surrounding country. The attached sketch map and sections (figs. 1-3) illustrate the principal features.

Up and Down Rocks is a scarp which appears to mark the position of an old fault line traceable in a west of northerly direction for about one and a half miles from the southern corner of Section 200 (Hundred of Hindmarsh), after which it is lost beneath consolidated dunes of wind-blown lime-sand and the ash beds of the basalt flow which forms the Mount Burr Range. The rocks down-thrown to the west consist of polyzoal limestone of Tertiary age, containing irregular masses of blue and grey flint. The up-thrown beds consist of massive pink- and yellow-dolomites and dolomitised limestone, also of Tertiary age.

The fault scarp has been incidentally revealed by marine erosion which has removed some of the polyzoal limestone near the line of the fault, thus throwing the dolomite into relief as a vertical wall and a slope standing about one hundred feet above the broad Tantanoola Plain, which here lies to the south-west. The Tertiary polyzoal limestone is present in a quarry near the foot of rocks at the northern end of the Section and has been described by Jack.[1]

The line of the fault scarp between Sections 200 and 211 and the line of the road to Section 124 marks the position of an old marine terrace upon which are still strewn the products of marine denudation and deposition in the form of beds of shells containing rounded flint pebbles (up to 30 lbs. in weight). These flints have been derived from the polyzoal limestone, by erosion. This marine cycle was apparently responsible for the cutting of the earlier cave A and for the deposition of the marine debris in it (fig. 2). Similar cave erosion and filling was carried out at Section 123 (fig. 3), where caves now filled with rock shells and shore debris may be seen in sections in the cavity formed by the collapse of a newer solution cave. Estimations, based on the fact that the elevation of Tantanoola Railway Station is 83 feet, suggest that this marine terrace is situated between 140 and 160 feet above present sea level. The immediate front of this shore line is marked between Sections 209 and 124 by a line of swamps which further north coalesce to form a long swamp lagoon. West of this line of swamps there are many dune-like hills composed of fine quartz- and shell-sand, cemented with lime, forming a belt up to half a mile in width and ranging from 20 to 40 feet in elevation. These dunes represent the shoreward debris formed during a still more recent period of marine stand-still at a height above sea level but little above that of the Tantanoola Railway Station (83 feet). The margin of this newer marine terrace can be traced north-west and south for some miles. Northward it appears to be continuous with the line of consolidated dunes forming West Avenue Range. At the level of the margin of the Tantanoola plain (*c.* 80 feet above sea level) there are beds of estuarine limestone with lagoonal shells (*Rissoa*, sp., and *Calliostoma nobile* Phillipi), above which there is the rich black soil, largely of volcanic origin, of the swamp plain.

In order to further elucidate the history of this site an examination is necessary of the wonderful series of successive sand ridges which mark the positions of former shore lines of the South-East of our State. In the following paragraphs a few general observations are given, derived partly from a study of the extensive series of bench marks recorded in the maps made by the South-

(1) Jack, R. L., Geological Survey of S. Aust., Bulletin 10, 1923, p. 45.

Eastern Drainage Commission, to a small degree from personal examination, and otherwise from the extensive literature relating to the subject. A possible interpretation of these facts will be given in a separate section of the paper.

This remarkable series of foreshores has been frequently described, *e.g.*, Tenison Woods,(2) Howchin,(3) and Fenner.(4)

The principal "ranges" and the relative heights of their probable foreshores above present sea level are given below. In the case of the older terraces doubt exists as to the exact level of the shoreline, the figures in brackets indicate the

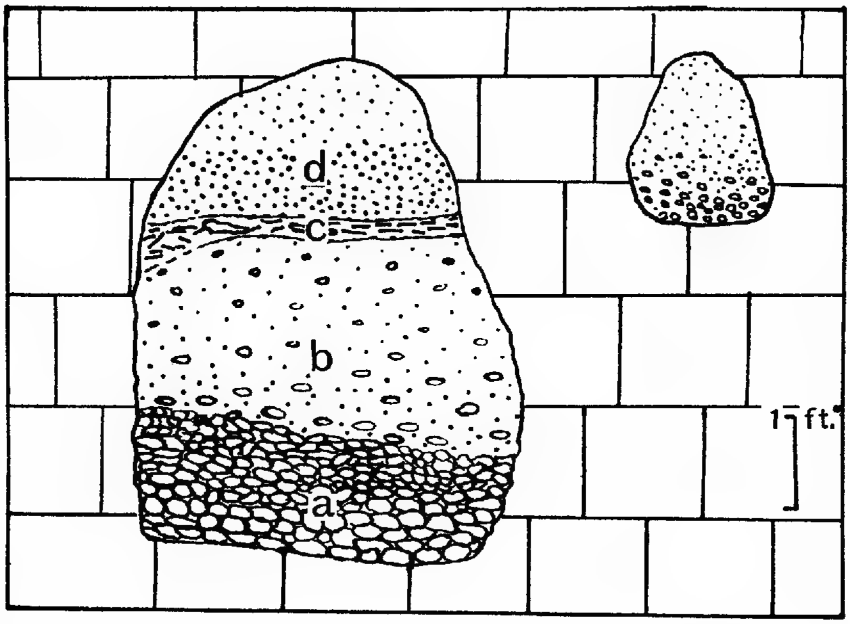


Fig. 4.
Transverse Sections (natural) of filled Marine Cave in Dolomite, as seen on wall of Cave A, Tantanoola.

absolute minimum as limited by the general level of the floor of the corresponding planes of marine denudation. The uncertainty of these figures is chiefly due to a lack in the records of the drainage survey; as a rule only the heights of the depressions to be drained were recorded in detail. Two or even more dune ridges may be present on the one foreshore. A section from the vicinity of Beachport north-eastward to the Naracoorte Range north of Glen Roy shows, in descending order, the following principal terraces:—

Naracoorte Range(5) - -	250 feet	(190 feet)
Cave Range - - - -	200 ,,	(160 ,,)
East Avenue Range - - -	150 ,,	(120 ,,)
West Avenue Range - - -	90 ,,	(80 ,,)
Reedy Creek Range - - -	65 ,,	(50 ,,)
Woakwine Range - - -	25 ,,	(10 ,,)

(2) Woods, J. Tenison, Geological Observations in South Australia, London, 1862.
(3) Howchin, W., Geography of South Australia, revised ed., 1917, p. 106.
(4) Fenner, C., South Australia: A Geographical Study, Melbourne, 1931, p. 59, *et seq.*

(5) The higher figure for the Naracoorte Range is given on the authority of a statement by Sir T. W. Edgeworth David, *vide* Explanatory notes to . . . a new geological map, Sydney, 1932, p. 96.

The earliest of these marine terraces appears to be continued north-westward in the Marmon Jabuk Range and to be cut across by the Murray River at Fromm Landing (Section 50, Hundred of Ridley), where the section depicted in fig. 5 may be seen. At Fromm Landing the Post-Pliocene calcareous dunes containing fragments of marine shells are met with at the elevation (measured by aneroid) of between 200 and 240 feet above the river (which is here only a few feet above sea level). They rest on a relatively great thickness of red clay, which itself lies upon the characteristic "*Ostrea* Beds," generally considered to be Lower Pliocene in age.

Further to the north, *e.g.*, at Swan Reach and Blanchetown, the Pliocene "*Ostrea* Beds" are the uppermost marine horizon and appear on the surface of the

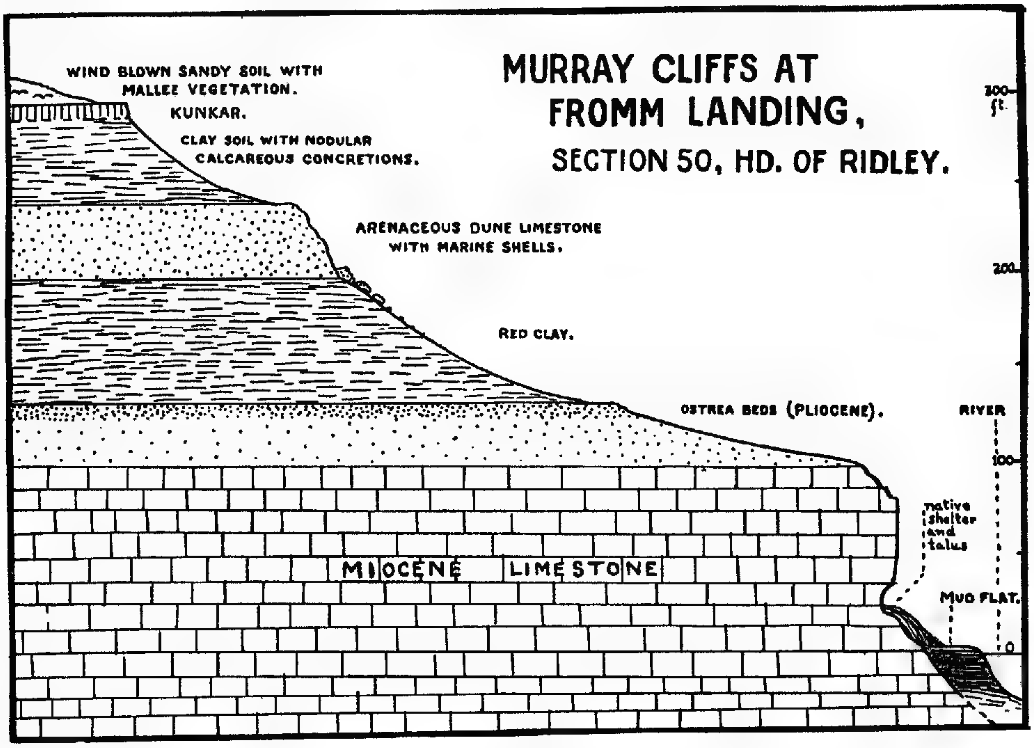


Fig. 5.
Section of Murray Cliffs at Fromm Landing, Section 50, Hundred of Ridley.

plateau. They have been identified at many places between Swan Reach and Morgan. The north-western extensions of marine terraces younger than the Naracoorte have not yet been traced in detail. One of the youngest of them may be represented approximately two miles north of Wellington, on the main road to Tailem Bend.

Discussion.

Before entering into a discussion of the significance of the marine deposits at Tantanoola it seems desirable to briefly mention the problem of the nomenclature of cherts, flints, and allied siliceous deposits, especially as it applies to the rocks of the South-East.

According to a recent authority [6] there is very little beyond a nomenclatorial difference between chert and flint. "The interior of a chert nodule is usually solid,

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(6) Milner, H. B., Sedimentary Petrography, London, 1929, p. 320.

often a fossil shell nucleus or aggregate of fossil particles; the interior of a flint on the other hand may be quite hollow, and from it a siliceous powder, full of sponge spicules, etc., may often be obtained." Sponge spicule filled cavities are a noteworthy feature of our Miocene siliceous boulders. The tendency to assume, with weathering, a pale porcellanous aspect, and the distinct conchoidal fracture, are other features which suggest that we are correct in using the term "flint" in preference to any other.

Fenner[7] records similar flint pebbles from the stratified tuffs of Mount Gambier, and tentatively derives them from Tertiary limestone beds. Evidence at Tantanoola indicates that these pebbles are derived by erosion from the polyzoal limestones, in which the flint occurs as irregular masses. The polyzoal limestones are of Miocene age. It seems likely that some, if not all, of the worn flint pebble beds were derived from the erosion of the limestone in Post-Tertiary times.

As a digression it may be remarked here that these flint boulders supply the principal materials employed by the South-Eastern aborigines in the fashioning of their stone weapons. Implements of superficial sites along the present-day coast are deep blue or grey in colour; the flints found on the older sites, especially those somewhat inland from the present coast, show differences in technique and are frequently altered to a white colour by the solution of portion of the opaline silica.

The presence in the South-East of caves with fossil bones has been known for a long time. In the vicinity of Mount Gambier they were noted by Burr[8], who states:—"There are . . . caverns which contain the bones and teeth of animals of larger size than those which are at present living in this part of the continent of New Holland. Some of them belong to gigantic kangaroos; others apparently to species of dogs." The "dog" bones referred to may belong to species of seals. They were not critically examined and the specimens cannot now be traced.

The presence in the earlier deposits of cave A, at Up and Down Rocks, of what appears to be a Pleistocene fauna, characterised by the bones of the extinct giant kangaroo, *M. raechus*, introduces an interesting problem in the correlation of the coastal terraces of the South-East of our State, with one of which this shoreline deposit is associated.

The formation of the series of coastal dunes in the South-East has been considered by some geologists to have taken place within a period loosely termed "Recent." On the basis of the new evidence available, it is suggested that this period will more probably be shown to extend over a period embracing Pleistocene and Recent times. There is remarkable correspondence between the successive "Ranges" and the corresponding marine terraces of stable foreshores in other lands.

From a study of the foreshores of various continents at places believed to be relatively stable, it has been frequently deduced that during Pleistocene and Recent times there have been marked variations in sea level. Cooke[9] has summarized some recent references to this subject, and has given his results of the study of the eastern coast of the United States.

In the accompanying diagram (fig. 6) an attempt has been made to compare the principal terraces of the South-East of South Australia with the

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(7) Fenner, C., Trans. Roy. Soc. S. Austr., vol. xlv., 1921, p. 179.

(8) Burr, T., Remarks on the Geology and Mineralogy of South Australia, Adelaide, 1846, p. 18.

(9) Cooke, C. W., Correlation of Coastal Terraces, Journal of Geology, xxxviii., 1930, pp. 557-589.

coastal terraces of the south-eastern United States, in the hope that it will serve as a basis for more serious discussion of the problem.

The acceptance of a theory connecting the South-Eastern marine terraces with Pleistocene variations of sea level would involve the assumption that the successive "ranges" are not the result of a simple and orderly recession, perhaps marked by "stand stills" during which the sand dunes were formed, but that there have been successive advances and retreats of the sea. If the raised terraces attest to the glacial high tides, there should be evidence for the corresponding low tides.

Chapman[10], in the records of the Sorrento Bore, has shown that for an area to the south-east of the present one there have been downward movements of

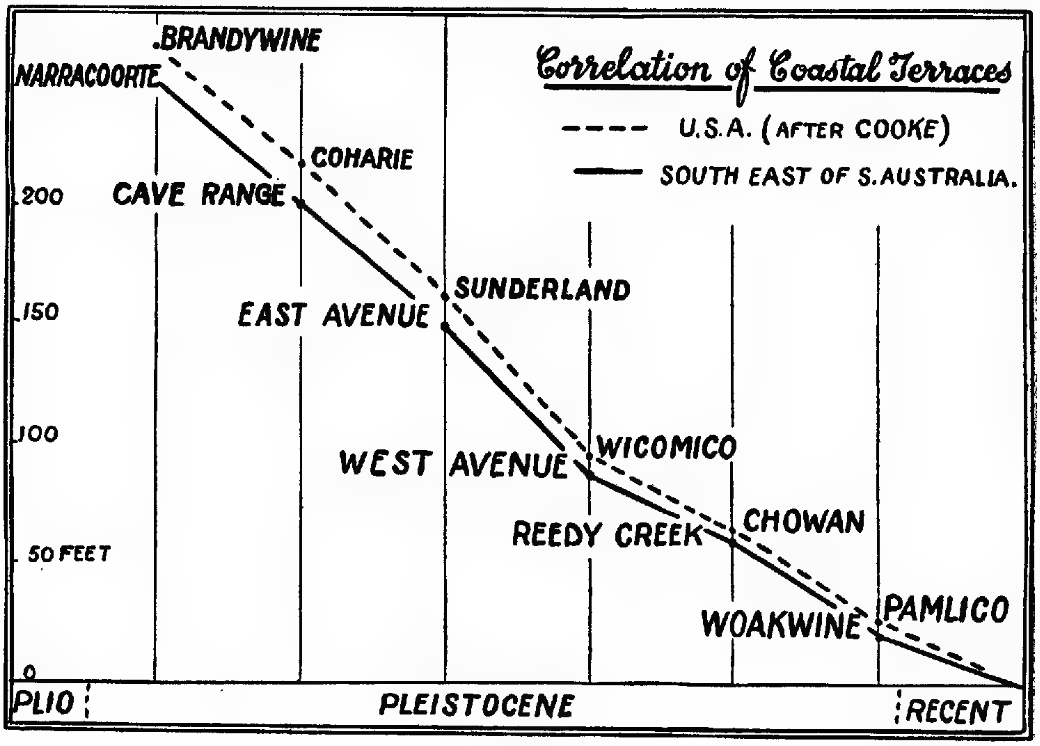

Fig. 6.
Correlation of Coastal Terraces, U.S.A., and South-East of South Australia.

the land in Tertiary time, but that this sinking has been relatively slow and therefore not very appreciable during the shorter interval of Pleistocene and Recent times. This is indicated by the fact that at least four (probably five) low water stages of sea level have occurred during the Pleistocene Period, permitting the deposition of dune deposits alternately with the marine ones.

The evidence from bores along the coastal regions in the Murray Basin, *e.g.*, at Tintinara,[11] also offers hints of such variations, but the facts have not yet been fully marshalled. The present discussion serves merely to draw added attention to a problem which will require much co-ordinated knowledge and research before positive dicta can be made.

Factors leading to the formation of these extensive calcareous dunes along our South-East coast may be:—(1) The presence of waters of the Murray heavily

(10) Chapman, F., Records of the Geological Survey of Victoria, v., 1928, pp. 1-195.

(11) Tate, R., Trans. Roy. Soc. S. Austr., xxii., 1898, pp. 67-68.

laden with calcareous salts. (2) The impingement of great food-laden marine currents from the west encouraging the development of a rich molluscan fauna to utilize this calcareous waste. (3) The milling action of the open Antarctic Ocean upon the abundant calcareous remains of animal life provided by these conditions.

Factors leading to the preservation of this remarkable series of dune ranges are perhaps:—(1) The absence of erosion through lack of primary drainage (in part due to the minor scale of crustal warpings in Pleistocene and Recent times). (2) The absence of highlands. (3) The dominantly subterranean drainage due to the underlying calcareous strata. (4) The calcareous nature of the dunes, which has led to their rapid consolidation and consequent fixation.

These factors seem to have assisted in preserving a youthful aspect which other facts belie. Pressing desiderata are the ascertaining of more detailed information regarding the elevation above sea level of the earlier dune "ranges" of the South-East and the collecting and study of the shell faunas both of the ranges and of the plains between them. The artificial draining of the swamplands has, in places, exposed excellent subsurface sections which show, by alterations from estuarine to marine, followed by further estuarine and lagoonal conditions that the detailed interpretation of the sequence of events may be complex.

One of the general results of the study of Pleistocene marine terrace faunas is the indication that raised beaches on stable foreshores frequently bear evidence of "warmer" climates than that at present existing in these places. Preliminary studies in South Australia seem to indicate that the "*Arca*" raised beaches of the northern portions of the coastline of South Australia are of early Recent or very late Pleistocene date, and that it may be possible to compare them with the Pamlico (Mid-Wisconsin) terrace of the eastern United States, with the London 20-feet terrace, and the newer raised beaches of Spitzbergen, all of which give indications of warmer climates than at present existing in the adjacent waters.

Howchin,(12) who has described many occurrences of this "*Arca*" terrace in South Australia, has already pointed out that the foraminifera associated with the "Arca beds" are of "warmer" type. Studies of the fauna of the Woakwine raised sea floor and terrace (15-25 feet) suggest that the degree of warming was not sufficient there to enable the "*Arca*" fauna to become dominant, although occasional examples may occur. The dominant forms of the terrace are *Chione* (several species). Recent work on the climatic zoning of littoral shells has shown (*e.g.*, Elton and Baden Powell) (13) that many differences are to be expected when marine terraces are traced from latitude to latitude. Bearing this in mind, it is possible to suggest a relatively uniform 20-25-feet terrace extending along the whole of the stable portions of the sea front of South Australia, disturbed only by minor movements in the unstable down-faulted region of St. Vincent Gulf. Fig. 7 (upper) suggests the distribution and zoning of the dominant forms of the 20-foot terrace.

With the onset of the cooler conditions characteristic of the present phase (fig. 7, lower) a zone characterised by a great abundance of *Donax deltoides* has moved north, replacing the *Chione* zone (as seen in sections in the Coorong), while the *Chione* fauna, in turn, has moved north and now finds its climatic equivalent in the warmer gulfs. The *Arca* zone has disappeared or doubtfully survives north of Streaky Bay, where living *Arca* has been taken.

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(12) Howchin, W., Geology of South Australia, 2nd ed., 192?, p. 254 (also consult bibliography).

(13) Elton, C. S., and Baden Powell, D. F. W., Geological Magazine, lxviii., 1931, pp. 385-405.

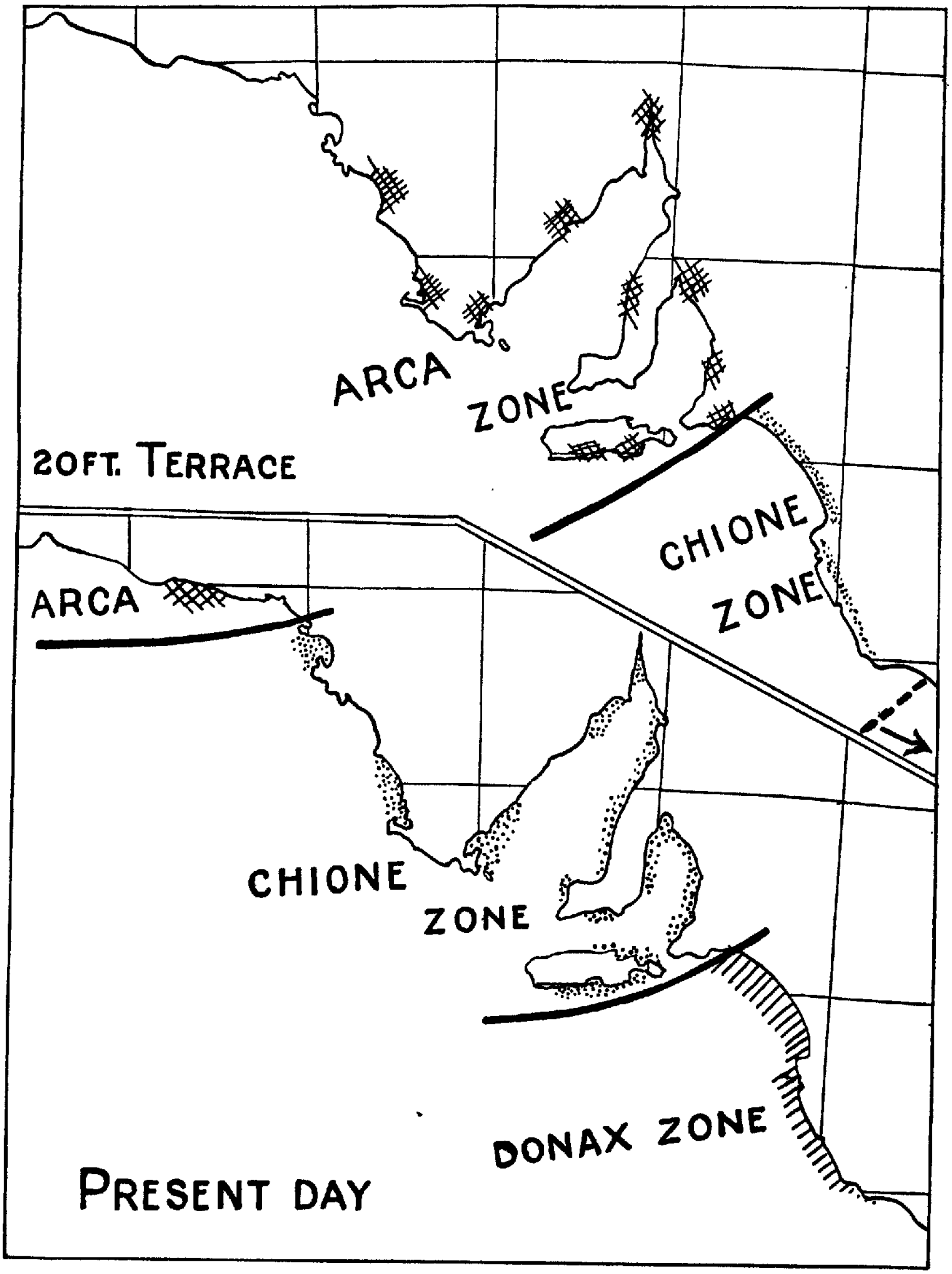


Fig. 7.
Maps of the Coastline of South Australia, showing distribution of Dominant Shells of the present and "20-foot" Shore Lines.

Man must have entered Australia some time during the latter part of the period when these dunes were being formed. The laws of mammalian dispersal suggest that once he had attained the continent he would rapidly (from a geological point of view, almost instantaneously) have spread to all parts of his extended domain. Thus a careful scrutiny of the series of marine beaches from the most recent backward is likely to eventually reveal to us an indication of the period of man's first advent in South Australia, and then enable us to interpret it in terms of physiographical changes. Hence the interest which the general problem may prove to have for the anthropologist.

Appendix.

Shell fauna of the Woakwine Terrace, as identified by Mr. B. C. Cotton:—

Brachydontes crosus Lam.
Ostrea sinuata Lam. *(angasi)*.
Pecten bifrons Lam.
Mytilus planulatus Lam.
Cardium tenuicostatum Lam.
Chione gallinula Lam.
Chione scalarina Lam.
Chione corrugata Lam.
Tapes galactites Lam.
Nacella parva Angas.
Astralium aurea Jonas.
Phasianella australis Gmelin.
Clanculus dunkeri Koch.
Monodonta constricta Lam.
Monodonta odontis Wood.
Cantharidus lehmanni Menke.
Cantharidus conicus Gray.
Capulus conicus Schuh.
Polynices conicus Lam.
Coxiella gilesi Angas, a thassaloid shell.
Bittium granarium Kiener, lagoonal shell.
Bittium lawleyanum Crosse, lagoonal shell.
Nassarius pyrrhus Menke.
Nassarius pauperatus Lam.
Pyrene austrina Gaskoin.
Cominella eburnea Reeve.
Cominella lineolata Lam.
Fusinus australis Quoy.
Fasciolaria australasia Perry.
Conus anemone Lam.
Bullaria botanica Hedley.

The absence of *Donax* and the dominance of individuals and species of *Chione* is characteristic.

The above series was collected at a point 6·1 miles from Robe on the road to Beachport, beside Section 187, Hundred of Waterhouse. The marine terrace ranges from nine feet above sea level on the floor to 28 feet on the former beach; above this the "Range" is composed exclusively of consolidated calcareous dune sands.

Summary.

This paper records the occurrence of mammal bones in several caves at Up and Down Rocks, South Australia. In addition to several finds of recent animals, the fossilized remains of Pleistocene mammals, including *Macropus raechus* and a seal, were obtained in a cave on the foreshore of an old marine (160-ft.) terrace.

Evidence for the Pleistocene origin of the "Ranges" of the South-East of South Australia is discussed and tentative comparisons made with the coastal terraces of the south-eastern United States.

Some details relating to the fauna of one of the most recent (Woakwine) terraces are discussed, and some general evidence is brought forward.

ADDITIONS TO THE FLORA OF SOUTH AUSTRALIA. NO. 31.

BY J. M. BLACK, A.L.S.

Summary

**Pennisetum macrourum,* Trin. This stout ornamental South African grass was found by Prof. Cleland growing along the River Onkaparinga, *6* miles above Clarendon.

**Lepturus pannonicus* (Host) Kunth. Greenock (near Nuriootpa) .-Spain; lower Danubian States; Southern Russia. Differs from other species of the genus in having 2-flowered spikelets. In general appearance it resembles *L. cylindricus.*

Leptochloa diqitata (R. Br.) Domin, in Bibl. Bot., Heft 85 : 379 (1915), instead of (R. Br.) J. M. Black, Fl. S. Aust., 85 (1922).

Spinifex inermis, Banks et Sol. in Hook. f . Fl. Nov.-Zel. i., 292 (1853), in place of *S. hirsutus,* Labill. (1806). The change is necessary because this grass was first named *Ixalum inerme* by *G.* Forster in his Prodromus, which was published in 1786.

ADDITIONS TO THE FLORA OF SOUTH AUSTRALIA.

No. 31.

By J. M. Black, A.L.S.

[Read October 12, 1933.]

Plates VIII. and IX.

Gramineae.

**Pennisetum macrourum,* Trin. This stout ornamental South African grass was found by Prof. Cleland growing along the River Onkaparinga, 6 miles above Clarendon.

**Lepturus pannonicus* (Host) Kunth. Greenock (near Nuriootpa).—Spain; lower Danubian States; Southern Russia. Differs from other species of the genus in having 2-flowered spikelets. In general appearance it resembles *L. cylindricus.*

Leptochloa digitata (R. Br.) Domin, in Bibl. Bot., Heft 85 : 379 (1915), instead of (R. Br.) J. M. Black, Fl. S. Aust., 85 (1922).

Spinifex inermis, Banks et Sol. in Hook. f. Fl. Nov.-Zel. i., 292 (1853), in place of *S. hirsutus,* Labill. (1806). The change is necessary because this grass was first named *Ixalum inerme* by G. Forster in his Prodromus, which was published in 1786.

Iseilema.

This genus, originally based by Andersson on *Anthistiria membranacea,* Lindl. has been found by Dr. K. Domin to comprise 4 species, of which at least 3 grow in South Australia. The bracts, which at first enclose each raceme of spikelets are here called *spathes* ("bracts" of Bentham, Fl. Aust. 7 : 543), while the larger leaf-like bracts, whose sheaths subtend several racemes, are called *involucral bracts* ("floral leaves or bracts" of Bentham).

Key to the Species.

A. Sheaths of involucral bracts herbaceous, flattened, keeled, 10-15 mm. long, the 4 involucral spikelets with 2 glumes each.
  B. Racemes more or less enclosed in the involucral sheaths; awn 20 mm. long .. .. *I. membranacea* 1
  B. Racemes quite exserted from involucral sheaths; awn 12-13 mm. long .. .. *I. actinostachys* 2
A. Sheaths of involucral bracts coriaceous, hard, convex, 7-10 mm. long; racemes closely surrounded by the sheaths; awns 17-20 mm. long, the 4 involucral spikelets with only 1 glume each .. .. *I. vaginiflora* 3

1. *I. membranacea* (Lindl.) Domin, in Bibl. Bot., Heft 95 : 280 (1915). Leaf-blades flat, 4-5 mm. broad; involucral sheaths 12-15 mm. long, flattened, keeled, herbaceous; racemes more or less exserted from the involucral sheaths; the 4 involucral spikelets about 4 mm. long, each with 2 glumes, of which the outer one is 7-9-nerved and minutely hairy or almost glabrous, all on short, stout pedicels which are much exceeded by the tufts of hair at their base; fertile spikelet 5-5½ mm. long, with a beard of long erect hairs at its base, and with a very short pedicel scarcely ½ mm. long, the outer glume 5-7-nerved, puberulent near summit, the second glume of equal length, but glabrous and 3-nerved; the third glume small, flat, hyaline; the awn (or fourth glume) about 20 mm. long; grain obovate,

2½-3 mm. long (pl. viii., fig. 2).—*Anthistiria membranacea,* Lindl. (1848), *Iseilema Mitchellii,* Anderss. (1856).

S. Australia. Peake Station, (Tate Herb.); Snake Gully, Pedirka, *E. H. Ising.*—Central and N. Australia; Queensland.

2. *I. actinostachys,* Domin, l.c. 282.—Leaf-blades flat, about 3 mm. broad; involucral sheaths 10-12 mm. long, or sometimes rather longer, flattened, keeled, herbaceous; racemes spreading-erect, conspicuous and quite exserted from the involucral sheaths; the 4 involucral spikelets 3½-4 mm. long, with 2 glumes each, the outer glume 7-9-nerved and minutely scabrous-hairy, all on short pedicels about as long or rather longer than the tufts of hair at their base; fertile spikelet 5 mm. long, bearded by a few long hairs at base and on a pedicel of about 1 mm., the outer glume 7-nerved, ciliate on margins and puberulent on lower part of back; awn or fourth glume very slender, 12-13 mm. long; grain elliptic-oblong, 2¼ mm. long (pl. viii., fig. 1).—*Anthistiria membranacea,* Turner, Aust. Grasses, pl. xi. (1895).

S. Australia. Near Oodnadatta, *Miss Staer;* Abminga Creek, *J. B. Cleland;* Minnie Downs, *L. Reese.*—Queensland.

3. *I. vaginiflora,* Domin, l.c. 281. Leaf-blades flat, 3-5 mm. broad; involucral sheaths 7-10 mm. long coriaceous, hard, rounded on back and scarcely keeled, almost completely concealing the racemes and their spathes, with the exception of the awns; 4 involucral spikelets consisting of only 1 glume each 3½-4 mm. long, 5-11-nerved, glabrous except ciliation near summit, always without stamens, all on short pedicels about as long or rather shorter than the tufts of hair at their base; fertile spikelets 6 mm. long, glabrous or with a few hairs at base, on a pedicel of about 1 mm., the outer glume 7-nerved, glabrous except ciliation near margin; awn slender 17-20 mm. long; grain elliptic-oblong, about 3 mm. long (pl. viii., fig. 3).

S. Australia. Near Oodnadatta, *Miss Staer;* Swallow Creek (10 miles N. of Oodnadatta), *R. Tate;* Marree, *D. N. George;* W. of Lake Torrens and Cordillo Downs, *J. B. Cleland.*—North Australia; Queensland.

In our 3 species the outer or first glume of the fertile spikelet is always 2-toothed at summit, the second glume is of about the same length, the third is hyaline and about ½ as long; the long pedicels of the 2 small upper male or barren spikelets of each raceme are more or less hairy. The embryo occupies about ¾ of the compressed grain; the hilum is punctiform and basal.

Domin's fourth species—*I. macrathera,* with awns 3 cm. long or more—belongs to N.E. Queensland. All are known as "Flinders Grass."

Aristida.

Much new light has been thrown on our species of *Aristida* by two recent works of Dr. J. Th. Henrard, of Leiden—"A critical revision of the genus Aristida," published in the Mededeelingen van's Rijks Herbarium (1926-28) and "A monograph of the genus *Aristida,*" in the same periodical, vol. i. (1929), vol. ii. (1932). These important publications describe the *Aristidas* of the whole world, about 320 species. It should be observed that Henrard, in his descriptions, applies the term "column or beak of the awn" to the straight, entire, usually twisted portion, which in several species forms a prolongation of the flowering glume, and reserves the term "awn" for the 3 long bristles which terminate the awn considered as a whole and which are always present in the genus, even when the supporting column is absent. For purposes of examination the flowering glume must be ripe, for in the early stages the characteristic clothing of hairs or bristles is often insufficiently developed.

The following key deals with our South Australian and one Central Australian species:—

SECTION I. *Arthratherum.* Flowering glume articulate at summit, the long, twisted column falling off at maturity; outer glumes very unequal; panicle narrow.

A. Stems rather stiff; panicle not half length of stem; flowering glume 9-10 mm. long .. .. *A. Browniana* 1

A. Stem more slender; panicle half or more as long as stem; flowering glume 6 mm. long .. .. *A. arenaria* 2

SECTION II. *Chaetaria.* Flowering glume not articulate at summit; column absent, or if present, not articulate on the glume.

- *B.* Awns sessile on flowering glume without any intervening column or beak.
  - *C.* Margins of flowering glume convolute (one overlapping the other).
    - *D.* Panicle short (5-8 cm. long), dense, not interrupted, nearly as broad as long; outer glumes very unequal; flowering glume glabrous .. .. *A. Behriana* 3
    - *D.* Panicle long (10-20 cm.), narrow, interrupted towards base; outer glumes subequal; flowering glume bristly in upper half.
      - *E.* Panicle very narrow; awns to 18 mm. .. .. .. *A. echinata* 4
      - *E.* Panicle rather broader and looser; awns to 25 mm. .. *A. muricata* 5
  - *C.* Margins of flowering glume involute, thus forming a furrow on the ventral side.
    - *F.* Panicle narrow, interrupted, to 35 cm. long; awns unequal, 25-35 mm. long .. .. *A. biglandulosa* 6
    - *F.* Panicle oblong, dense, 3-7 cm. long; awns equal, 10-12 mm. long .. .. *A. anthoxanthoides* 7
- *B.* Awns supported by a twisted column or beak, as in the section *Arthratherum*, but the column shorter and not articulate on the flowering glume (sub-section *Schoenatheron*). Leaves flat, often twisted; panicle narrow; column 5-6 mm. long .. *A. latifolia* 8

1. *A. Browniana,* Henr. Rev. 63 (1926). Stems erect, rather stiff, 15-40 cm. high; leaf-blades convolute-filiform, 8-20 cm. long; panicle 8-15 cm. long (with the awns), very narrow; outer glumes 1-nerved, very unequal, at first purplish, later straw-coloured, the lower 8-12 mm. long, the upper 15-22 mm. long; flowering glume 9-10 mm. long (including bearded callus of about 2 mm.), smooth except for minute tubercles near summit; column 25-38 mm. long, rarely longer, twisted; awns subequal, slender, 35-65 mm. or rarely longer (pl. viii., fig. 8).—*A. stipoides,* R. Br. (1810) non Lamk. (1791).

S. Australia. From the Flinders Range, near Lake Torrens, northwards. There is also one record from as far S. as Angaston.—Central and N. Australia; N. S. Wales; Queensland and (according to Henrard) W. Australia.

Henrard considers it probable that *A. Browniana* is a hybrid between his new tropical species *A. Muelleri* and *A. arenaria.* He distinguishes *A. Muelleri* from *A. Browniana* as having "column of awns about 4 cm. long; upper glume more than 2 cm. long." We have, however, specimens with awns to 4 cm. long and short outer glumes, and others where the reverse is the case. The length of the combined flowering glume and callus, together with the habit of the plant, appear to yield the best distinguishing characters for *A. Browniana* and *A. arenaria,* but they leave no satisfactory place for *A. Muelleri.* A specimen from the Adelaide River, N.A., preserved in the Tate Herbarium, has the lower glume 11 mm., the upper 25 mm., the column 35-38 mm. and the awns 7-8½ cm. From Cockatoo Creek, in the northern part of Central Australia, I have a specimen with the column 36-43 mm. and the awns 5½-6½ cm. Both have the long flowering glume of *A. Browniana.*

2. *A. arenaria,* Gaudich. Stems slender, densely tufted, 8-30 cm. high; leaf-blades filiform, glabrous, 3-8 cm. long, often curved; panicle 5-20 cm. long, narrow, always occupying half or more of the plant; outer glumes very unequal, 1-nerved, dark-purple, withering to straw-colour, the lower 9-12 mm. long, the upper 15-26 mm. long; flowering glume 5-6, rarely 7 mm. long (including callus of 2 mm.), glabrous except for minute tubercles towards summit; column 18-26 mm.; awns subequal, slender, 3½-7 cm. long.

All the Australian States, but usually in dry country.

Var. *hirsuta,* Henr. Leaves hairy.—Mount Lyndhurst; Lake Frome (Flinders Range).

4. *A. echinata,* Henr. Monogr. 284 (1932). Stems erect, rather stiff, 20-50 cm. high, about 1 mm. thick; leaves almost glabrous except hairs at orifice of sheath, the blades convolute-filiform, rather stiff; panicle 10-20 cm. long, narrow, spike-like, usually straw-coloured, the branches erect, rather distant towards base; outer glumes strongly 1-nerved, subequal, mucronate, scábrous on keel, about 8-9 mm. long; flowering glume 8-9 mm. long (including the bearded callus), bristly with short glassy conical hairs in its upper half, sometimes mottled with purple; awns rather broad and flat at base, about equal, 12-18 mm. long (pl. viii., fig. 7).

S. Australia. Flinders Range (Mount Parry Gap, Mount Lyndhurst, Aroona Range, Moolooloo); Cordillo Downs.—N. S. Wales; Queensland.

Var. *nitidula,* Henr. Only differs from the type in the outer glumes glabrous or almost so; the first outer glume is sometimes slightly longer than the second and may reach 10 mm. or a little more.

S. Australia. Finniss Springs (near Lake Eyre); Mount Goolwa (S. of Musgrave Ranges).—Central Australia (near Mount Thomas); N. S. Wales; Queensland; W. Australia (Victoria Desert; Fraser Range, *R. Helms).*

5. *A. muricata,* Henr., l.c. 285. Stems rigid, 50-70 cm. high, 2-2½ mm. thick; nodes glabrous, leaf-blades minutely scabrous, long, flat but convolute and acute in the upper part or almost all the way; orifice of sheath hairy; panicle 12-26 cm. long, straw-coloured, narrow and compact above, rather loose below, the branches erect and the lower ones distant; outer glumes 1-nerved, rather unequal, the lower one 8-10 mm. long, scabrous on keel, the upper 10-12 mm. long, scabrous on keel only near summit, both with a mucro usually inserted between 2 small terminal teeth; flowering glume (including the bearded callus) 9-11 mm. long, becoming purplish, more or less bristly in upper half with small glassy erect hairs; awns subequal, slender, 15-25 mm. long.

S. Australia. Swallow's Waterhole (called "Swallow Creek" by Tate), about 10 miles N. of Oodnadatta, May 5, 1894, *R. Tate;* Arkaringa Creek, *R. Helms.*

Central Australia. Horseshoe Bend, Finke River, *E. H. Ising.*—N. S. Wales.

6. **A. biglandulosa,** nov. sp. Culmi caespitosi, rigidi, saepe plus quam metrales; foliorum laminae superiores filiformes, inferiores planiusculae, vaginis orificio pilosis; panicula 20-35 cm. longa, angusta, superne compacta, purpurascens, ramis erectis, inferioribus distantibus, 8-10 cm. longis, plerisque ad basin glandulis binis instructis; glumae exteriores subaequales, mucronatae, purpurascentes, fere glabrae, 14-16 mm. longae, prima sub-3-nervi, secunda 1-nervi; gluma florifera (cum callo barbato) 11-12 mm. longa, glabra, punctulata, purpurea, marginibus involutis sulcum denticulatum efformantibus; aristae inaequales, suberectae, centralis circa 30-35 mm. longa, laterales circa 25-30 mm. longae. (pl. viii., fig. 9).

Central Australia. Glen Helen, June, 1894, *R. Tate;* Alice Springs, August, 1931, *J. B. Cleland.*

7. *A. anthoxanthoides* (Domin) Henr. Rev. 29 (1926). Stems 8-30 cm. high; leaves subulate, 3-5 cm. long, somewhat rigid, minutely scabrous; panicle oblong, dense, 3-7 cm. long, 1-1½ cm. broad; outer glumes somewhat unequal, 1-nerved, mucronate, the lower 5-6 mm., the upper 6-7 mm. long; flowering glume about 6 mm. long (including bearded callus of 1 mm.), very scabrous or almost bristly in upper half, furrowed on the ventral side by the involute margins; awns equal, 10-12 mm. long, divergent when ripe (pl. viii., fig. 5).—*A. Adscensionis* var. *anthoxanthoides,* Domin (1915); *A. depressa,* Benth. and others partly, not Retz; *A. Adscensionis* of other Australian authors partly, not of L.

S. Australia. Mount Lyndhurst; Mount Parry; Calanna Station; Andamooka Station; Musgrave Ranges; Diamentina River; Cordillo Downs.—Western N. S. Wales.

8. *A. latifolia,* Domin, in Bibl. Bot., Heft 85 ; 339 (1915), nov. var. **minor.** Stems erect, rigid but rather slender, 40-50 cm. high, 1-1½ mm. thick; leaf-blades long, flat except towards the summit, 2-3 mm. broad, striate, minutely scabrous above, glabrous below, becoming twisted; orifice of sheath almost glabrous; panicle 12-15 cm. long, narrow, pale-coloured, branches erect, the lower ones rather distant; outer glumes subequal, 1-nerved, mucronate, about 10 mm. long, the lower one scabrous on keel, otherwise both glabrous; flowering glume (including the bearded callus) 5-6 mm. long, scabrous towards summit and surmounted by a slender continuous twisted scabrous column of 5-7 mm., or about 12 mm. long in all; awns subequal, very slender, 15-18 mm. long (pl. viii., fig. 6).

Var. *minor* differt a typo praecipue paniculâ aristisque valde brevioribus.

S. Australia. Near Oodnadatta, *Miss Staer;* Snake Gully, near Pedirka, *E. H. Ising.*

The type occurs in N. Australia, N. S. Wales, Queensland and W. Australia. According to Domin's description it has the panicle up to 50 cm. long and the awns 20-30 mm. long, although the drawing on plate 112 of the monograph shows the awns only 19-21 mm. long.

A. ramosa, R. Br., and *A. calycina,* R. Br. belong to Eastern N. S. Wales and Queensland. Their names have been applied to many S. Australian specimens, but apparently they are not natives of this State.

Eragrostis elongata (Willd.) Jacq. Eclog. Gram. 3, t. 3 (1813). Stems slender, erect, 20-40 cm. high; leaves glabrous, the basal sheaths broad, the orifice usually with a few silky hairs, the blades 4-20 cm. long, filiform or flattish in lower part and then 2-3 mm. broad; panicle very loose, 8-15 cm. long, the lower branches distant, sometimes shortly again branched near base, finally spreading, 2-6 cm. long; spikelets linear, greenish to lead-coloured, 6-10 mm. long, about 2 mm. broad, 8-18-flowered, 1-furrowed down the centre, on capillary pedicels ½-4 mm. long, solitary or twin, the terminal pedicel sometimes 10-15 mm. long; flowering glumes 2 mm. long, conspicuously 3-nerved; palea about ¾ as long, curved, strongly ciliate on the 2 nerves; rhachilla finally disarticulating downwards; grain globular to ovoid, ½-¾ mm. long, pale or reddish (pl. viii., fig. 10). —*E. Brownii* (Kunth) Nees (1841) partly; *Poa elongata,* Willd. (1809); *P. polymorpha,* R. Br. (1810) non Koenig (1803).

S. Australia. Bridgewater; Blumberg; Square Waterhole; Mount Compass; Onkaparinga Gorge; Inman Valley; Myponga (all in Mount Lofty Range).—Victoria; N. S. Wales; Queensland; North Australia; tropical Asia; New Caledonia.

Dr. Domin points out that *E. Brownii,* as described by Bentham in the Fl. Aust., is a mixture of *E. elongata,* Jacq., *E. diandra* (R. Br.) Steud. and *E. pubescens* (R. Br.) Steud. Forms of *E. diandra* with the spikelets few in the clusters or in short dense spikes and sometimes very shortly pedicellate, such as we have from Sevenhills, Bordertown and Naracoorte, were placed by Bentham under *E. Brownii*. *E. pubescens* belongs to tropical Australia.

Eragrostis xerophila, Domin in Journ. Linn. Soc. 41 : 281, t. 12 (1912). Densely tufted perennial, with numerous slender but rigid stems, 25-40 cm. high, rising from hard bulbous bases arranged along the shortly woolly rhizome, which is covered by short, scarious, deltoid, striate scales, as in *E. laniflora;* leaf-sheaths tight, minutely hairy on margins near orifice; blades short, more or less spreading, striate, subdistichous, rather stiff but not pungent, 1½-5 cm. long, flat near base and 2-3 mm. broad, scaberulous above, glabrous below, often breaking off abruptly from the sheath; panicle narrow, spike-like, 5-14 cm. long, 6-10 mm. broad, the lower branches alternate, short, erect, 2-7-spiculate; spikelets linear, subsessile, 6-14 mm. long, 1-2 mm. broad, 10-30-flowered, longitudinally 1-furrowed, brownish-purple, later straw-coloured, suberect; flowering glumes 2-2½ mm. long, the lateral nerves faint; palea nearly as long, ciliolate on nerves; grain ovoid-oblong, 1-1¼ mm. long.

S. Australia. Finniss Springs, *F. D. Warren;* Snake Gully, Pedirka, *E. H. Ising;* Calanna Station, *J. P. H. Fabian;* Peake River, *Chandler.*—Central Australia; W. Australia.

Differs in minor particulars from the type: the leaf-blades are stiff and acute, but not pungent, rather broader (1-1½ mm. broad in Domin's description), the panicle sometimes slightly longer and the branches occasionally with more numerous spikelets. The type was collected by Dr. E. Clement between the Ashburton and De Gray Rivers, W.A. The species is distinguished from *E. eriopoda, laniflora* and *setifolia* chiefly by the short broad leaves and cylindrical panicle.

Mr. Warren, of Finniss Springs, writes:—"A very tough grass, growing in clay and stony places; never dies out; stock eat it readily."

Eragrostis Kennedyae F. Turner. Specimens collected by E. H. Ising at Wall Creek, C.A., just beyond our border, have the panicle 5-12 cm. long, purplish and looser than usual, so that, when fully out, it is 10-15 mm. broad at the base. The upper branches are more erect than in *E. japonica*, the panicle of which has a much looser appearance, not only on account of the spreading-erect branches, but because the lateral pedicels of the spikelets are 1-1½ mm. long, while in *E. Kennedyae* and *E. confertiflora* they are only ¼-½ mm. long.

Eriachne Isingiana, nov. sp. Gramen annuum, 10-15 cm. altum, culmis supra basin ramosis, geniculatis, gracilibus, ad basin et divisionem ramorum foliatis; folia pilis e tuberculis ortis instructa, vaginis laxis, striatis, brevibus, laminis lineari-lanceolatis, planis, 10-25 mm. longis, circa 2 mm. latis; folium supremum fere ad vaginam 15-20 mm. longam, glabrescentem, basin rhacheos florentis arcte amplexantem redactum; panicula valde exserta, angusta, spiciformis, 12-25 mm. longa, 5-6 mm. lata; spiculae 4 mm. longae, biflorae, pedicellatae; glumae exteriores glabrae, purpurascentes, circa 3½ mm. longae, acutae, 7-nerves; gluma florifera 3½-4 mm. longa, acuminata sed non aristata, dorso inferne villosa, superne glabra et 5-nervi; palea paulo brevior, dorso villosa, apice biaristulata; semen obovatum, rubellum, 1½ mm. longum (pl. ix., fig. 6).

Pedirka, September, 1932. Part of the valuable collection made in the Far North by Mr. E. H. Ising, to whom the species is dedicated. Near *E. pulchella* Domin, of Western Australia, differing in the more leafy stems, longer spikelets and glumes, and in the palea tapering to a fine point which is not entire, but consists of 2 small erect parallel awns. Both species agree in the uppermost leaf of each stem being almost reduced to a long sheath which embraces the base of the panicle-axis and is surmounted by a very short inconspicuous blade.

Dactyloctenium radulans (R. Br.) Beauv. Agrost. 72 (1812) instead of *D. aegyptium* (L.) Richt. Appears to be specifically distinguished from the Asiatic and African plant by its shorter and more numerous spikes (6-12 mm. long and usually 4-10 in number, instead of 12-25 mm. long or more and 2-5 in number, as in *D. aegyptium)* and by the glumes with ciliolate keels, not glabrous. —*Eleusine radulans,* R. Br. Prodr. 186 (1810).

S. Australia. All our northern districts.—North and Central Australia; Queensland; N. S. Wales; N.E. Victoria. Said also to occur in Abyssinia, Sokotra and S.E. Arabia.

Our plant, popularly known as Button Grass, provides good feed, which is said not to be the case with *D. aegyptium.* The spikes of *D. radulans* sometimes spread horizontally when in fruit.

Stipa nitida, Summerh. et Hubbard. This shining grass is common at Mount Ferguson, near Port Pirie, which is its most southerly locality near the Flinders Range and the only maritime station yet discovered. The outer glumes may be only 8-9 mm. long.

Stipa acrociliata, Reader, Ardrossan, November, 1932, *E. C. Black.* A new locality for this handsome grass. These specimens from Yorke Peninsula have a ring of short white appressed hairs below each glabrous node of the stem.

**Schismus barbatus* (L.) Juel. This small Mediterranean and South African grass, which was first collected along the Broken Hill railway, has now appeared in our Murray lands and Far North. It has also extended to New South Wales and Victoria, and is said by some observers to be good fodder.

**Psilurus aristatus* (L.) Duval-Jouve (1866). In scrub near Saddleworth, *Worsley C. Johnston;* cliffs S. of Hallett's Cove, *J. B. Cleland.* A very slender annual Mediterranean grass, not previously recorded.—*Nardus aristata,* L. (1763); *Psilurus nardoides,* Trin. (1820).

Astrebla lappacea (Lindl.) Domin in Bibl. Bot. 85 : 372 (1915). This name must replace that of *A. triticoides* (Lindl.) F. v. M. As shown by C. E. Hubbard in Kew Bull., 1928, *Danthonia lappacea,* Lindl. (1839) and *D. triticoides,* Lindl. (1848) are conspecific. Bentham considered, mistakenly, that *D. lappacea* was the form of Mitchell Grass with hooked awns, which he named *A. triticoides* var. *lappacea.* This has now been described as *A. squarrosa,* Hubbard. It has not so far been found in South Australia.

Elytrophorus spicatus (Willd.) A. Camus in Lecomte, Fl. gén. Indo-Chine 7 : 547 (1923). Abminga Creek, August 2, 1931; *E. H. Ising.* This small plant, which looks more like a *Juncus* than a grass, has not been recorded in South Australia for some 80 years. In the Fl. Aust. it is noted for "Murray River, S.A., *F. Mueller;* Charlotte Waters, *C. A. Giles.*" It has recently been found in the Wimmera, Vict. The flowering glume in our specimens is 4-5 mm. long, including the narrow point, which can scarcely be described as an awn, as it is open almost to the summit. It has 3 nerves, but the 2 lateral ones ascend only as far as the base of the point and are not excurrent. The broad dorsal (abaxial) denticulate wings of the palea embrace the base of the adjoining flower in the spikelet, while the 2 inner (abaxial) wings are very narrow and embrace the grain in the usual manner. The grain is 1 mm. long, ovoid-oblong, slightly compressed, brown, the embryo acute and extending ¾ of its length, the hilum basal and punctiform. The outer glumes are 1-nerved and distinctly shorter than the 3-5 flowers of the spikelet (pl. viii., fig. 4).

The chief synonyms are: *Dactylis spicata,* Willd. in Ges. Naturf. Fr. N. Schr. 3 : 416 (1801); *Elytrophorus articulatus,* Beauv. Agrost. 67 (1812). Hitherto the latter specific name has been generally used, but has to give place to Willdenow's under the law of priority. This grass is a native of Southern Asia as well as of Australia.

Cyperaceae.

Cyperus aristatus, Rottb. Descr. et icon. 23, t. 6, fig. 1 (1773) instead of *C. squarrosus,* L. p.p. Linnaeus confused 2 species in his descriptions of *C. squarrosus. C. aristatus,* which occurs in Australia, India, tropical Africa and America, has the glumes conspicuously 5-7-nerved, with 2-3 nerves on each side, besides the keel-nerve, and the rhachilla is persistent, so that the plant belongs to the section *Eucyperus. C. squarrosus* is a native of India, Cochin-China and Africa. Its glumes are 3-5-nerved on the keel only, and the rhachilla disarticulates at its base and falls off when ripe. It belongs to the section *Mariscus. C. aristatus* has been found at Alberga Creek, Macumba River, Minnie Downs and other places in the Far North; also in Central Australia, North Australia and Queensland.

Liliaceae.

Bulbine semibarbata (R. Br.) Haw. A curious form was collected at Callana, 9 miles north of Marree, by Professor Cleland. Only 4-8 cm. high, it has all the filaments bearded at some distance under the anther and not close below it, as in *B. bulbosa.* Moreover it has the fibrous roots, the ovules, the trigonous and wrinkled seeds and the smaller flowers of the typical *semibarbata. B. semibarbata* has only 2 ovules in each cell of the ovary, or 6 in all, while *B. bulbosa* has about 4 ovules in each cell or about 12 in all. Both species have the upper part of the perianth-segments slightly twisted in a deciduous calyptra which covers the young capsule.

Iridaceae.

**Gladiolus cuspidatus,* Jacq. This South African plant, originally an escape from gardens, has been found growing, usually near creeks, at Mount Lofty, Morialta Gully, Nairne, Normanville, and Kersbrook; also Koppio, E.P. In some of these places it is abundant, and should, therefore, be considered an established alien. It is also common in parts of Victoria.

**Moraea xerospatha,* MacOwan var. *monophylla,* J. M. Black, was collected by Pastor Hoff at Koonibba Mission Station, near the Great Bight, in September, 1928.

Santalaceae.

Santalum lanceolatum, R. Br. Granite hills 24 miles east of Oparinna, at the western end of the Musgrave Ranges; *H. H. Finlayson,* December, 1932. This appears to be the first time that the typical form, with ovate or oblong, acute, thick and rigid leaves, 2-3 cm. broad, has been found in South Australia. The locality is near the border of Central Australia. The plant is a shrub or small tree 4-6 m. high and is fairly numerous. By the white inhabitants it is called "Plum Bush," on account of the juicy dark-blue fruit, which is eaten by the natives. The wood is aromatic. Our ordinary form is the narrow-leaved var. *angustifolium,* Benth.

Chenopodiaceae.

Bassia articulata, nov. sp. Fruticulus glaber absque lanâ densâ in axillis foliorum; folia 3-10 mm. longa, 1 mm. diam., plano-convexa, subclavata; perianthia fructifera in ramulis brevibus ad basin attenuatis articulatisque dense aggregata, quasi imbricata, tubo lineari-oblongo, 4-5 mm. longo, areolâ longâ obliquissimâ quasi laterali ad ramulum affixo, limbo scarioso, erecto, ciliato, 1½ mm. longo, spinis 3, gracilibus, patentibus vel recurvis, 5-8 mm. longis, saepe rubris; semen verticale (pl. ix., fig. 2).

Pedirka railway station (Far North), August, 1932, *J. B. Cleland.*

Differs from *B. intricata* in the spines always 3; the perianths are crowded, as in that species, on short branches, but these branches are narrowed, almost pointed, articulate at base and finally separate without tearing; from *B. divaricata* it differs in the fewer and shorter spines, often recurved, and in the erect limb of the perianth; from *B. tricuspis* in the perianth-tube linear-oblong, not swollen at base and more obliquely adnate to the branch; from both it differs in the articulate branchlets.

NYCTAGINACEAE.

Boerhavia diffusa, L. Specimens with almost glabrous leaves and others with the whole plant glandular-viscid occur in the Musgrave Ranges. Concerning the latter form Mr. Allan Brumby, of Ernabella, informed Mr. H. H. Finlayson that the plant often becomes a dense sticky mass lying prostrate on the ground, and that small insectivorous birds are trapped in it. The native children then collect and cook the birds.

AIZOACEAE.

Carpobrotus aequilaterus (Haw.) N. E. Br. in Journ. Bot. 66 : 324 (1928), instead of *C. aequilateralis*, J. M. Black in Trans. Roy. Soc. S. Aust. 56 : 41 (1932). The form of the specific name is due to the fact that the species was first published by Haworth (in 1794) as *Mesembryanthemum aequilaterum*, and only later (in 1803) as *M. aequilaterale*. Mr. N. E. Brown remarks:—"In modern books all Australian members of this genus *(Carpobrotus)* are referred to *M. aequilaterale*, Haw., but from the very scanty material at Kew, I believe that when properly examined and when the character of the ripe fruit (which has never been noted) is taken into consideration, at least 4 or 5 well-marked species will be found to exist there. None of the material I have seen belongs to the true *C. aequilaterus*, which has slender stems and the smallest leaves of all known species. I have never seen it, but from an original drawing of the type at Kew, it is evident that Salm Dyck's figure correctly represents this species. It is unknown in which part of Australia it grows."

**Cryophytum nodiflorum* (L.) L. Bolus, instead of the names *C. caducum* (Ait.) L. Bolus, used in these Trans. 56 : 41 (1932) and *Mesembryanthemum caducum*, Ait., used in Fl. S. A., 219 (1924). *M. caducum* appears to have been misunderstood by earlier botanists, and this correction has been kindly made by Mr. N. E. Brown on specimens collected near Port Germein.

PAPAVERACEAE.

In view of the question sometimes raised as to the identity of the South African *Papaver aculeatum*, Thunb. and the *P. horridum*, DC. (described from Australian specimens), Sir Arthur Hill, Director of the Royal Botanic Gardens, Kew, was good enough to have the material in the Kew Herbarium examined by Messrs. V. S. Summerhayes and R. A. Dyer. They consider that the specimens passing under these two names are conspecific, stating that "there do not seem to be any recognisable differences between them." The earlier name, *P. aculeatum*, will therefore continue as that of our Australian plant, which, at least in South Australia, seems to be rapidly approaching extinction. As the references were wrongly given by Bentham, Fl. Aust. 1 : 63, they are here quoted as supplied by Messrs. Summerhayes and Dyer:—*Papaver aculeatum*, Thunb. Prodr. Fl. Cap. 2 : 92 (1800); Fl. Cap. ed. Schultes 431 (1823). *P. horridum*, DC, Syst. Veg. 2 : 79 (1821). *P. gariepinum*, Burchell ex DC. Syst. Veg. 2 : 79 (1821).

**Papaver somniferum*, L. var. *setigerum* (DC.) Boiss. This Mediterranean variety, distinguished by its bristly peduncles and smaller capsules with usually only 7-8 stigmatic rays, has been found near Mile End, *J. Crocker*, and near Roseworthy Agricultural College, *G. H. Clarke*.

Cruciferae.

**Neslia paniculata* (L.) Desv. This European and West-Asiatic weed has established itself of recent years at Roseworthy, Wasleys, Reeves Plains and Gawler River. It is distinguished by its small globular 1-celled and 1-seeded pods and by its oblong auricled and stem-clasping leaves.

Leguminosae.

**Trigonella monspeliaca,* L. Outer Harbour, October, 1932, coll. J. B. Cleland; Barabba (6 miles west of Hamley Bridge), per Department of Agriculture. This Mediterranean species has not hitherto been recorded. It is easily recognised by its clusters of 5-10 sessile slender curved pods, about 10 mm. long, nerved transversely and spreading radiately from the stem.

Swainsona tephrotricha, F. v. M. Specimens collected at Terowie by Dr. E. C. Black, in September, 1932, show that the number of leaflets varies from 7 to 21 and the number of flowers in the raceme from 15 to 28. The plants were growing in the corner of a cultivated field, where they were safe from the plough. This is much the same class of country as that in which Mueller collected the type about 1850 (from near Spalding to the Burra Mines). The true *S. tephrotricha* can at once be recognised by its ashy-white obovate-oblong leaflets 4-12 mm. long, 2-4 mm. broad, the terminal one no longer than its neighbours, all concave above and sometimes folded, rather obtuse, but with a small recurved mucro. The style has a minute tuft of hairs behind the stigma.

Swainsona uniflora, nov. sp. Planta pumila, probabiliter annua, 5-6 cm. alta, pilis densis adpressis centrifixis omnino (absque petalis) cinerea, caule 10-15 mm. longo; foliola 3-7, prope basin plantae interdum solitaria, plana vel supra concava, ovato-lanceolata, recurvo-mucronata, 8-15 mm. longa, 3-6 mm. lata, terminale longius quam lateralia; stipulis lineari-lanceolatis; pedunculus uniflorus, 2-3 cm. longus, folium subaequans vel paulo brevior; pedicellus bracteatus, calyce brevior; calyx 7 mm. longus, dentibus lanceolatis paulo longioribus quam tubus; bracteae bracteolaeque minutae; flores purpurascentes, siccitate flavescentes; vexillum 11 mm. longum, 12 mm. latum, callis duobus confluentibus decurrentibusque praeditus; carina obtusa, 10 mm. longa, bisacculata, vexillo brevior, alis longior; stylus tenuis, supra curvaturam rectus, fere totâ longitudine barbatus, pilis basin versus longioribus; legumen non visum (pl. ix., fig. 4).

Horseshoe Bend, Finke River, C.A., *E. H. Ising,* August, 1931. Apparently a small annual; differs from all other species in its 1-flowered peduncles scarcely exceeding the leaves. In the style and the 2 calli on the standard it approaches *S. phacoides.*

Swainsona adenophylla has been found by Prof. Cleland between Wirrulla and Yardea, a locality much further west than any previously recorded.

Acacia salicina, Lindl. In our northern districts this is often only a shrub 2-3 m. high, and when growing on the bank and not close to the creek or other water, the branches sometimes scarcely droop. It is always distinguishable from *A. ligulata* by its loose racemes or panicles, its thick straight-edged pod and its partiality for moist situations.

Acacia spinescens, Benth. Specimens have been found on the roads near Roseworthy Agricultural College with the flowerheads not sessile, but on peduncles 3-6 mm. long.

Acacia obliqua, A. Cunn. Mr. G. H. Clarke, botanist at the Roseworthy Agricultural College, has also discovered, near that institution, a form of this species with pubescent phyllodes. Some specimens from the same locality show the transition between this hairy form and the typical one with glabrous phyllodes.

Acacia mollissima, Willd., instead of *A. decurrens* (Wendl.) Willd. var. *mollis,* Lindl. This handsome wattle, found only in our South-Eastern district, deserves specific rank, as it differs from the typical *A. decurrens,* in shorter pubescent leaflets, larger flowerheads and a narrower pod, as well as in the time of flowering. *A. decurrens,* which is confined to New South Wales, although often grown here and in Victoria as an ornamental tree, flowers usually from July to September, while *A. mollissima,* which inhabits the Eastern States and Tasmania, as well as our South-East, has its ordinary flowering season in November and December.

Pultenaea scabra, R. Br. This species, hitherto only known in South Australia by one specimen, in leaf only, from Birchman Lagoon, K.I., has been found fruiting near Rocky River, K.I., by Prof. Cleland. Calyx very shortly pedunculate, about 4 mm. long, the lobes lanceolate, the 2 upper ones united to middle; pod obovate, pubescent, nearly twice as long as calyx, usually drooping.

**Trifolium arvense,* L. var. *glabrum,* Vis. has been found growing on a farm near Kapunda since 1931, but does not appear to make much progress. This form of Hare's-foot Clover is quite glabrous, even on the calyx-teeth. It has been placed by some botanists under var. *gracile* (Thuill.) Ser., which is somewhat glabrous, has the calyx-teeth merely ciliate, not plumose, and inhabits France, Italy and Spain. Var. *glabrum* belongs to the Balkan Peninsula and probably to other countries of the eastern Mediterranean.

Lotus australis, Andr. var. nov. **exstipulatus.** Variat foliis 3-foliolatis sessilibus (foliolis basilaribus stipularibus deficientibus); bracteis 1-foliolatis.

Horseshoe Bend, Finke River, C.A., *E. H. Ising.* Agrees with ordinary specimens except in the omission of the 2 lower stipular leaflets; it has a single leaflet at the base of each umbel.

Indigofera enneaphylla, L. This species, hitherto only known (in our State) from Cordillo Downs, has been found by E. H. Ising at Pedirka railway station, near the Hamilton River, Far North.

Templetonia egena (F. v. M.) Benth. Sandhills near Pedirka on the Hamilton River, a station much further north than any previous record. Coll. E. H. Ising.

**Medicago reticulata,* Benth. (*M. hispida,* Gaertn, var. *inermis,* Urb.) has appeared on the slopes of the Torrens, near Kintore Avenue.

Oxalidaceae.

**Oxalis compressa,* Thunb. Has appeared for some years in a field at Roseworthy Agricultural College. Near *O. cernua* ("Soursob"), from which it differs in the woolly calyx, the leaflets woolly on the lower face, and the broad, flattish, ciliate petioles.—S. Africa.

Rosaceae.

**Poterium Sanguisorba,* L. "Sheep's Burnet." Hill between Beaumont and Waterfall Gully, November, 1931. This is the form most common in Mediterranean countries, the fruits with 4 narrow sinuate wings and rather deeply pitted, sometimes distinguished as *P. muricatum,* Spach.

Euphorbiaceae.

Euphorbia Stevenii, F. M. Bailey in Qld. Agric. Journ., 1910, p. 288, t. 30, in place of *E. Murrayana,* J. M. Black in Trans. Roy. Soc. S. Aust., 56 : 42, t. 1, fig. 5 (1932). Bailey's type came from the claypans of the Georgina River, in the dry districts of Western Queensland. On meeting with his description and figure, published 23 years ago, I sent a South Australian specimen of *E. Murrayana* to Mr. C. T. White, Government Botanist of Queensland, who, after comparison with the type of *E. Stevenii,* agreed with me that they are conspecific. *E. Murrayana* is, therefore, reduced to a synonym.

**Euphorbia Cyparissias,* L., a Spurge with a creeping rootstock and a native of most countries of continental Europe, has appeared along roadsides in Sefton Park.

MALVACEAE.

Hibiscus crassicalyx, nov. sp. Fruticulus omnino stellato-tomentosus; folia patentia, ovata vel ovato-oblonga, late crenulata, crassa, velutina, 3-7 cm. longa, 2-3 cm. lata; stipulae lineares, caducae; petioli crassi, circa 2 cm. longi; flores solitarii, axillares, in pedunculis crassis petiolos subaequantibus vel superantibus sub flore incrassatis et articulatis; involucrum velutinum, 2-2½ cm. longum, lobis 5 lanceolatis, tubum late cyathiformem subaequantibus; calyx involucro paulo longior, lobis lanceolato-acuminatis extus stellato-velutinis, intus pilis simplicibus instructis; petala minuta (circa 3 mm. longa), orbicularia, imbricata, alba, base purpurea, exteriora dorso stellato-tomentosa, omnia deorsum in cyathum inversum scariosum ipsis petalis aequilongum et parti inferiore columnae staminalis adnatum productae (an forma cleistogama hiemalis?); capsula ovoidea, circa 12 mm. longa, pilosa, 5-locularis; semina 20-25, dense lanata, 4 mm. longa (pl. ix., fig. 5).

Mount Liebig, C. Aust., August, 1932, *J. B. Cleland.*

Differs from *H. Sturtii* in the much greater length of the calyx and involucre (2½--3 cm. long), a corresponding increase in thickness, and in the fewer lobes of the involucre; from *H. Farragei* in the same particulars, also in the pointed, not clavate, lobes of the involucre and in the free style-branches. The minute petals here described are probably those of a winter-flowering cleistogamous form of the species, such as has been also observed in *H. Sturtii.*

FRANKENIACEAE.

Frankenia granulata, n. sp. Fruticulus 30-45 cm. altus; ramuli folia et calyces granulis albo-cinereis dense obtecti; folia pseudo-verticillatim congregata, teretia, rigida, 6-10 mm. longa, 1½ mm. diam., breviter petiolatis marginibus revolutis nervum medianum omnino occludentibus; internodia 5-14 mm. longa; flores in cymas corymbosas foliatas dispositi; calyx oblongo-ovoideus, 7 mm. longus; petala 5, rosea, 10 mm. longa, laminis circa 4 mm. latis; stamina 6; antherae roseae, 1½ mm. longae; styli rami 3, 2 mm. longi (cum stigmatibus clavatis); ovarii placentae 3, parietales; ovula 7-9 pro placentâ; capsula 4 mm. longa; semina 10-14, oblongo-ovoidea, 1 mm. longa, minute tuberculata (pl. ix., fig. 3).

Witchellina, in the Willouran Hills, S.W. of Marree, *H. H. Finlayson,* February, 1933.

Near *F. foliosa,* of which it has the habit, but is a stouter and taller plant, distinguished by its ashy-white, densely granular clothing, its longer, terete, shortly petiolate leaves, with margins so revolute as to hide the lower surface entirely, the larger calyx and petals and the fewer ovules and seeds. It is a handsome Frankenia, the white, tuberculate leaves contrasting well with the comparatively large pink flowers.

OENOTHERACEAE.

The following changes must be made in the names of our 2 introduced *Oenotheras* from temperate South America. The new and more correct determinations are due to the courtesy of Professor P. A. Munz, of Pomona College, Claremont, California, who is preparing a monograph of the genus and to whom specimens from South Australia were submitted.

**Oenothera stricta,* Ledeb., instead of *Oe. odorata,* Jacq. The 2 species are closely allied, but *Oe. odorata* has larger flowers, is glaucous, more villous and has the leaves more strongly crisped-undulate.

**Oe. affinis, Cambess.*, instead of *Oe. longiflora*, Jacq. Both these species of Evening Primrose have a very long beak to the receptacle, but *Oe. longiflora* has oblong, rather obtuse leaves more or less rounded at base and is covered with a much coarser pubescence, whereas *Oe. affinis* has lanceolate acute leaves narrowed at base and is covered with a soft velvety pubescence.

Myrtaceae.

Eucalyptus diversifolia, Bonpl. Wilpena Pound, November, 1928, *J. B. Cleland.* This is the most northerly record of the species.

Eucalyptus viminalis, Labill. Wilpena Pound, November, 1930, *J. B. Cleland.* First record for the Flinders Range.

Eucalyptus incrassata, Labill. var. *protrusa*, J. M. Black. Between Whyalla and Iron Knob, E.P., *A. Morris.* The fruits in these specimens are comparatively small—5-6 mm. long, a trifle broader and slightly contracted at summit.

Umbelliferae.

Hydrocotyle tripartita, R. Br. Rocky River, K.I., *J. B. Cleland.*

Gentianaceae.

**Microcala quadrangularis*, Griseb. This little yellow-flowered South American annual, only 2-4 cm. high, with quadrangular calyx and opposite ovate-oblong leaves, is now well established along the foothills near Adelaide. First discovered on a road near Knightsbridge in 1912, it was supposed to have disappeared, but this impression was probably due to the fact that the plant is only apparent during its few weeks of flowering in September and October.

Borraginaceae.

Heliotropium tenuifolium, R. Br. nov. var. **parviflorum.** Variat corollâ calycem tantum aequante vel eo paulo breviore, intus glabrâ vel fere glabrâ.

Mount Liebig, C.A., August 16, 1932, *J. B. Cleland.* This appears to differ from the type only in the shorter corolla and its complete or almost complete lack of pubescence inside the tube. The glabrous interior of the corolla is one of the characters of the section *Euheliotropium*, but it may occur exceptionally in the section *Orthostachys*, to which *H. tenuifolium* belongs. De Candolle, in defining *Orthostachys*, says:—"Corollae tubus sub fauce vel fauce pubescens, rarissime glaber." The cohering anthers, which occur in the variety and the type, indicate *Orthostachys.* The calyx is the same in the variety and the type (3½-4 mm. long), but the corolla of var. *parviflorum* is only 2-4 mm. long, while in the typical form it is about 7 mm. long and conspicuous above the calyx. The typical *H. tenuifolium* was also collected in the same locality by Professor Cleland.

Solanaceae.

Nicotiana Gossei, Domin in Bibl. Bot., Heft 89 : 1,146 (1929). Plant 30-50 cm. high, green but woolly all over with short silky spreading hairs; stems 6-9 mm. thick below the inflorescence; stem-leaves undulate, sessile, clasping the stem with rounded auricles, the upper ones ovate-lanceolate, acute, 4-14 cm. long, 2-9 cm. broad near base, the lower ones tapering towards the clasping base and sometimes broadly ovate and 20 cm. long by 12 cm. broad; bracts lanceolate; flowers in racemes which are sometimes corymbose, on thick woolly pedicels 5-10 mm. long; calyx green, woolly-pubescent, 5-ribbed, 17-24 mm. long, about 6 mm. diam., the lobes lanceolate, about as long as tube; corolla woolly outside, 30-40 mm. long in all, the tube oblong, purplish, 22-30 mm. long, about 4 mm. diam. and from ⅓ longer to almost twice as long as calyx, the limb about 25 mm.

across, white, its lobes rounded; 4 anthers on filaments of 1-2 mm., the fifth lower down on a filament 6-7 mm. long, affixed 8-12 mm. above base of tube; capsule oblong-conical, smooth, brown, reticulate, 12-15 mm. long, exceeding the calyx-tube, opening in 4 valves; seeds wrinkled, 1 mm. long.

Near Ernabella in the Musgrave Ranges, *J. B. Cleland,* August, 1933. Leaves chewed by the natives as a narcotic.

The type was collected by W. C. Gosse, "in the centre of S. Australia," on his journey of 1873, when he traversed what is now the southern part of Central Australia returning through the Musgrave Ranges. His collection of plants was sent to Baron von Mueller, but his type of *N. Gossei* is at present in Leningrad, on loan from the National Herbarium of Victoria. However, our plant accords well with Domin's description. The species is chiefly distinguished by its soft, woolly, broad, sessile, stem-clasping leaves.

Nicotiana ingulba, nov. sp. Caules erecti, glabri, 30-50 cm. alti, graciles sed rigidi, circa 2 mm. diam.; folia omnia in petiolum angustata, caulina lanceolata, distantia, glabra, undulata, 4-9 cm. longa (petiolo incluso) 1-2 cm. lata, suprema linearia, radicalia, late lanceolata vel ovata, plerumque 6-11 cm. longa, 3-5 cm. lata, omnino vel fere glabra; bracteae parvae, caducae; flores racemoso-paniculati, pedicellis gracilibus, 5-10 mm. longis, puberulis; calyx 12-17 mm. longus, 5-costatus, puberulus, lobis lineari-lanceolatis, tubo quasi aequilongis; corolla saepius 4-5 cm. longa, tubo gracili, virescente, puberulo, 3-4 cm. longo, 2½ mm. diam., limbo albo, transverse 25 mm. lato, lobis obtusis; 4 de antheris in filamentis circa 4 mm. longis innixi, quintum inferius in filamento circa 5 mm. longo et 20 mm. supra basin tubi affixo; capsula oblonga, 10-13 mm. longa, 4-fida, tubum calycis paulo vel multo superans, basin versus transverse rugosa; semina reniformia, rubella, rugulosa, 1 mm. longa (pl. ix., fig. 1).

Central Australia. Harper's Spring, *E. Kramer.*

Distinguished from other species by the leaves all petiolate, and from *N. Gossei* and *suaveolens* by its almost glabrous character. *Ingulba (ingoolba)* is the name applied by the natives to this and other species whose leaves they chew as a narcotic. During winter-flowering the corolla-tube may be only 2-3 cm. long.

Nicotiana excelsior. Specimens from Ernabella, Musgrave Ranges, collected by Prof. J. B. Cleland, authorise the following additions to previous descriptions:— Stems about 15 mm. diam. near base; stem-leaves rather fleshy, sessile, green, glabrous, ovate-lanceolate, acute, 10-30 cm. long, 2-10 cm. broad, including the decurrent tapering wings, which are 2-12 cm. long; calyx 20-30 mm. long, 10-ribbed, with scattered glands, the lobes rather shorter than tube, lanceolate, channelled inside and glandular-denticulate along the margins; corolla-tube 35-50 mm. long, purplish, minutely pubescent, the limb white, 30-35 mm. across, the lobes very shallow and obtuse; 4 anthers on filaments about 1 mm. long, the fifth lower down, on a filament 10-15 mm. long, affixed 20-30 mm. above base of tube. Flowering specimens are sometimes less than 1 m. high. Mr. H. H. Finlayson also collected specimens at Walthaljalkana, in the northern Everards, where the plant is called "mingle" by the natives. The slightly perfumed flowers open before sunset.

N. macrocalyx, Domin in Bibl. Bot., Heft 89 : 1,147 (1929) is a synonym of *N. excelsior,* which was published by me in 1926. The type of *N. macrocalyx* was collected by R. Helms in the Birksgate Range, S.A., in 1891, and a co-type, which agrees exactly with *N. excelsior,* is in the Tate Herbarium.

SCROPHULARIACEAE.

Peplidium maritimum (L. f.) Wettst. (1891). This species, distinguished from P. Muelleri chiefly by its sessile or subsessile flowers and fruits, was recorded by Tate for Central Australia, but had not been found in our State until it was collected near the Abminga Creek, August 6, 1932, by Prof. J. B. Cleland. It also inhabits North Australia, Queensland, northern New South Wales, Egypt, and India. Synonyms:—*Hedyotis maritima*, L. f. Suppl. 119 (1781); *Peplidium humifusum*, Delile, Fl. aegypt. illustr. 148 (1813).

MYOPORACEAE.

Eremophila Battii F. v. M. n. var. **major.** Variat foliis floribusque majoribus quam in typo. Folia usque 2 cm. longa; calyx circa 12 mm. longus; corolla 30 mm. longa.

Finke River, C.A., August, 1931; coll. J. B. Cleland.

Eremophila Willsii, F. v. M. var *integrifolia*, Ewart, Fl. N. Terr. 254 (1917). On granite hills at Ernabella, Musgrave Ranges, January, 1933, *H. H. Finlayson.* "Straggling shrub 60 cm.-1m. high; flowers pale-blue." All the leaves on the 2 specimens are entire; the sepals are about 10 mm. long the corolla under 20 mm. and the peduncles 3-4 mm. long.

RUBIACEAE.

Messrs. H. K. A. Shaw and W. B. Turrill revised the Australian *Asperulas* in the Kew Bulletin of 1928, replacing *Galium geminifolium*, F. v. M. by a new name:—

Asperula gemella, Shaw et Turrill. Flaccid plant; leaves in pairs, linear, 5-30 mm. long, glabrous, the margins more or less recurved, the interpetiolar stipules usually minute or absent, rarely leaflike; flowers in irregular cymes; male corolla about 1½ mm. long, the lobes more than 3 times as long as the tube; female corolla about 1¼ mm. long, the lobes 4 times as long as the minute tube, and spreading, so that the corolla appears rotate; fruit rugose, 2-3 mm. diam.

In swamps and floodwaters near rivers in South Australia, Victoria, New South Wales and S.W. Queensland. It was originally described as *Galium geminifolium* by Mueller in Trans. Vict. Inst., 1 : 147 (1855), and by Bentham, Fl. Aust. 3 : 445 (1866), and was illustrated (as *Asperula geminifolia)* in Key Vict. Pl. t. 75 and Pl. Vict. t. 31. The true *Asperula geminifolia*, F. v. M. Fragm. 5 : 147 (1866); Benth. Fl. Aust. 3 : 443 (1866), with the tube rather longer than the corolla-lobes, is, as far as is known, confined to the eastern coast of Queensland.

Shaw and Turrill distinguish their new species *A. euryphylla* from *A. Gunnii*, Hook. f. chiefly by the fact that the leaves of *euryphylla* dry green, while those of *Gunnii* dry black. They therefore transfer our Kangaroo Island plant from *A. Gunnii* to *A. euryphylla* var *tetraphylla*, Shaw et Turrill. Our specimens have the small ovate or elliptical leaves usually in 4's, rarely in 3's or 5's, glabrous except for short cilia on the margins and along the midrib below.

CAMPANULACEAE.

Isotoma petraea, F. v. M. Walthajalkana Soak, Everard Range; Ernabella Waterhole, Musgrave Ranges. Found round soaks and more widely spread on the sandhills. Mr. H. H. Finlayson reports that this plant is often fatal to camels which eat it.

GOODENIACEAE.

Goodenia unilobata, J. M. Black. This species, hitherto only known by a scrap in the Tate Herbarium, labelled "Ooldea," without date or name of collector, has been found by Prof. J. B. Cleland at Rumbalara, S. of Horseshoe Bend, River Finke, C.A. Some particulars can, therefore, be added to the description in Trans. Roy. Soc. S. Aust., 51 : 383 (1927) and in Fl. S.A., 554. Stems several, prostrate or ascending, 10-15 cm. long, pubescent in all their length or glabrous near base; leaves usually irregularly, broadly and obtusely lobed towards the base (the stem-leaves often conspicuously 1-lobed), minutely and distantly toothed in upper part, rarely entire, the radical ones 3-4 cm. long, about 10 mm. broad, tapering into a petiole 12-15 mm. long, all the leaves nearly glabrous except for short cilia along the margin; peduncles always 1-flowered and rising from the axils of the radical, as well as from those of the stem-leaves.

Near *G. heterophylla,* Sm., of Eastern Australia, but differs in the stem-leaves often prominently 1-lobed, the long petioles of the radical leaves, the larger corolla, the longer dissepiment and the arid habitat. The capsule and seeds have not been seen.

COMPOSITAE.

**Iva axillaris,* Pursh. This scabrous perennial, about 30 cm. high, has established itself in a vineyard near Sevenhills for about 8 years past. It belongs to the tribe *Heliantheae,* subtribe *Ambrosiinae,* and has racemes of small pedunculate drooping heads, one in each of the upper axils. A native of North America, from the Saskatchewan to New Mexico and California. This appears to be its first record in Australia. I received an excellent specimen through Mr. Worsley C. Johnston.

**Centaurea nigra,* L. Knapweed. Encounter Bay, September, 1928, *J. B. Cleland.* First record for South Australia; recorded for Victoria in 1925.—Europe.

Pterocaulon sphacelatum (Labill.) Benth. et Hook. Witchellina, S.W. of Marree. H. H. Finlayson reports that this plant is known as "Apple Bush" on account of its pleasant odour of apple.

Dimorphocoma minutula, F. v. M. et Tate has been found by Prof. Cleland at Curdiemurka, N. of Marree. It has hitherto only been collected in the Flinders Range near Lake Torrens.

Minuria integerrima (DC.) Benth. and *M. denticulata* (DC.) Benth. have frequently, in at least some of the heads, female ligulate flowers only, the bisexual disk-flowers being absent.

DESCRIPTION OF PLATES.

PLATE VIII.

Fig. 1. *Iseilema actinostachys:—A,* raceme of spikelets; *B,* grain.

Fig. 2. *Iseilema membranacea:—C,* raceme of spikelets; *D,* grain.

Fig. 3. *Iseilema vaginiflora:—E,* involucral bracts enclosing spathes and racemes; *F,* raceme of spikelets; *G,* solitary glume of involucral spikelets; *H,* grain.

Fig. 4. *Elytrophorus spicatus:—I,* flowering glume and palea.

Fig 5. *Aristida anthoxanthoides:—J,* spikelet.

Fig. 6. *Aristida latifolia* var. *minor:—K,* spikelet; *L,* leaf.

Fig. 7. *Aristida echinata:—M,* spikelet; *N,* flowering glume.

Fig. 8. *Aristida Browniana.*

Fig. 9. *Aristida biglandulosa:—O,* spikelet; *P,* flowering glume; *Q,* base of panicle-branch showing glands.

Fig. 10. *Eragrostis elongata:—R,* portion of panicle; *S,* spikelet; *T,* flowering glume; *U,* palea; *V,* grain.

PLATE IX.

Fig. 1. *Nicotiana ingulba:—A,* limb of corolla; *B,* calyx; *C,* capsule.

Fig. 2. *Bassia articulata.*

Fig. 3. *Frankenia granulata:—D,* one valve of capsula; *E,* cross section of leaf; *F,* leaf.

Fig. 4. *Swainsona uniflora:—G,* pistil; *H,* standard.

Fig. 5. *Hibiscus crassicalyx:—I,* flower; *J,* imbricate petals and large base of same; *K,* pistil.

Fig. 6. *Eriachne Isingiana:—L,* back of flowering glume; *M,* palea and grain; *N* spikelet.

NEW AUSTRALIAN LEPIDOPTERA.

BY A. JEFFERIS TURNER, M.D., F.E.S.

Summary

Head grey-whitish; face brownish; fillet white. Palpi under 1; brown-whitish. Antennae whitish. Thorax dull bluish-green. Abdomen dull bluish-green ; apex whitish ; underside pale grey, Legs pale fuscous ; posterior pair whitish. Forewings triangular, costa moderately arched, apex pointed, termen nearly straight, moderately oblique; dull bluish-green with white markings; costal edge grey throughout ; antemedian line from $^1/_3$ costa to $^3/_8$ dorsum, slightly curved outwards, slender, indistinct towards costa ; postmedian from $^2/_3$ costa to $^5/_8$ dorsum, stronger, slightly outwardly curved, becoming sinuate towards dorsum ; cilia pale grey. Hindwings with termen strongly rounded ; as forewings but lines more approximated.

NEW AUSTRALIAN LEPIDOPTERA.

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

[Read October 12, 1933.]

Family LARENTIADAE.

Poecilasthena cisseres, n. sp.

κισσηρης, ivy-green.

♀, 28 mm. Head grey-whitish; face brownish; fillet white. Palpi under 1; brown-whitish. Antennae whitish. Thorax dull bluish-green. Abdomen dull bluish-green; apex whitish; underside pale grey. Legs pale fuscous; posterior pair whitish. Forewings triangular, costa moderately arched, apex pointed, termen nearly straight, moderately oblique; dull bluish-green with white markings; costal edge grey throughout; antemedian line from $\frac{1}{3}$ costa to $\frac{3}{8}$ dorsum, slightly curved outwards, slender, indistinct towards costa; postmedian from $\frac{2}{3}$ costa to $\frac{5}{8}$ dorsum, stronger, slightly outwardly curved, becoming sinuate towards dorsum; cilia pale grey. Hindwings with termen strongly rounded; as forewings but lines more approximated.

Very distinct, but nearest *P. euphylla* Meyr.

Victoria: Moe, in February; one specimen.

Family OENOCHROMIDAE.

Taxeotis limbosa, n. sp.

limbosus, fringed.

♀, 22 mm. Head and thorax dark grey. Palpi 2; pale ferruginous-brown with a sharply defined white basal area. Antennae fuscous. Abdomen and legs fuscous. Forewings triangular, costa straight, apex rectangular, termen almost straight, scarcely oblique, crenulate; dark grey slightly tinged with brownish; some whitish costal strigulae; fuscous dots on costa at $\frac{1}{3}$ and $\frac{2}{3}$; a brownish discal dot slightly beyond middle; a subterminal series of blackish streaks on veins ending in terminal dots, each interrupted by a white dot; a very fine blackish terminal line; cilia grey sprinkled with fuscous, apices and a postmedian line grey-whitish. Hindwings with termen gently rounded, crenulate; dark grey, a terminal series of dark fuscous dots; cilia as forewings.

Very distinct but probably nearest *T. exsectaria* Wlk.

Western Australia: Perth; one specimen received from Mr. W. H. Matthews.

Tapinogyna oxypeuces, n. sp.

ὀξυπευκης, sharp-pointed.

♂, 30-35 mm. Head, thorax, and abdomen grey. Palpi slightly over 1; dark fuscous. Antennae grey; pectinations in male 3. Legs fuscous. Forewings triangular, costa slightly arched, apex acute, termen straight, slightly oblique; grey with a few fuscous scales; lines fuscous, variably developed; antemedian from beneath $\frac{1}{3}$ costa to $\frac{1}{4}$ dorsum, slightly curved, often obsolete; postmedian from beneath $\frac{2}{3}$ costa to $\frac{3}{4}$ dorsum, slightly sinuate, pale-edged posteriorly; it may be obsolete leaving only a pale line; a pale dentate subterminal line immediately preceded by a series of fuscous dots; a dark fuscous discal dot beneath midcosta;

an interrupted terminal line; cilia grey. Hindwings with termen gently rounded; as forewings but without antemedian line.

♀, 35 mm. Similar but wings darker and all markings obsolete.

Structurally a *Tapinogyna*, this species looks like a *Nearcha*. It is larger than *T. perichroa* Low., the sexes of equal size, and the apex of the forewings much more acute. In both sexes 6 and 7 of hindwings are separate, 7 arising before angle.

Queensland: Milmerran, in September; four specimens.

Family SYNTOMIDAE.

Eressa stenothyris, n. sp.

στενοθυρις, narrowly transparent.

♂, 28 mm. Head orange. Palpi fuscous. Antennae dark fuscous; pectinations in male $1\frac{1}{2}$. Thorax fuscous with anterior and posterior orange spots. Abdomen orange, bases of segments fuscous. Legs dark fuscous; posterior pair pale ochreous. Forewings broadly triangular, costa straight to near apex; apex rounded, termen slightly rounded, slightly oblique; fuscous with pale ochreous spots; a sub-basal spot at $\frac{1}{3}$ with a long, narrow posterior process; two median spots placed transversely, the lower smaller; a subcostal spot at $\frac{2}{3}$; twin spots placed transversely before midtermen; cilia fuscous. Hindwings moderate, emarginate beyond tornus; fuscous; a long, narrow spindle devoid of scales, narrowly edged with ochreous on anal vein; a pale ochreous sub-basal dot; a small subapical spot with a dot just beneath; cilia fuscous.

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Family NOCTUIDAE.

Gen. Hedymiges, nov.

ἡδυμιγης, sweetly blended.

I substitute this name for *Cycloprora* (Turn., P.L.S.N.S., 1931, p. 338), which I had previously used in this family in a different sense. Type *H. aridoxa* Turn. The type of *Cycloprora* is *C. nodyna* Turn.

Cycloprora symprepes, n. sp.

συμπρεπης, decorous.

♀, 38 mm. Head white; a blackish dot between antennae, and a blackish transverse line across middle of face. Palpi $1\frac{1}{2}$; white, second joint except apex blackish. Thorax white; lateral and posterior margins blackish. Abdomen white sprinkled with fuscous, appearing pale grey. Legs blackish with white rings. Forewings elongate-triangular, costa slightly arched, apex rectangular, termen straight, not oblique, rounded beneath; white with fuscous irroration, appearing grey; markings blackish; two slender transverse lines from costa near base, succeeded by a small costal blotch; a round white sub-basal dorsal spot, containing a blackish dot before middle; a slender dentate transverse line at $\frac{1}{3}$; orbicular a small circular ring slenderly outlined; reniform larger, broadly bilobed; between these a suffused median line bent outwards in middle; two dentate lines follow reniform; a white terminal band containing three blackish spots and a fine broken dentate line; cilia blackish with white bars. Hindwings with termen wavy; fuscous, paler towards base; a curved dentate postmedian line; two whitish tornal spots; cilia white with fuscous bars.

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Namangana fulvescens, n. sp.

fulvescens, partly yellowish-brown.

♂, 36-39 mm. Head fuscous-brown. Palpi 1; fuscous-brown. Antennae grey; ciliations in male minute. Thorax fuscous; anterior and posterior crests whitish. Abdomen brown. Legs brown; tarsi fuscous with whitish rings. Forewings elongate-triangular, costa almost straight, apex rectangular, termen strongly rounded, crenulate; dark fuscous; orbicular obscurely ringed; reniform pale outlined with blackish; between them a blackish suffusion; postmedian line double, slender, wavy, strongly angled above middle; a blackish triangular subapical costal spot containing two pale marginal dots; terminal area whitish-grey with some grey suffusion; within this a short series of fuscous dots from dorsum; cilia fuscous, apices partly whitish. Hindwings with a termen rounded, wavy; pale orange-brown; a broad fuscous terminal band; cilia as forewings.

Queensland: Yeppoon, in December; two specimens received from Mr. E. J. Dumigan.

Gen. Amphipyra Ochs.

Peripyra Hmps. is not, I think, distinguishable from this genus.

Amphopyra rubripuncta, n. sp.

rubripunctus, with red dots.

♂, 42 mm. Head and thorax fuscous. Palpi fuscous; terminal joint and apex of second joint whitish. Antennae grey; ciliations in male $\frac{1}{2}$. Abdomen fuscous; apices of tuft whitish. Legs fuscous. Forewings elongate-triangular, costa straight to near apex, apex rounded, termen rounded, slightly oblique; grey with dark fuscous markings and red dots; three transverse striae from costa near base, the middle one ending in a red dot; antemedian line strongly dentate, from $\frac{1}{3}$ costa to mid-dorsum; orbicular and reniform small, dark fuscous with red centre, an additional similar spot posterior to reniform; postmedian line double, finely dentate, outwardly curved from $\frac{2}{3}$ costa, below middle, more strongly dentate to $\frac{3}{4}$ dorsum; a subterminal shade, posterior margin sharply defined with minute red dots; a terminal series of dark fuscous dots; cilia grey. Hindwings with termen rounded, slightly waved; pale fuscous; cilia pale fuscous.

South Australia: Mount Lofty (1,500 feet), in February; one specimen.

Araeoptera imbecilla, n. sp.

imbecillus, weak.

♂, 10 mm. Head, thorax and antennae white. Palpi fuscous. Forewings elongate-triangular, costa gently arched, apex pointed, termen slightly rounded, strongly oblique; white with some fuscous suffusion towards apex; a costal dot at $\frac{1}{3}$; a median dark fuscous fascia from midcosta, obsolete towards dorsum; some terminal dark fuscous dots; cilia white with a few fuscous points. Hindwings triangular, apex pointed, termen straight; white with some fuscous suffusion; a blackish discal dot before middle, and another on mid-dorsum; cilia as forewings.

North Queensland: Babinda, near Innisfail, in September, one specimen.

Eublemma amphidasys, n. sp.

ἀμφιδασυς, fringed all round.

♀, 16 mm. Head and thorax dark fuscous. Palpi $1\frac{1}{2}$; ochreous. Antennae grey. Abdomen dark fuscous; apex and underside ochreous. Legs fuscous; posterior pair mostly pale ochreous. Forewings triangular, costa nearly straight, apex subrectangular, termen rounded, scarcely oblique; purple-fuscous with broadly suffused transverse lines partly confluent; five minute ochreous—white costal dots between middle and apex; cilia ochreous-white with a median fuscous bar. Hindwings with termen rounded; fuscous; cilia ochreous-white.

Nearest *E. iophaënna* Turn.

Queensland: Brisbane, in January; one specimen.

Oruza megalospila, n. sp.

μεγαλοσπιλος, large-spotted.

♀, 26 mm. Head, palpi, antennae, thorax, abdomen, and legs grey. Forewings elongate-triangular, costa almost straight, apex obtusely pointed, termen gently rounded, moderately oblique; grey; a fuscous sub-dorsal dot near base; two or three similar dots in disc at $\frac{1}{6}$; a small fuscous spot at $\frac{1}{3}$ representing orbicular; reniform oval, fuscous; just posterior to reniform a large circular ferruginous spot edged with fuscous; a suffused fuscous spot between this and costa; another similar on dorsum before tornus; a series of dark fuscous dots near termen; cilia grey. Hindwings with termen slightly rounded; grey; two fine median lines angled posteriorly in middle; a subterminal series of dark fuscous dots; submarginal dots and cilia as forewings.

North Queensland: Kuranda, in March; one specimen received from Mr. F. P. Dodd.

Stictoptera aequisecta, n. sp.

aequisectus, equally divided.

♂, 50 mm. Head ochreous-whitish. Palpi grey, anterior surface brown. Antennae grey; a fan-shaped internal tuft of scales on basal joint; ciliations in male $\frac{1}{2}$. Thorax with high erect tufts of scales from inner surfaces of patagia meeting in middle line, and a small posterior tuft; grey-brown, anteriorly ochreous-whitish. Abdomen pale grey, posteriorly darker. Legs grey-brown; posterior pair mostly ochreous-whitish. Forewings narrow, only slightly dilated, costa almost straight, apex pointed, termen slightly rounded, strongly oblique, crenulate; pale grey suffused with brown on costa before middle, and more broadly in tornal area; two irregularly crenulate transverse lines at $\frac{1}{4}$; orbicular circular, pale with fuscous centre, posteriorly edged with blackish; claviform a blackish V-shaped mark with apex posterior; a blackish line from midcosta to $\frac{2}{3}$ dorsum; very slightly waved; reniform broad, pale with fuscous centre and edged with blackish except beneath; postmedian line double, from $\frac{3}{4}$ costa outwardly curved and then inwardly to before tornus, three blackish spots on its outer edge below middle; a pale dentate subterminal line; a brownish subapical costal spot containing two blackish streaks; three blackish streaks before subterminal below middle; a fine blackish line from subterminal to termen beneath apex, and others similar between veins; cilia pale grey. Hindwings ample, termen rounded, bisinuate; without scales and translucent, except veins and a terminal band not reaching tornus, which are blackish; cilia whitish.

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Gen. **Cryphimaea**, nov.

κρυφιμαιος, hidden.

Tongue present. Palpi porrect; second joint broadly dilated, laterally compressed; terminal joint very short, obtuse. Abdomen with dorsal tufts on first three segments. Forewings without areole, 2 from $\frac{2}{3}$, 3 from before angle, 4 and 5 approximated at origin, 6 from upper angle, 7 and 8 stalked, 9 and 10 absent.

Hindwings with 2 from $\frac{2}{3}$, 3 and 4 coincident, 5 well separate, 6 and 7 stalked, 12 anastomosing with cell to $\frac{1}{3}$.

Nearest *Microthripa,* distinguished by the loss of two veins in the forewing.

Cryphimaea poliophasma, n. sp.

πολιοφασμα, a grey phantom.

♀, 20 mm. Head grey-whitish. Palpi 3; pale grey. Antennae pale grey. Thorax grey; patagia grey-whitish with a small anterior median brownish spot. Abdomen grey. Legs fuscous; posterior pair pale grey. Forewings suboblong, costa strongly arched, apex rounded-rectangular, termen rounded, not oblique; pale grey; markings fuscous, obscure; a suffused irregular line from $\frac{1}{3}$ costa to $\frac{1}{3}$ dorsum; a slender sinuate line from $\frac{3}{4}$ costa to $\frac{3}{4}$ dorsum; an imperfect dentate subterminal line; cilia pale grey. Hindwings and cilia pale grey.

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Gen. Dumigania, nov.

Tongue strong. Palpi short, ascending, not reaching vertex. Thorax with a posterior crest. Abdomen with a crest on basal segment. Forewings with a strong tooth of scales on tornus; 2 from $\frac{2}{3}$, 3 from angle, 4 and 5 well separate, 6 from upper angle, areole very small, 7, 8, 9 stalked from areole, 10 separate. Hindwings with 2 from $\frac{3}{4}$, 3 and 4 approximated from angle, 5 well separate, strongly developed, curved towards 4 near base, 6 and 7 connate, 12 anastomosing shortly with cell at $\frac{1}{5}$.

I have much pleasure in dedicating this genus to its discoverer. Although the male is unknown, it is probably one of the *Acontianae.*

Dumigania iochlora, n. sp.

ἰοχλωρος, purple-green.

♀, 32 mm. Head reddish-purple. Palpi 1; fuscous. Antennae grey. Thorax reddish-purple. Abdomen pale grey; basal crest purple. Legs dark fuscous with whitish rings; posterior pair mostly whitish. Forewings triangular, costa straight to $\frac{3}{5}$, thence bisinuate, apex round-pointed, termen angled on vein 4, slightly crenulate; reddish-purple; base and costa to middle suffused with white; costa with some dark fuscous irroration before middle; a fine blackish line from $\frac{2}{5}$ costa to $\frac{2}{5}$ dorsum; acutely angled outwards on fold; a similar line from $\frac{4}{5}$ costa, gently curved inwards to fold, where it is connected to the antemedian line, thence outwardly curved to $\frac{4}{5}$ dorsum; a white terminal band, edged anteriorly with grey-green suffusion; a grey-green terminal line; cilia fuscous, apices white. Hindwings with termen rounded, bisinuate; whitish, towards termen grey; a fine fuscous postmedian line; cilia whitish with several fuscous bars.

Queensland: Mount Tambourine, in March; one specimen received from Mr. E. J. Dumigan.

Plusia didymospila, n. sp.

διδυμοσπιλος, twin-spotted.

♀, 34 mm. Head, palpi, and thorax fuscous-brown. Antennae fuscous. Abdomen grey. Legs fuscous. Forewings elongate-triangular with a strong scale-tuft at tornus, costa slightly arched, apex pointed, termen rounded, slightly oblique; grey partly suffused with fuscous-brown; a short pinkish-white interrupted sub-basal transverse line; a similar line from $\frac{1}{3}$ costa to $\frac{1}{4}$ dorsum, slightly curved outwards; a pale dentate line from $\frac{2}{3}$ costa to $\frac{3}{4}$ dorsum, toothed inwards on fold; orbicular obsolete; reniform indistinctly darker, with two silvery dots, one on anterior and one on posterior margin below middle; an oblique oval silvery spot immediately after midpoint of antemedian line, and a similar spot below and posterior, nearly touching postmedian line on fold; a subterminal dark shade, well defined posteriorly, with a large posterior tooth beneath costa; a dark terminal lunule on midtermen and three smaller lunules above it; cilia grey, tornal tuft fuscous. Hindwings with termen rounded, slightly wavy; grey, paler towards base; cilia grey with a dark sub-basal line.

North Queensland: Kuranda; one specimen received from Mr. F. P. Dodd.

Nyctipao phaea, n. sp.

φαιος, dusky.

♂, ♀, 104-146 mm. Head, thorax, abdomen, and legs fuscous. Palpi with second joint scarcely reaching vertex, terminal joint $\frac{3}{4}$; fuscous. Antennae fuscous; ciliations in male minute, bristles $\frac{1}{2}$. Forewings triangular, broader in female, costa slightly arched, more strongly towards apex, termen nearly straight, scarcely oblique, strongly crenulate; fuscous; a darker sub-basal line, in female gently rounded, in male strongly waved; a large round antemedian ocellus edged by a dark fuscous line except on costal side, outside this a pale line on lower and outer side, running to midcosta, sometimes white as it approaches costa; ocellus contains on its inner side a brown blackish-edged lunate area with a bidentate process below middle, lower part of edge doubly defined by bluish-white scales; a dark fuscous line from ocellus, commencing with a posterior tooth, in female wavy to $\frac{1}{3}$ dorsum, in male straight to $\frac{1}{4}$ dorsum; a line from $\frac{3}{4}$ costa to $\frac{1}{3}$ dorsum, nearly straight, being the anterior edge of a slightly paler area; a large triangular dark fuscous subapical blotch containing a pale or white subapical spot; from this blotch a strongly crenate line to $\frac{3}{4}$ dorsum, interrupted in middle, dark fuscous edged anteriorly with a narrow pale or white line; a small dark fuscous blotch opposite the gap in postmedian line, containing a small posterior pale or white spot; cilia fuscous. Hindwings as forewings but without sub-basal line. Underside with posterior white marks larger and better defined.

Nearest *N. leucotaenia* Clerck, but without its white fascia.

North Queensland: Cairns; Palm Island, in June; Ingham, in April; five specimens.

ATTATHA REGALIS Moore.

Proc. Zool. Soc., 1872, p. 575, Lep. Ceyl. iii., pl. 212, fig. 4. Hmps. Lep. Phal. xiii., p. 8.

♀, 46 mm. Head pale ochreous-grey, pinkish-tinged; upper half of face blackish. Palpi blackish; lower surface and base of second joint reddish. Antennae grey. Thorax pale ochreous grey with anterior, median, and posterior blackish lines. Abdomen orange-brown; beneath reddish. Legs blackish; coxae and posterior tibiae red. Forewings triangular, costa nearly straight, apex pointed, termen straight, not oblique, rounded beneath; pale ochreous-grey with blackish markings; a very short median streak from base; a dorsal streak from near base to beyond middle; a triangular median costal blotch with a long oblique process towards tornus; a triangular subapical costal blotch; two terminal spots below middle; a suffused reddish tornal spot; cilia pale ochreous-grey. Hindwings with termen rounded; bright red; several minute fuscous terminal dots; cilia reddish-grey. Underside reddish with a suffused oblique median mark on forewing, and a series of terminal dots on hindwing, blackish.

North Queensland: Banks Island (Australian Museum).

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Erceia spilophracta, n. sp.

σπιλοφρακτος, with spotted edge.

♂, 38-43 mm. Head and thorax fuscous with a few whitish points. Palpi ascending, appressed to face; second joint rough on anterior edge only, reaching vertex; terminal joint $\frac{2}{3}$, stout, obtuse; fuscous, apices of second and terminal joints whitish. Antennae fuscous; in male bipectinate, pectinations slender, $1\frac{1}{2}$, each with a long terminal bristle. Abdomen and legs fuscous. Forewings triangular, costa almost straight, apex rectangular, termen rounded, not oblique; fuscous; markings pale ferruginous; a wavy transverse line at $\frac{1}{5}$; orbicular and reniform obscurely indicated; a whitish spot on $\frac{3}{5}$ costa, from which proceeds a sinuate line of dots to a spot on $\frac{3}{5}$ dorsum; a faint subterminal line; a series of terminal dots on veins; cilia fuscous; Hindwings as forewings but without subbasal line.

In the type the areole has been lost by the failure of the basal part of vein 9 to chitinise, leaving 10 separate and 7, 8, 9 stalked. In a second example the structure is that typical of the genus, a small areole from the apex of which 8, 9, 10 arise by a common stalk, 7 being connate with them.

Queensland: Yeppoon, in December; Brisbane, in January; two specimens.

Gen. Brachycyttara, nov.

βραχυκυτταρος, with short cell.

Tongue strong. Palpi ascending, not reaching vertex; second joint densely hairy; terminal joint moderate, smooth, obtuse. Antennae of male with tufts of short cilia. Head with loose-haired crest on vertex. Thorax with rounded anterior but no posterior crest. Abdomen with well-developed crests on first three segments. Femora and tibiae densely hairy. Forewings with normal neuration. Hindwings with cell short ($\frac{1}{3}$); 3 and 4 short-stalked, 5 well developed from near above angle ($\frac{1}{5}$), 6 and 7 connate, 12 anastomosing with cell near base.

Brachycyttara crypsipyrrha, n. sp.

κρυψιπυρρος, with hidden red.

♂, 40 mm. Head and thorax fuscous with a few whitish hairs. Palpi with terminal joint $\frac{2}{5}$; fuscous sprinkled with whitish. Antennae whitish-brown; ciliations in male $\frac{3}{4}$. Abdomen grey. Legs fuscous with some whitish hairs. Forewings elongate-triangular, costa almost straight but slightly sinuate, apex pointed, termen long, moderately rounded, wavy, oblique; fuscous; several minute dots ferruginous-red, one in middle near base, one at and another beneath end of cell, fourth and fifth above and below middle preceding postmedian line; ill-defined antemedian and median dark fuscous transverse lines; stigmata obsolete; postmedian line double, finely waved, outwardly curved, from $\frac{2}{3}$ costa to $\frac{2}{3}$ dorsum, edged posteriorly by a pale line; a fine pale dentate subterminal line; fine dark fuscous submarginal and terminal lines; cilia fuscous-whitish with dark median and terminal lines. Hindwings with termen rounded, crenulate, whitish; towards termen sprinkled with fuscous, especially on veins; a fuscous terminal line; cilia whitish with fuscous bars.

New South Wales: Bourke (Helms); two specimens received from Mr. G. M. Goldfinch, who has the type.

Fodina miranda, n. sp.

mirandus, wonderful.

♀, 45 mm. Head brown; fillet whitish. Palpi $3\frac{1}{2}$; second joint red sprinkled with fuscous on outer surface; terminal joint $\frac{1}{2}$; fuscous, apex whitish. Antennae grey. Thorax brown with antemedian and postmedian whitish transverse lines. Abdomen grey-brown. Legs reddish; tarsi and anterior tibiae pale fuscous. Forewings triangular, costa slightly arched, more strongly towards apex, apex rectangular, termen nearly straight, slightly oblique; grey; costal edge reddish; a small subcostal subquadrate brown basal blotch; a large dark brown blotch extending on dorsum from near base to $\frac{3}{4}$, its costal edged curved to $\frac{2}{5}$, thence abruptly angled towards dorsum, but soon deeply excavated, angled again sharply above dorsum, edged in disc with whitish; a similar large apical blotch, but paler on costa, on which it extends from $\frac{3}{5}$ to apex, triangular, ending obtusely above tornus, narrowly separated from termen; cilia grey, apices whitish. Hindwings with termen rounded, crenulate; orange; a terminal band, straight-edged, broad at apex, not reaching tornus; cilia fuscous, on tornus and dorsum orange.

North Queensland: Kuranda, in November; one specimen received from Mr. F. P. Dodd.

Fodina pergrata, n. sp.

pergratus, delightful.

♂, 42 mm. Head reddish-white; face red. Palpi $2\frac{1}{2}$; red, outer surface sprinkled with fuscous; terminal joint $\frac{1}{3}$. Antennae pale grey; in male shortly ciliated ($\frac{1}{4}$) with a pair of bristles ($\frac{1}{2}$) on each segment. Thorax reddish-brown; crest dark fuscous. Abdomen pale ochreous; tuft reddish-tinged. Legs reddish; tarsi pale fuscous. Forewings triangular, costa nearly straight (apex broken), termen rounded, not oblique; reddish-grey; an irregular dark fuscous blotch commencing as a sub-basal fascia from dorsum, upper edge oblique to beneath $\frac{1}{3}$ costa, longitudinal to near middle, bent at a right angle towards dorsum, then curved outwards to a sharp-toothed projection, lower edge sinuate, ending on $\frac{1}{3}$ dorsum, whitish-edged; a whitish line from beneath costa before apex to apex of discal blotch, with a strong anterior tooth above middle, posteriorly edged with dark fuscous, more broadly opposite supramedian tooth; terminal area greyer; cilia grey. Hindwings with termen rounded; yellow; a moderate fuscous terminal band; cilia fuscous, on dorsum yellow.

North Queensland: Cape York, in October; one specimen received from Mr. E. J. Dumigan.

Pantydia dochmosticha, n. sp.

δοχμοστιχος, with oblique line.

♂, 56 mm. Head grey-brown. Palpi $1\frac{1}{2}$, terminal joint $\frac{1}{4}$; dark fuscous, terminal joint grey-brown. Antennae grey-brown; in male minutely ciliated with a pair of short bristles ($\frac{1}{2}$) on each segment. Thorax grey-brown; tegulae paler; patagia dark fuscous. Abdomen grey-brown. Legs fuscous. Forewings elongate-triangular, costa straight to near apex, apex rectangular, termen rounded, slightly oblique; grey-brown with sparsely scattered dark fuscous scales; an oblique brown line from $\frac{2}{3}$ costa to mid-dorsum, becoming indistinct towards costa; three brown dots, one above and two below middle, representing subterminal line; cilia grey-brown. Hindwings with termen gently rounded; fuscous-brown with some dark fuscous irroration towards dorsum and termen; cilia grey-brown.

North Queensland: Kuranda; one specimen received from Mr. F. P. Dodd.

Anomis microphrica, n. sp.

ημκροφρικος, minutely rippled.

♀, 32 mm. Head and thorax pale reddish-grey. Palpi $1\frac{1}{2}$; whitish sprinkled with reddish-grey. Antennae whitish-grey. Abdomen and legs pale grey. Forewings elongate-triangular, costa straight almost to apex, apex subrectangular, termen sinuate, scarcely oblique; pale reddish-grey with numerous very fine transverse strigulae; a white discal dot beneath $\frac{1}{3}$ costa, and another beyond middle nearer mid-disc; cilia grey. Hindwings with termen rounded; pale reddish-grey; cilia pale grey.

North Australia: Darwin; one specimen received from Mr. G. F. Hill.

Gen. **Baryphanes**, nov.

βαρυφανης, heavy-looking.

Tongue strong. Palpi long, obliquely ascending; second joint thickened with loose hairs; terminal joint short, porrect, obtuse. Thorax and abdomen without crests. Femora and tibiae densely hairy. Forewings with 2 from $\frac{2}{3}$, 3 from well before angle, 4 from angle, 5 approximated, 6 from upper angle, areole long, 7 and 10 arising from it separately, 11 from about middle. Hindwings with 2 from middle, 3 from well before angle, 4, 5 connate from angle, 6 and 7 approximated from angle.

Baryphanes niphosema

Monoctenia niphosema Low. Trans. Roy. Soc., S. Aust., 1908, p. 114.

♀, 52 mm. Head and thorax pale reddish-brown. Palpi 3; grey; towards base sprinkled with red. Antennae grey, towards base pale reddish. Abdomen grey. Legs grey sprinkled with red. Forewings elongate-triangular, costa nearly straight, slightly sinuate, apex pointed, slightly produced, termen strongly rounded, oblique; pale reddish-brown; a fuscous sub-basal dot beneath costa; a small white spot outlined with fuscous beneath $\frac{1}{4}$ costa; a transversely oval grey spot outlined with fuscous beneath midcosta; a faint wavy transverse line from $\frac{3}{4}$ costa to $\frac{3}{4}$ dorsum; a parallel series of fuscous dots between this and termen; cilia reddish, apices grey. Hindwings with termen rounded; grey; cilia grey.

Western Australia: Perth; one specimen received from Mr. L. J. Newman.

Avitta quadrilinea Wlk.

Journ. Lin. Soc., vii., p. 171 (1864). Hmps., Moths, India, iii., p. 29.

Bocana quadrilinealis Moore, Proc. Zool. Soc., 1867, p. 88.

♂, 50 mm. Head and thorax fuscous-brown. Palpi erect, exceeding vertex, second joint much thickened, slightly rough, terminal joint $\frac{2}{5}$, smooth, obtusely pointed; pale fuscous-brown. Antennae $\frac{3}{4}$; fuscous; in male with bilateral tufts of short cilia ($\frac{1}{2}$) on each segment. Abdomen and legs fuscous. Forewings elongate, suboblong, apex round-pointed, termen rounded, oblique; fuscous-brown; four nearly straight oblique dark fuscous transverse lines; first from $\frac{1}{4}$ costa to dorsum near base; second from midcosta to $\frac{2}{5}$ dorsum; third from $\frac{3}{5}$ costa to $\frac{3}{5}$ dorsum; fourth from costa near apex to dorsum before tornus; a slender fuscous irregularly dentate subterminal line; cilia fuscous with a pale basal line. Hindwings with termen strongly rounded; fuscous; cilia fuscous, apices paler.

North Queensland: Kuranda; one specimen received from Mr. F. P. Dodd.

Gen. **Orthozancla**, nov.

ὀρθοζαγκλος, with erect sickles.

Tongue strong. Palpi very long, ascending, appressed to face; second joint exceeding vertex, thickened with smoothly appressed hairs, but with rough hairs posteriorly towards apex; terminal joint long, stout, obtusely pointed, with a small posterior tuft at apex. Antennae in male bipectinate, pectinations long, not quite reaching apex. Thorax and abdomen without crests. Forewings with 2 from $\frac{4}{5}$, 3 from angle, 4 and 5 separate, 6 from upper angle, areole present, from it 7 connate with stalk of 8, 9, 10 arising separately from areole, 11 from $\frac{2}{3}$. Hindwings with cell about $\frac{2}{5}$, 2 from $\frac{4}{5}$, 3 and 4 stalked from angle, 5 well developed from above angle ($\frac{1}{4}$), 6 and 7 connate, 12 anastomosing with cell near base.

Orthozancla rhythmotypa, n. sp.

ῥυθμοτυπος, with symmetrical markings.

♂, 26 mm. Head, thorax, and abdomen fuscous. Palpi $3\frac{1}{2}$; second joint much exceeding vertex, terminal joint $\frac{1}{3}$; fuscous. Antennae fuscous; pectinations in male 4, each ending in a long bristle, extreme apex simple. Legs fuscous. Forewings triangular, costa bisinuate, apex very obtusely pointed, termen bowed on vein 4; brownish-fuscous with some whitish irroration; a small elongate triangular white area on costa from middle to $\frac{7}{8}$; three darker transverse lines; antemedian from $\frac{1}{4}$ costa obliquely outwards, interrupted by orbicular, with a small tooth beneath this, then inwardly oblique to $\frac{1}{3}$ dorsum, edged anteriorly by a pale line; median more suffused, oblique, passing beyond reniform, there rounded inwards and oblique to $\frac{2}{3}$ dorsum; postmedian from $\frac{2}{3}$ costa, outwardly oblique, traversing white area, then rounded inwards and sinuate to before tornus, edged posteriorly by a pale line; orbicular small, circular, pale with brown centre; reniform pale, small, lunate; a wavy subterminal line faintly indicated; cilia fuscous, on costa before apex white. Hindwings subquadrate, termen rounded; as forewings, but without first line; a fuscous discal dot at $\frac{1}{3}$.

Queensland: Montville (1,500 feet), near Nambour, in February; one specimen received from Mr. E. J. Dumigan.

Tamba grandis, n. sp.

grandis, large.

♀, 48 mm. Head brown, face whitish. Palpi 3, erect, second joint exceeding vertex, terminal joint $\frac{2}{5}$, stout, obtuse, whitish-grey. Antennae grey. Thorax pale grey; patagia brown. Abdomen whitish-grey with brown suffusion. Legs brown; posterior pair pale grey. Forewings triangular, costa straight except near base and apex, termen angled on vein 4, concave above, oblique below, wavy; brown with a few blackish scales; markings whitish-grey; a basal patch, its posterior edge outwardly oblique from costa to a sharp tooth, thence inwardly oblique, a moderately oblique fascia containing a brown costal spot and another in disc before and beneath; anterior edge irregular from $\frac{1}{3}$ costa to $\frac{1}{4}$ dorsum, posterior edge nearly straight from $\frac{2}{3}$ costa to mid-dorsum; a small spot beyond this below middle; a large roundish apical blotch; three small blackish spots between this and tornus; cilia brown with a whitish basal line, on apical blotch whitish-grey. Hindwings angled and toothed on vein 4, crenulate; colour and cilia as forewings; a whitish-grey basal patch, posterior edge straight; a narrow marginal blotch from tornus to mid-dorsum, containing a brown spot; a whitish line from $\frac{4}{5}$ costa to tornal blotch.

North Queensland: Kuranda; one specimen received from Mr. F. P. Dodd.

Adrapsa tapinostola, n. sp.

ταπεινοστολος, plainly clothed.

♂, 34 mm. Head, thorax, and abdomen pale brownish-grey. Palpi ochreous-whitish sprinkled with fuscous. Antennae pale grey; in male unipectinate, pectinations short ($\frac{1}{2}$), slender, a pair of long bristles (4) from base of each pectination. Forewings triangular, costa straight, apex pointed, termen sinuate beneath apex, strongly bowed on vein 4; pale brownish-grey sparsely sprinkled with fuscous; markings fuscous; a wavy line from $\frac{1}{3}$ costa to $\frac{1}{3}$ dorsum;

another from costa beyond middle to dorsum before middle; a crenulate line from $\frac{3}{4}$ costa to $\frac{3}{4}$ dorsum, curved outwards beneath costa; a subterminal series of dots; a terminal line; cilia fuscous, bases paler. Hindwings subquadrate, termen angled on vein 4; as forewings but without antemedian line.

Queensland: Mount Tambourine, in March; one specimen received from Mr. E. J. Dumigan.

Hypenodes mesoscia, n. sp.

μεσοσκιος, with median shade.

♀, 17 mm. Head and thorax whitish. Palpi 4; whitish with a few fuscous scales. Antennae grey. Abdomen grey; apices of segments and tuft whitish. Legs whitish sprinkled with fuscous; anterior and middle tarsi fuscous. Forewings elongate-triangular, costa almost straight, apex acute, slightly produced, termen strongly angled on vein 4, concave above angle, straight and oblique below; whitish with some pale fuscous irroration and suffusion; three fuscous dots forming an oblique sub-basal line; antemedian line oblique, wavy, indistinct, from $\frac{1}{3}$ costa to $\frac{1}{6}$ dorsum; a median shade, its anterior edge defined, straight, from midcosta to $\frac{1}{3}$ dorsum; postmedian from midcosta strongly curved outwards, then straight to mid-dorsum; the area between this and median shade pale fuscous; blackish dots on costa at $\frac{1}{3}$, middle, and three between middle and apex; a blackish dot in disc at $\frac{2}{3}$ before postmedian line; a subterminal line of blackish dots; a strong blackish median bar from subterminal line to termen and through cilia; fine submarginal and terminal blackish lines; cilia grey-whitish with a postmedian fuscous line. Hindwings with termen strongly toothed on veins 4 and 7; not rounded; colour, marginal lines, and cilia as forewings; a narrow fuscous and blackish bar from mid-dorsum, and a sinuate dotted line from $\frac{3}{4}$ dorsum, both ending about mid-disc.

North Queensland: Mackay, in August; one specimen.

Hypena caerulealis Wlk.

Cat. Brit. Mus., xxxiv., p. 1,142.

I am indebted to Miss A. E. Prout for pointing out that this is distinct from *H. masurialis* Gn. In that species there is a marked difference between the sexes, the male being larger and with the apices of the forewings more acute. The females of the two species are very similar. *H. caerulealis* has a suffused whitish subcostal streak running into the apex of the forewing, but this varies and may be absent; also the postmedian line is more or less irregularly waved or rippled; that in *H. masurialis* is almost straight, not rippled, and edged posteriorly by a pale line. I am informed that the two species can be separated by their genitalia.

North Queensland: Cairns: Dunk Island; Herberton. Queensland: Brisbane.

Family LIMACODIDAE.

Doratifera ochroptila Turn.

Through the kindness of Mr. Geo. Lyell I have seen four examples of this species, two of each sex, expanding in the male 32-34 mm., in the female 42-44 mm., from Mount Guide Station 25 miles south of Mount Isa, North Queensland. They were obtained by Mr. J. G. Mackellar from cup-shaped cocoons similar to those of *D. vulnerans* attached to twigs. This is an interesting discovery, and adds another species to those common to North-west Australia and West Queensland. Species attached to the dry districts of the interior frequently have a wide range.

Antennal pectinations in male 2, ceasing rather abruptly at $\frac{1}{2}$.

Family PYRALIDAE.

Gen. **Hypermeces**, nov.

ὑπερμηκης, very long.

Tongue strong. Labial palpi rather long, porrect; second joint thickened with appressed scales; terminal joint short, curved downwards. Maxillary palpi obsolete. Forewings with 2 from $\frac{3}{4}$, 3, 4, 5, approximated from angle, 6 from upper angle, 7, 8, 9, stalked, 10 from end of cell closely approximated to 9, 11 from $\frac{4}{5}$. Hindwings with cell short (about $\frac{1}{4}$), 2 from $\frac{4}{5}$, 3, 4, 5, approximated from angle, 6, 7, connate from upper angle, 7 anastomosing strongly with 12.

Hypermeces xanthochyta, n. sp.

ξανθοχυτος, yellow-stained.

♀, 45 mm. Palpi $1\frac{1}{4}$; pale ochreous. Antennae fuscous. Thorax orange with two anterior fuscous dots; tegulae with blackish basal and antemedian spots. Abdomen ochreous with interrupted fuscous dorsal bars. Legs pale ochreous; anterior pair mostly dark fuscous. Forewings narrow, elongate-triangular, costa straight to $\frac{2}{3}$, thence arched, apex rounded, termen very obliquely rounded; whitish partly suffused with yellow between veins; markings blackish; a basal costal spot; three sub-basal spots arranged transversely; an interrupted curved transverse line at $\frac{1}{5}$; a broad transverse median subcostal bar; a sinuate postmedian fascia composed of broad interneural bars; a line of interneural dots closely following; cilia whitish-yellow. Hindwings with termen gently rounded; whitish suffused with yellow near termen and dorsum; a slight postmedian fuscous mark; cilia as forewings.

North Queensland: Meringa, near Cairns, in December; one specimen. Type in Coll. Lyell.

Epipaschia nephelodes, n. sp.

νεφελωδης, cloudy.

♂, 32 mm. Head and thorax fuscous-brown mixed with whitish. Palpi fuscous. Antennae fuscous; in male with a short, stout basal process reaching mid-thorax, ciliations 1. Abdomen pale grey partly tinged with ferruginous. Legs dark fuscous with whitish rings; posterior tibiae mostly whitish. Forewings elongate-triangular, costa slightly arched, apex rectangular, termen slightly rounded, not oblique; fuscous partly suffused with whitish; a basal suffusion; an ill-defined dark antemedian fascia partly ferruginous, containing a blackish line from $\frac{2}{5}$ costa, angled inwards beneath costa, and sharply downwards in middle, to mid-dorsum before tornus; a broad whitish suffusion beyond middle; a wavy line edged with whitish posteriorly from $\frac{2}{3}$ costa obliquely outwards, sharply angled in middle, ending on dorsum before tornus; terminal area darker; a terminal series of blackish dots; cilia white with fuscous bars, on tornus ferruginous. Hindwings with termen gently rounded; pale fuscous; a faint whitish subterminal line; cilia whitish.

Queensland: Yeppoon, in December; one specimen received from Mr. E. J. Dumigan.

Family PYRAUSTIDAE.

Noorda hemileuca, n. sp.

ἡμιλευκος, half-white.

♂, 27 mm. Head and thorax white. Palpi 2; blackish, sharply white beneath towards base. Antennae fuscous; ciliations in male minute. Abdomen white; tuft fuscous above, white beneath. Legs white; anterior pair dark fuscous with white rings. Forewings elongate-triangular, costa straight for $\frac{4}{5}$, arched before apex, apex rounded, termen rounded, scarcely oblique; white; a costal line and a broad terminal band, its anterior edged curved, fuscous; cilia fuscous. Hindwings white; a narrow fuscous terminal band not reaching tornus; cilia fuscous, on tornus and dorsum white.

New South Wales: Acacia Plateau (3,000 feet), near Killarney (Queensland), in January; one specimen received from Mr. E. J. Dumigan.

Family COSSIDAE.

Dudgeona polyastra, n. sp.

πολυαστρος, many-starred.

♂, 54 mm.; ♀, 65 mm. Head brown; face pale yellow. Palpi brown; anterior surface pale yellow. Antennae fuscous-brown, basal joint whitish; unipectinate in both sexes, pectinations 1¼. Thorax with a posterior crest; brown with a posterior pair of white dots, tegulae shining white. Abdomen orange-brown. Legs brown with white and yellowish rings; posterior tibiae whitish-yellow. Forewings elongate-oblong, costa slightly arched, more strongly in female, apex rounded, termen slightly rounded, slightly oblique; brown with numerous circular spots, some of which are shining white, others whitish with brown strigulae; a costal series of five strigulated spots; a cluster of seven shining white spots on dorsal ⅔ of basal third; a subapical cluster of shining white spots, six in disc and six on termen, between these are numerous whitish spots, as also in costal and basal areas; cilia brown with several pale yellow bars. Hindwings with termen rounded, slightly sinuate; fuscous-brown; base and dorsum orange-brown; some paler spots near apex; cilia whitish.

Larger than *D. actinias* Turn., thoracic crest smaller, hindwings darker, forewings with more numerous spots, and antennae unipectinate.

Queensland: Yeppoon, in December; two specimens received from Mr. E. J. Dumigan.

Family TORTRICIDAE.

Acropolitis hedista Turn.

Trans. Roy. Soc. S. Aust., 1916, p. 504.

I took the type of this species 40 years ago in Brisbane and erroneously referred it to the genus Catamacta, the thoracic crest being denuded. Mr. W. B. Barnard took 7 examples in the Bunya Mountains in November, 1931. It is probably nearest *A. lichenica* Turn.

Tortrix eurystropha Turn.

Trans. Roy. Soc. S. Aust., 1926, p. 135.

Tortrix hemiphoena Turn., Proc. Roy. Soc. Tas., 1926, p. 126.

The former name has two months priority.

Queensland: National Park (3-3,500 feet), Tasmania; Russell Falls; Zeehan.

Arotrophora neanthes, n. sp.

νεανθης, freshly blooming.

♂, 22 mm.; ♀ 24 mm. Head ochreous-grey. Palpi 5; ochreous-grey. Antennae in male dentate and very shortly ciliated; white sharply barred with blackish, terminal half wholly dark fuscous. Thorax ochreous-grey tinged with greenish. Abdomen grey; tuft reddish-brown. Legs fuscous; tibiae and tarsi with whitish rings; posterior pair almost wholly whitish. Forewings broadly triangular, costa slightly arched, apex subrectangular, termen straight, not oblique;

grey-green, dorsal area more or less suffused with brown; a reddish-brown subcostal streak from base to apex, where it expands and is suffusedly produced along termen to tornus; a fuscous-brown costal streak from base to $\frac{2}{3}$; a scattered sparse irroration of fugitive white scales, most abundant on costa, where they form strigulae; cilia dark fuscous, bases and a spot beneath apex reddish-brown. Hindwings broad, termen not sinuate; pale brown becoming grey towards base; cilia pale brown, on tornus and dorsum grey.

Handsome and conspicuously distinct.

Queensland: National Park (25-3,000 feet), in February and March; Bunya Mountains (3,500 feet), in March; four specimens.

Family EUCOSMIDAE.

EUCOSMA PERPLEXA Turn.

Trans. Roy. Soc. S. Aust., 1916, p. 526.

Sciaphila absconditana Wlk., Cat. Brit. Mus., xxviii., p. 351. Meyr. Proc. Lin. Soc. N.S.W., 1911, p. 248, *nec* Laharpe (1860).

Argyroploce angustifascia Turn., Trans. Roy. Soc. S. Aust., 1925, p. 58.

Queensland: Toowoomba; Bunya Mountains; Killarney; National Park. New South Wales: Sydney.

Argyroploce microlychna, n. sp.

μικρολυχνος, with tiny lights.

♀, 22 mm. Head grey-brown. Palpi $2\frac{1}{2}$; dark fuscous. Antennae grey. Thorax dark fuscous. Abdomen grey. Legs fuscous, with ochreous-whitish rings. Forewings suboblong, costa strongly arched, apex rectangular, termen gently rounded, not oblique; dark fuscous; a series of whitish costal dots, of which those in basal half give rise to short grey-metallic transverse streaks; in disc are numerous shining white dots irregularly arranged, of these some are larger, for instance one beneath costa at $\frac{1}{6}$, two on fold towards base, and a spot in disc at $\frac{2}{3}$; cilia fuscous barred with brown-whitish. Hindwings with termen sinuate; grey; cilia grey-whitish with basal and median grey lines.

Queensland: National Park (4,000 feet), in March; one specimen. Type in Coll. Barnard.

Family COSMOPTERYGIDAE.

Labdia chalcoplecta, n. sp.

χαλχοπλεκτος, brassy.

♀, 12 mm. Head and thorax brown-brassy; face whitish. Palpi blackish; second joint with a broad whitish ring before apex. Antennae dark fuscous with five whitish rings, two close together at $\frac{2}{5}$, two equally spaced between these and apex, fifth just before apex. Abdomen blackish; apices of segments and underside whitish. Legs whitish with blackish rings. Forewings narrow, apex obtusely pointed; brown-brassy; a very oblique short slender white streak from $\frac{1}{4}$ costa; a triangular white spot on midcosta, its apex prolonged to fold, edged anteriorly with blackish; a white spot on $\frac{3}{4}$ costa, outlined with blackish, connected by an interrupted longitudinal blackish streak with apex; a similar dot above tornus; a white apical dot; cilia grey, bases blackish, and also apices opposite apex of wing. Hindwings narrowly lanceolate; grey; cilia 4, grey with brassy reflections.

The convergent white costal markings together with the peculiar dots in disc should be sufficient for recognition.

Queensland: National Park (2,500 feet), in November; one specimen.

Family GELECHIADAE.

Apatetris dinota, n. sp.

δινωτος, rounded.

♂, 13 mm. Head and thorax white. Palpi with second joint somewhat dilated with loose scales towards apex, terminal joint about $\frac{1}{2}$; white sprinkled with fuscous except apices of joints. Antennae whitish. Abdomen grey-whitish. Legs whitish sprinkled with fuscous; anterior pair mostly fuscous. Forewings narrow, costa strongly arched, more so towards apex, apex acute, termen and dorsum continuous, sinuate; white with fine scanty fuscous irroration; markings dark fuscous; subcostal dots at $\frac{1}{5}$ and $\frac{2}{5}$; a spot above mid-dorsum, obliquely placed, followed by a median dot; a subapical dot; cilia whitish with a few fuscous points. Hindwings narrow, emargination obtuse, apical process about $\frac{1}{4}$; whitish; cilia 4, whitish.

Queensland: National Park (2,500 feet), in open forest in November; one specimen.

Aristotelia ochrostephana, n. sp.

ὠχροστεφανος, with pale crown.

♂, 9 mm. Head grey-whitish. Palpi grey-whitish; second joint except apex, and a subapical ring on terminal joint, dark fuscous. Antennae fuscous. Thorax and abdomen grey. Legs fuscous with whitish rings. Forewings narrow, costa slightly arched, apex pointed, termen and dorsum continuous; 7 and 8 out of 6; grey with dark fuscous irroration and markings; costal dots at $\frac{1}{6}$ and $\frac{1}{3}$; a fine streak on fold from near base, just continuous with a broad oblique streak from fold nearly to midcosta; a discal dot in middle touching this streak, and another discal dot a $\frac{3}{4}$; apical area mostly dark fuscous; cilia whitish-ochreous, with dark fuscous basal bars. Hindwings narrow, apical process short, acute; pale, grey; cilia 3, pale grey.

Near *A furtiva* Meyr. The head is paler than in that species, and the marking of forewings different.

Queensland: National Park (3,500 feet), in December; one specimen.

Gen. **Leurozancla,** nov.

λευροξαγκλος, with smooth sickles.

Tongue present. Palpi long, slender, smooth-scaled; second joint exceeding base of antennae, only slightly thickened; terminal joint longer than second, very slender, acute. Antennae with basal joint long and somewhat thickened towards apex, without pecten; in male simple. Forewings broadly lanceolate; 2 from $\frac{5}{6}$ widely separate from 3, which is from near angle, 7 and 8 stalked, 7 to costa. Hindwings ovate-lanceolate; 2 from near angle, 3 and 4 stalked, 5, 6, 7, separate, equidistant, parallel.

Allied to *Phthorimaea,* but with different palpi.

Leurozancla humilis, n. sp.

humilis, humble, insignificant.

♂, 20 mm. Head, palpi, and thorax dark fuscous. Antennae ochreous-whitish; basal joint fuscous on dorsum. Abdomen fuscous; tuft pale ochreous. Legs fuscous with obscure whitish rings. Forewings broadly lanceolate, apex obtusely pointed; fuscous; an obscure darker discal dot at $\frac{2}{3}$; cilia ochreous-grey-whitish, on apex fuscous. Hindwings ovate-lanceolate, termen slightly sinuate; pale grey, towards base whitish; cilia 1, ochreous-whitish, on apex and costa tinged with grey.

Queensland: National Park (3,000 feet), in November; one specimen.

Gen. **Tanycyttara**, nov.

τανυκυτταρος, long-celled.

Tongue present. Palpi moderately long, recurved ascending, slender, smooth; second joint not reaching base of antennae; terminal joint $\frac{1}{5}$. Antennae about $\frac{2}{3}$; without pecten; in male simple. Forewings with 2 and 3 stalked from angle, connate with 4, 6 to apex, 7 and 8 stalked, 7 to costa. Hindwings with cell very long ($\frac{3}{4}$), 3 and 4 separate, 5 curved from below middle, 6 and 7 connate, 12 anastomosing at a point with cell at $\frac{1}{3}$.

Tanycyttara xanthomochla, n. sp.

ξανθομοχλος, yellow-barred.

♂, 15 mm. Head and thorax brassy-fuscous. Palpi and antennae fuscous. Abdomen grey. Legs pale fuscous; posterior pair grey-whitish. Forewings narrow, costa slightly arched, apex rounded, termen very oblique; pale yellow; dorsal area suffused with fuscous; a fuscous streak from base along fold to tornus; a fuscous costal streak from base to middle, its apex connected by an oblique streak with a dark fuscous V-shaped mark resting on tornus; a broad dark fuscous marginal line on posterior $\frac{1}{4}$ of costa and tornus; cilia dark fuscous, on costa and apex pale yellow. Hindwings elongate-ovate, termen not sinuate; pale grey; cilia $\frac{1}{2}$, pale grey.

Queensland: Crow's Nest, near Toowoomba, in September; one specimen.

Hemiarcha metableta, n. sp.

μεταβλητος, variable.

♂, 18 mm. Head fuscous; sides of crown and face ochreous-whitish. Palpi dark fuscous; apex and inner surface of second joint ochreous-whitish. Antennae grey. Thorax fuscous; tegulae whitish-ochreous. Abdomen grey; tuft ochreous-whitish. Legs fuscous with whitish rings; posterior pair mostly whitish. Forewings posteriorly dilated, costa rather strongly arched, apex pointed, termen obliquely rounded; whitish-ochreous suffused with grey and sprinkled with fuscous; a pale ochreous costal streak throughout, broader towards base; blackish costal dots at and near base, connected on costal edge; fuscous dots at base and in disc beneath costal streak at $\frac{1}{4}$, $\frac{1}{3}$, and beyond middle, a plical dot between and beneath the first two; a fuscous line on termen and fuscous dots on apical $\frac{2}{5}$ of costa; cilia fuscous-grey, with a postmedian ochreous-whitish line. Hindwings $1\frac{1}{2}$, termen scarcely sinuate; pale grey becoming whitish towards base; cilia whitish with a pale grey basal line.

A second male example differs as follows:—Head and tegulae ochreous-brown. Forewings ochreous-brown with less grey suffusion; costal streak undefined; terminal line preceded by a darker line, between them four whitish-ochreous spots; plical dot large and connected with second discal dot. Hindwings and cilia pale grey. The two specimens are so different that I would not have referred them to one species, if I had not taken both at the same place and nearly at the same date.

Queensland: National Park (2,500 feet), in open forest in November; two specimens.

Hemiarcha basipercna, n. sp.

βασιπερκνος, dark at the base.

♂, 20 mm. Head brown-whitish. Palpi with second joint reaching base of antennae, terminal joint $\frac{4}{5}$, stout; fuscous. Antennae fuscous. Thorax fuscous; tegulae paler. Abdomen fuscous. Legs fuscous with whitish rings. Forewings moderate, costa almost straight, apex rounded, termen rounded, slightly oblique; pale brownish densely sprinkled with fuscous, more so in terminal area; a dark fuscous basal fascia; stigmata fuscous, first discal at $\frac{1}{3}$, obscure, plical before it, second discal before $\frac{2}{3}$, more distinct; cilia pale fuscous. Hindwings $1\frac{1}{2}$, termen not sinuate; whitish; cilia whitish.

Queensland: Rockhampton, in October; one specimen.

Gen. **Lophozancla**, nov.

λοφοζαγκλος, with tufted sickles.

Tongue present. Palpi very long, ascending, recurved; second joint long, thickened with appressed scales; terminal joint as long as second, moderately stout, acute, with a tuft of scales on posterior surface extending from middle to near apex. Antennae in male simple. Posterior tibiae with long hairs on dorsum; inner spurs twice as long as outer. Forewings with all veins present, 2 and 3 stalked, 7 and 8 stalked, 7 to costa. Hindwings broader than forewings; all veins present, 3 and 4 connate, 5 approximated at origin, 6 and 7 widely separate gradually diverging.

Lophozancla stenochorda, n. sp.

στενοχορδος, narrowly streaked.

♂, ♀, 19-21 mm. Head brown-whitish. Palpi brown-whitish sprinkled with fuscous. Antennae brown-whitish. Thorax brown-whitish; lateral streaks and tegulae fuscous-brown. Abdomen whitish-grey; tuft whitish-ochreous. Legs ochreous-whitish sprinkled, except posterior pair, with fuscous; anterior pair except coxae fuscous. Forewings suboblong, costa gently arched, apex rounded, termen obliquely rounded; brown-whitish sprinkled and suffused with fuscous-brown; fuscous dots on costa at base, $\frac{1}{5}$, middle, and three or four between this and apex; a narrow fuscous-brown bar from base along fold to $\frac{2}{3}$; two suffused fuscous-brown spots beneath costa beyond middle, and a third at apex, these may be confluent; cilia brown-whitish, towards tornus with a fuscous median line, on apex fuscous. Hindwings with termen slightly sinuate; pale grey; cilia whitish with a fuscous median line not extending to tornus.

Queensland: National Park (3,000 feet), in December and January; four specimens.

Gen. **Oncerozancla**, nov.

ὀγκεροζαγκλος, with swollen sickles.

Tongue present. Palpi long, recurved; second joint exceeding base of antennae, thickened with appressed scales, slightly rough anteriorly; terminal joint over $\frac{1}{2}$, laterally compressed, swollen anteroposteriorly so as to be as broad as second joint, anterior surface rough towards apex, which is obtusely pointed. Antennae without pecten. Forewings with 2 and 3 stalked, 7 and 8 stalked, 7 to costa. Hindwings 2, subquadrate; 3 and 4 connate, 5 approximated to 4 at origin, 6 and 7 widely separate.

This and the preceding genus are derivatives of *Protolechia*.

Oncerozancla euopa, n. sp.

εὐωπος, good-looking.

♀, 24 mm. Head ochreous-whitish; sides of face fuscous. Palpi dark fuscous; apex and inner surface of second joint, and terminal joint except apex, ochreous-whitish. Antennae grey becoming ochreous-whitish towards base. Thorax ochreous-whitish with some fuscous and brownish scales towards anterior margin. Abdomen whitish-ochreous; tuft except apex dark fuscous.

Legs ochreous-whitish irrorated, and tibiae banded with dark fuscous; anterior pair wholly dark fuscous except for narrow tibial and tarsal whitish rings. Forewings narrow, elongate, posteriorly slightly dilated, costa slightly arched, apex rounded-rectangular, termen obliquely rounded; ochreous-whitish largely suffused with brown, which forms a costal streak from base to $\frac{2}{5}$, a large suffused postmedian blotch, and a slighter dorsal suffusion; five dark fuscous costal dots, the first two elongate; a subcostal mark in disc below the first; a large quadrangular spot in disc at $\frac{1}{4}$, and another triangular at apex, fuscous; an interrupted whitish terminal line; a fuscous dorsal mark at $\frac{1}{3}$, followed by dots before and on tornus; cilia grey with an imperfect fuscous median line. Hindwings whitish-ochreous; a large fuscous apical blotch produced along termen; cilia whitish-ochreous, a fuscous median line not reaching tornus.

Queensland: National Park (3,000 feet), in November; one specimen.

Protolechia trichroma, n. sp.

τριχρωμος, three-coloured.

♀, 15 mm. Head and thorax reddish. Palpi with terminal joint as long as second; whitish-ochreous, external surface of second and anterior edge of terminal joint fuscous. Antennae pale reddish annulated with blackish. Abdomen fuscous; underside pale ochreous. Legs fuscous with pale ochreous rings; posterior pair wholly pale ochreous. Forewings elongate, suboblong, costa rather strongly arched, apex rectangular, termen, nearly straight, not oblique; 2 and 3 stalked; reddish with some tendency to darker red streaks on veins; a whitish terminal line edged anteriorly and posteriorly with fuscous; cilia reddish. Hindwings $1\frac{1}{4}$; pale yellow; apical half grey; cilia grey, on tornus and dorsum pale yellow.

Queensland: National Park (3,000 feet), in March; one specimen.

Protolechia polioxysta, n. sp.

πολιοξυστος, polished grey.

♀, 18 mm. Head and thorax grey. Palpi with second joint much exceeding base of antennae, terminal joint $\frac{2}{3}$, slender; fuscous, apex of second joint, base and extreme apex of terminal joint, whitish. Antennae dark grey. Abdomen grey. Legs fuscous; posterior tibiae mostly whitish. Forewings narrow, costa slightly arched, apex subrectangular, termen slightly rounded, scarcely oblique; 2 and 3 stalked; pale shining grey with fuscous irroration and markings; costal edge whitish, beyond middle ochreous-tinged; a dark fuscous dot on base of costa; stigmata indistinct, first discal at $\frac{1}{4}$, plical beyond it, second discal at $\frac{3}{5}$; several other dots irregularly distributed; a subterminal series of dots; cilia grey-whitish with a dark grey antemedian line. Hindwings over 1, termen not sinuate; whitish becoming grey towards apex; whitish with a grey antemedian line.

Queensland: Springbrook (3,000 feet), Macpherson Range, in November; one specimen.

Protolechia tyroessa, n. sp.

τυροεις, cheese-coloured.

♂, 18 mm. Head and thorax ochreous-orange. (Palpi missing.) Antennae ochreous-orange with fuscous annulations. Abdomen grey. Legs fuscous; posterior pair whitish-ochreous. Forewings with costa gently arched, apex rounded, termen very obliquely rounded; 2 and 3 stalked; ochreous-orange with sparse dark fuscous irroration, mostly in terminal third, and markings; a broad outwardly oblique mark at $\frac{1}{3}$ representing conjoined first discal and plical, second discal about $\frac{2}{3}$; a costal dot at $\frac{1}{6}$, another at $\frac{3}{5}$, and four smaller between this and apex; a fine interrupted terminal line; cilia ochreous. Hindwings $1\frac{1}{2}$, termen not sinuate; grey, paler towards base; cilia grey, apices whitish.

Queensland: National Park (3,500 feet), in December; one specimen.

Protolechia neurosticha, n. sp.

νευροστιχος, with lines on nerves.

♂, 23 mm. Head and thorax brown. Palpi with second joint exceeding base of antennae, terminal joint $\frac{4}{5}$; pale brownish, sprinkled with fuscous. Antennae brown. Abdomen brownish. Legs fuscous; posterior pair brown-whitish. Forewings elongate-oblong, costa gently arched, apex rectangular, termen nearly straight, slightly oblique; brown; cell and all veins outlined by pale streaks; two obscure fuscous dots at posterior angles of cell; cilia brown with two fuscous lines. Hindwings $1\frac{1}{2}$, termen very sinuate; pale grey; cilia whitish with two grey lines.

Queensland: Brisbane; one specimen.

Protolechia ochrobathra, n. sp.

ὠχροβαθρος, pale at the base.

♀, 20 mm. Head grey-brown. Palpi with second joint exceeding base of antennae, terminal joint $\frac{3}{5}$, stout; grey, apex of second joint whitish, terminal joint dark fuscous. Antennae dark fuscous. Thorax pale brownish with a large central dark fuscous spot. Abdomen grey. Legs fuscous with whitish rings. Forewings with costa moderately arched, apex rounded-rectangular, termen slightly rounded, slightly oblique; 2 and 3 stalked; brown mostly suffused with dark fuscous; a pale brownish basal area bounded by a straight line from $\frac{1}{4}$ costa to near base of dorsum, containing two fuscous costal dots; first discal and plical lost in dark fuscous suffusion, second discal slightly beyond middle, oval, transverse, whitish with fuscous centre; apical half of costa with alternate dark and pale bars; tornal area less suffused and more brownish; cilia brownish with two faint fuscous lines. Hindwings $1\frac{1}{2}$, termen not sinuate; grey; cilia grey.

Queensland: Bunya Mountains (3,500 feet), in February; one specimen.

Protolechia obscura, n. sp.

obcurus, dark.

♂, ♀, 22-24 mm. Head, antennae, thorax, and abdomen fuscous. Palpi stout, terminal joint $\frac{3}{4}$, slender; fuscous, extreme apex of second joint whitish. Legs dark fuscous with whitish-ochreous rings; posterior pair whitish-ochreous. Forewings slightly dilated, costa gently arched, apex subrectangular, termen straight, slightly oblique; 2 and 3 stalked; fuscous; markings and some sparse irroration dark fuscous; five discal dots at $\frac{1}{3}$, on fold beyond this, at $\frac{2}{3}$, and immediately below this; the three posterior dots circular, pale centred; a series of minute costal dots; a subterminal series of dots near margin; cilia fuscous, apices paler. Hindwings $1\frac{1}{2}$; grey; cilia grey.

Recognisable by the comparatively large size, uniform fuscous colouring, and ring-like posterior costal dots.

Queensland: National Park (2-2,500 feet), in December and January; four specimens.

Protolechia euprepta, n. sp.

εὐπρεπτος, conspicuous.

♂, 18 mm. Head grey. Palpi with second joint long, thickened with smooth appressed scales, terminal joint $\frac{3}{5}$; fuscous, terminal joint whitish except anterior edge. Antennae fuscous; in male simple. Thorax white with a broad central fuscous stripe. Abdomen ochreous-whitish. Legs fuscous; posterior pair ochreous-whitish. Forewings suboblong, costa strongly and evenly arched, apex rounded, termen obliquely rounded; 2 and 3 stalked; white; markings fuscous; four costal dots, sub-basal, at $\frac{1}{6}$, middle, and $\frac{2}{3}$; a broad streak on dorsum from near base to beyond middle; a large oval outwardly oblique spot in disc before middle, its lower and outer end confluent with dorsal streak; a large tornal blotch, connected with costa at $\frac{5}{6}$; a suffused spot on midtermen; a blackish terminal line; cilia grey, on costa whitish-ochreous. Hindwings broader than forewings, termen scarcely sinuate; whitish-ochreous; a large pale fuscous apical blotch; cilia whitish-ochreous, on apical blotch bases grey.

One of the *chiradia* group, but very distinct.

Queensland: National Park (3,000 feet), in January; one specimen.

Protolechia emmeles, n. sp.

ἐμμελης, elegant, harmonious.

♂, 14-16 mm. Head whitish-brown. Palpi stout; terminal joint $\frac{2}{3}$; fuscous sprinkled with whitish-brown, apices of second and terminal joints and base of terminal joint whitish-brown. Antennae fuscous. Thorax brown. Abdomen whitish-grey. Legs dark fuscous partly suffused and tarsi annulated with whitish-brown; posterior pair mostly whitish-brown. Forewings narrow, suboblong, not dilated, costa slightly arched, apex rounded-rectangular, termen not oblique, rounded beneath; 2 and 3 stalked; pale brown partly suffused with darker brown; dark fuscous costal dots at base and $\frac{1}{6}$, and on dorsum at $\frac{1}{6}$ preceded by a sub-dorsal dot; five oblique fuscous marks on costa from $\frac{1}{3}$ to apex their apices running into a subcostal fuscous suffusion, which is cut by an oblique white line, partly fuscous in centre from $\frac{2}{5}$ costa to middle of disc; a short blackish streak from apex separated from subcostal suffusion by a white dot; an interrupted white terminal line doubly edged with fuscous; cilia brown, apices paler, with a fine fuscous median line. Hindwings $1\frac{1}{4}$; grey-whitish; cila whitish with a sub-basal grey line.

Queensland: National Park (3,000 feet), in November, January, and March. New South Wales: Lismore, in October. Four specimens.

Protolechia arenaria, n. sp.

arenarius, sand-coloured.

♂, 17-18 mm. Head brown or brown-whitish. Palpi fuscous; apex of second joint, base and extreme apex of terminal joint, whitish. Antennae grey. Thorax brown or brown-whitish; if the former, bases of patagia brown-whitish; extreme basal edge of patagia dark fuscous. Abdomen whitish-grey tuft whitish-ochreous. Legs fuscous with whitish ochreous rings; posterior pair whitish-ochreous. Forewings suboblong, costa strongly arched, apex round-pointed, termen obliquely rounded; 2 and 3 stalked; brown or brown-whitish; costa broadly and suffusedly whitish from base to beyond middle; basal $\frac{1}{6}$ of costal edge dark fuscous; fuscous costal dots at $\frac{1}{6}$, middle, and four between this and apex; stigmata fuscous, first discal at $\frac{1}{3}$, plical beyond it, second discal at $\frac{2}{3}$, and a dot beneath it, both within a transverse whitish suffusion; a dot between and above discals; a narrow fuscous apical suffusion containing a series of pale marginal dots; cilia pale brownish with a fuscous median line. Hindwings broad, termen not sinuate; whitish-ochreous; extreme apex pale fuscous; cilia whitish, bases grey.

Nearest *P. selenia* Meyr.

Queensland: National Park (3,000 feet), in October and November; three specimens.

Crocanthes venustula, n. sp.

venustulus, exquisite.

♂, 10 mm. Head and thorax whitish-yellow. Palpi in male with second joint short, reaching middle of face, terminal joint 3, recurved, expanded from before middle to apex, laterally compressed; whitish. Antennae whitish, towards apex grey. Abdomen pale grey. Legs ochreous-whitish; anterior pair and apices of middle tibiae fuscous. Forewings narrow, costa slightly arched, apex rectangular, termen nearly straight, slightly oblique; orange-yellow, two blackish transverse lines at $\frac{1}{3}$ and $\frac{2}{3}$; a minute subapical blackish dot; cilia orange-yellow. Hindwings whitish-yellow; a fuscous discal dot and a faint transverse line from tornus; cilia yellow.

North Queensland: Cape York, in June; one specimen received from Mr. W. B. Barnard.

Crocanthes thiomorpha, n. sp.

θειομορφος, sulphur-yellow.

♂, ♀, 15-17 mm. Head and thorax whitish. Palpi with second joint exceeding base of antennae, terminal joint in male $^1/_{10}$, in female $\frac{2}{3}$; whitish, terminal joint pale fuscous. Antennae grey. Abdomen ochreous-fuscous. Legs whitish-ochreous; anterior pair pale fuscous; apices of middle and posterior tibiae fuscous. Forewings narrow, costa straight, apex obtusely pointed, termen very obliquely rounded; 10 separate; pale yellow; sometimes a small fuscous basal fascia; terminal area, bounded by a straight line from $\frac{2}{3}$ costa to mid-dorsum, pale fuscous, but this may be more or less suffused with pale yellow on costa and before termen; cilia grey, bases yellowish. Hindwings and cilia pale grey.

North Queensland: Eungella, in October; three specimens.

Family HELIODINIDAE.

Stathmopoda xanthocrana, n. sp.

ξανθοκρανος, with yellow head.

♀, 10 mm. Head yellow; fillet and face paler and glossy. Palpi fuscous; internal surface whitish. Antennae fuscous. Thorax and abdomen fuscous. Legs fuscous; ventral surfaces partly whitish. Forewings lanceolate; yellow; markings fuscous; a small suffused basal patch; a broadly suffused median fascia; apical third of wing fuscous, leaving only a narrow yellow band beyond median fascia; cilia fuscous. Hindwings linear-lanceolate; fuscous; cilia 8, fuscous.

Queensland: National Park (3,000 feet), in March; one specimen.

Family CARPOSINIDAE.

Gen. **Epicopistis,** nov.

ἐπικοπιστις, cut short.

Palpi comparatively short, porrect or subascending, smooth-scaled, cylindrical; terminal joint very short. Antennae of male with long ciliations. Posterior tibiae clothed with long hairs. Forewings with all veins present and separate, 2, 3, 4, approximated from angle, 7 to termen. Hindwings without cubital pecten; 3 and 4 stalked, 5 absent, 6 obsolete but represented by a membranous fold well separate from and nearly parallel to 7.

Near *Paramorpha* Meyr., but with different palpi.

Epicopistis pleurospila, n. sp.

πλευροσπιλος, with costal spot.

♂, 18 mm. Head and thorax white. Palpi $1\frac{1}{2}$; fuscous, apex white. Antennae grey; basal joint white; ciliations in male 3. Abdomen grey; male genitalia with two pairs of long tufts, dorsal and lateral. Legs fuscous; posterior pair whitish. Forewings narrow, suboblong, costa gently arched, apex round-pointed, termen straight, oblique; white; markings dark fuscous; a triangular spot on base of costa; a costal dot at $\frac{1}{3}$; a rather large subtriangular spot on $\frac{2}{3}$ costa, pale fuscous containing three darker costal dots and a darker apical portiom; two costal dots between this and apex; a very slender dentate subterminal line; a terminal series of dots; cilia white.

Queensland: National Park (3,000 feet), in March; two specimens received from Mr. W. B. Barnard, who has the type.

Family TINEIDAE.

Gen. **Gongylodes,** nov.

γογγυλωδης, rounded.

Head and face rough-haired. Tongue and maxillary palpi absent. Palpi ascending, exceeding vertex; second joint long, shortly rough-haired; terminal joint minute. Antennae about $\frac{3}{4}$. Posterior tibiae with long hairs on dorsum. Forewings with all veins present and separate, 2 from $\frac{3}{4}$, 3 from $\frac{7}{8}$, 7 to costa. Hindwings with cell long ($\frac{2}{3}$), 2 from $\frac{3}{4}$, 3, 4, 5, 6, and 7 separate, parallel.

Gongylodes centroscia, n. sp.

κεντροσκιος, with central shade.

♀, 17 mm. Head and thorax brown. Palpi $3\frac{1}{2}$; brownish. Antennae pale grey, darker towards base. Abdomen grey. Legs ochreous-whitish; anterior pair fuscous. Forewings rather narrow, suboval, costa strongly and uniformly arched, apex pointed, termen very oblique, continuous with dorsum; whitish-ochreous; an ill-defined basal patch; a suffused brown median streak from this, expanding in disc, and broadly suffused over terminal area; cilia whitish-ochreous, on apex brown. Hindwings elongate, termen gently rounded; grey, cilia pale grey.

Queensland: National Park, in March; one specimen received from Mr. W. B. Barnard.

Narycia commatica, n. sp.

κομματικος, stamped, impressed.

♂, 30-33 mm.; ♀, 42 mm. Head, thorax, and abdomen dark brown. Palpi 1; dark brown. Antennae dark brown; in male dentate, ciliations 1. Legs dark brown; anterior and middle tarsi dark fuscous. Forewings suboval, costa strongly arched, at base very strongly, apex round-pointed, termen slightly rounded, oblique; 7 and 8 stalked; dark brown finely reticulated with fuscous; costa with fine short fuscous strigulae; a somewhat darker basal patch; sometimes a darker fascia, its anterior edge from $\frac{1}{4}$ costa to mid-dorsum, posterior edge undefined, commonly this is reduced to ill-defined costal and dorsal dark spots; cilia brownish. Hindwings with termen gently rounded; pale grey reticulated with darker; cilia pale grey.

In wing-shape this resembles *N. euryptera* Meyr, but with very different colouring.

Queensland: National Park (3-3,500 feet), in March; a series taken, but including only one female.

Gen. **Dinocrana**, nov.

δινοκρανος, with rounded head.

Head shortly rough-scaled; face projecting in a strong rounded prominence between eyes. Tongue and maxillary palpi absent. Labial palpi moderate, porrect; second joint shortly rough-haired beneath towards apex; terminal joint short, acute. Antennae about $\frac{1}{2}$; in male moderately and evenly ciliated. Posterior tibiae smooth. Forewings with all veins present and separate, 2 from near angle, 7 to termen. Hindwings with cell about $\frac{3}{5}$, all veins present and separate, 4, 5, 6, 7, equidistant, parallel.

One of the *Narycia-Ardiosteres* group, but not closely related to either.

Dinocrana chrysomitra, n. sp.

χρυσομιτρος, with golden girdle.

♂, 14 mm. Head, thorax, and abdomen fuscous. Palpi fuscous, towards base whitish-ochreous. Antennae fuscous; ciliations in male 1. Legs whitish-ochreous partly suffused with fuscous leaving pale tibial and tarsal rings. Forewings oval, costa rather strongly arched, apex rounded, termen very obliquely rounded; fuscous; an antemedian subtriangular yellow fascia, narrow on costa at $\frac{1}{3}$, anterior edge inwardly oblique to dorsum near base, posterior edge transverse; cilia fuscous, a pale yellow dot opposite midtermen. Hindwings elongate-ovate, apex rounded; fuscous; cilia fuscous.

Queensland: National Park (3,500 feet), in March; one specimen.

Gen. **Baeophylla**, nov.

βαιοφυλλος, slight-winged.

Head and face hairy. Maxillary palpi long, folded. Labial palpi rather long, smooth, slender, drooping. Antennae about 1. Posterior tibiae with a few long hairs from basal half of dorsum, otherwise smooth. Forewings with 4 absent, 7 and 8 by a common stalk from 6, 7 to costa. Hindwings almost linear; 2, 3, and 6 absent, 4 and 5 stalked.

Probably a development of *Tinea.*

Baeophylla eupasta, n. sp.

εὐπαστος, well sprinkled.

♀, 8-9 mm. Head ochreous-fuscous; face whitish. Thorax pale ochreous with some fuscous irroration. Antennae whitish. Abdomen grey. Legs fuscous with whitish rings; posterior pair whitish. Forewings very narrow, costa gently arched, apex pointed; ochreous-whitish partly suffused with ochreous-brown with a few dark fuscous scales; costa ochreous-brown becoming fuscous towards base, interrupted by whitish-ochreous dots; a similar median series of pale and dark dots, and a dorsal series, the last continued along termen to an apical whitish dot; cilia ochreous with a subapical dark fuscous line, becoming uniformly grey on lower half of termen, tornus, and dorsum. Hindwings almost linear, grey; cilia 20, grey.

Queensland: National Park (25-500 feet), in December and January; two specimens.

Gen. **Ptyssoptera**, nov.

πτυσσοπτερος, with crumpled wing.

Head and face rough-haired. Maxillary palpi long, folded. Labial palpi moderate, drooping, smooth-scaled; second joint with a pencil of short divergent hairs from external surface near apex. Antennae less than $\frac{1}{2}$; in female slender; in male much thickened almost to apex. Posterior tibiae clothed in long, dense hairs. Forewings with all veins present and separate, 7 to costa. Hindwings elongate-ovate; 5 and 6 stalked; in male with disc crumpled beneath, on upper surface with a very strong ridge of long hairs from near dorsum in basal third, bent over costally, and partly concealing a subcostal ridge of shorter hairs.

Type *Tinea phaeochrysa* Turn. (These Proceedings, 1926, p. 135.) I have taken two examples of the male in the National Park (3,000 feet), in November.

Tinea mesoporphyra, n. sp.

μεσοπορφυρος, purple in the middle.

♀, 10 mm. Head, thorax, abdomen, and legs brownish-fuscous. Antennae about 1; pale ochreous annulated with fuscous. Forewings rather narrow, costa nearly straight, apex pointed; ochreous-fuscous; the whole median area suffused with purple-fuscous, undefined, but leaving moderate basal and apical areas free; cilia grey sprinkled with fuscous. Hindwings lanceolate; grey; cilia 2, grey.

Queensland: National Park (3,500 feet), in March; one specimen.

Tinea sulfurata, n. sp.

sulfuratus, sulphur-yellow.

♀, 24 mm. Head yellow. Palpi 4; fuscous, extreme apex yellowish. Antennae $\frac{5}{6}$ fuscous. Thorax fuscous; tegulae except bases yellow. Abdomen fuscous; tuft yellowish. Legs yellowish; anterior pair dark fuscous. Forewings elongate, narrow, suboval, costa moderately arched, apex pointed, termen straight, very oblique; all veins separate; yellow with fuscous markings more or less developed; a fuscous costal streak from base to beyond middle; a darker dot on fold beneath this, connected with dorsum by some fuscous suffusion; a rather broad transverse mark in disc at $\frac{2}{3}$; terminal area beyond this more or less suffused with fuscous; cilia yellow, bases sometimes fuscous. Hindwings with termen gently rounded; grey; cilia grey, partly yellowish-tinged.

Queensland: National Park (3,000 feet), in March; two specimens received from Mr. W. B. Barnard, who has the type.

NOTES ON THE FLORA OF SOUTH AUSTRALIA. NO. 2.

BY *ERNEST H. ISING*

Summary

Marsilia hirsuta R. Br. In a number of specimens collected in the Far North. Nos. 2,430, 2,431, 2,432, 2,433, 2,788, and 2,789, further details can now be given to aid in the identification of this difficult group. Leaflets from obovate to cuneate, 2-12 mm. long hairy when young and often becoming glabrous with age, usually woolly at the base; sporocarps 2-7 mm. long- and 2+-5 mm. wide, usually swollen (but not globular), regularly transversely corrugated and covered with dense appressed hairs, stalks 1-5 mn1. long, apparently rarely sessile.

NOTES ON THE FLORA OF SOUTH AUSTRALIA.

No. 2.

(With Descriptions of New Species.)

By Ernest H. Ising.

[Read October 12, 1933.]

Marsiliaceae.

Marsilia hirsuta R. Br. In a number of specimens collected in the Far North, Nos. 2,430, 2,431, 2,432, 2,433, 2,788, and 2,789, further details can now be given to aid in the identification of this difficult group. Leaflets from obovate to cuneate, 2-12 mm. long hairy when young and often becoming glabrous with age, usually woolly at the base; sporocarps 2-7 mm. long and 2½-5 mm. wide, usually swollen (but not globular), regularly transversely corrugated and covered with dense appressed hairs, stalks 1-5 mm. long, apparently rarely sessile.

Scheuchzeriaceae.

Triglochin elongata, n. sp. Annua, erecta, 6-10 cm. alta; folia filiformia, scapis aequilonga vel longiora, vaginâ membraneâ, ligulis capillaribus; racemi 2 cm. longi, 8-13-flori; fructus 4-5½ mm. longus, oblongus, apice angustatus, base 1½ mm. latus; calcaria basilaria conspicua, 1½-2 mm. longa, sursum curvata, duo breviora, 1 mm. longa, a basi cujusque carpelli inferius producta et inter se laminâ membraneâ conjuncta; pedicelli 2-3½ mm. longi, divergentes (figs. 6-9, p. 184).

Erect annual, 6-10 cm. high; leaves filiform, as long or longer than the scapes, base with membranous sheaths and two hairlike ligules; scapes bearing 8-13 racemose flowers, raceme 2 cm. long; fruits 4-5½ mm. long, oblong and contracted at the summit, 1½ mm. wide at the base, spurs on the base of 3 carpels, conspicuous 1½-2 mm. long, curved upwards, also 2 spurs each 1 mm. long are produced from the base of and extended below the carpels, and are joined by a membranous plate; pedicels 2-3½ mm. long, divergent.

Differs from all other species in having extra basal spurs produced below the carpels with a connecting plate between them.

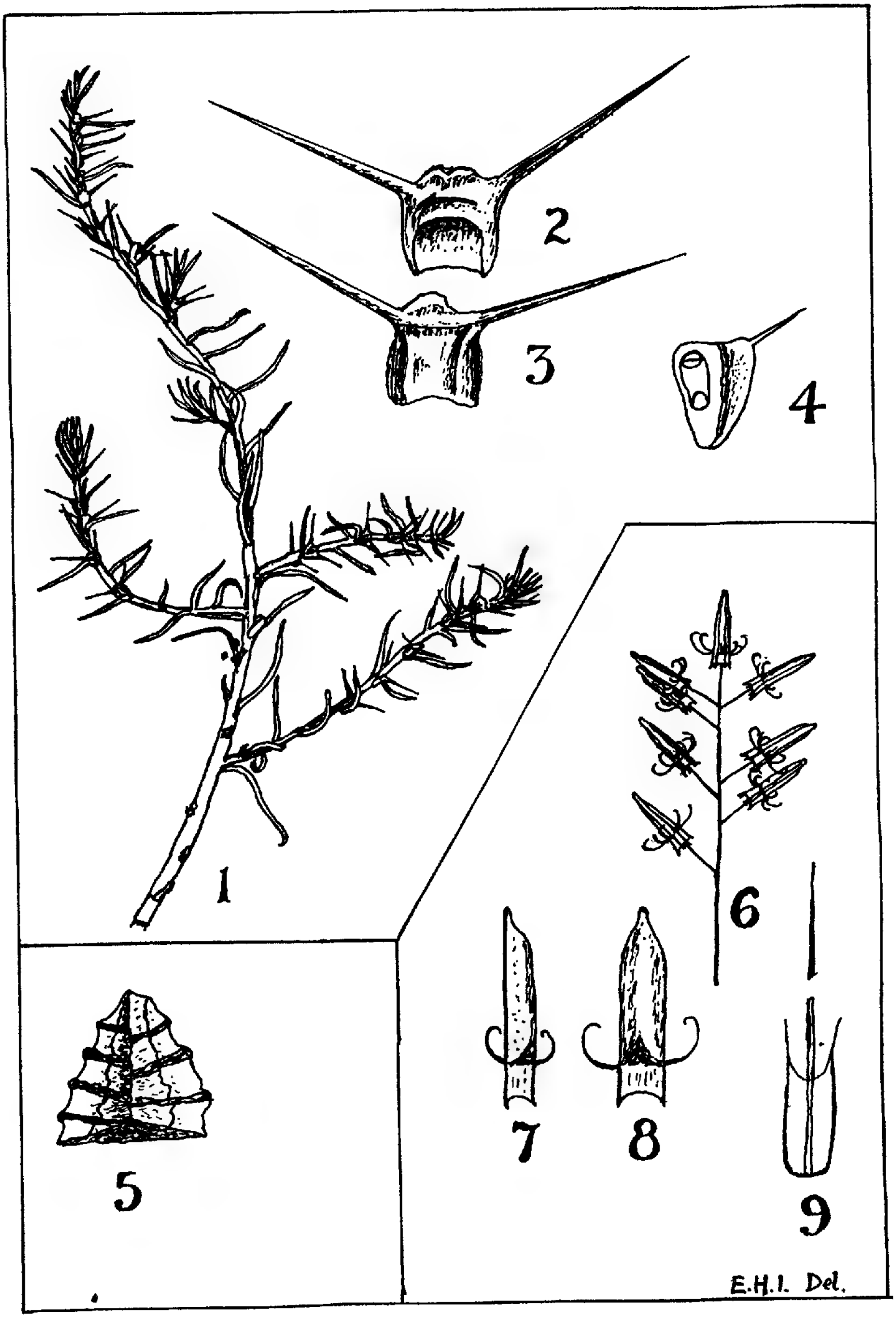
Central Australia, Coglin Creek, August 26, 1931, No. 2,409. Type in author's collection.

A specimen in the Tate Herbarium, Adelaide University, from near Mount Squires, collected by R. Helms, August 26, 1891, on the Elder Exploring Expedition, is labelled *T. calcitrapa,* but belongs to the new species.

Liliaceae.

Bulbine semibarbata (R. Br.) Haw. var. *depilata* J. M. Black. Two specimens were collected at Callana, August 21, 1931, which is in the same district from which the type of the variety came. I can confirm Black's observations [1] on this new variety with regard to the filaments being scantily hairy and in the number and disposition of the seeds. My specimen, No. 2,394, has only one flower open but a number of ripe capsules. Three of the anthers are beardless, and the three longer ones have very few and very short hairs, which are easily observed by the aid of a hand lens. Three ripe capsules were examined, and the rule is

(1) These Trans. vol. lvi. (1932), 39.



DESCRIPTION OF FIGURES.

Fig. 1. *Bassia Andersonii,* n. sp. Fruiting branch, nat. size. Fig. 2. Fruit of same showing posterior face, x 5. Fig. 3. Fruit of same showing anterior face, x 5. Fig. 4. Showing vertical section of fruit with vertical seed. x 5.

Fig. 5. *Bulbine semibarbata* var. *depilata.* Seed showing transverse ridges, x 7.

Fig. 6. *Triglochin elongata,* n. sp. Part of scape showing raceme, x 2. Fig, 7. Side view of one carpel, x 5. Fig. 8. Back (anterior) view of one carpel, x 5. Fig. 9. Base of leaf showing sheath and ligules, x 2.

two superposed seeds in each cell; sometimes a cell has only one seed developed, in which case it is larger than usual and tapering both ends. The seeds are triangular in shape (fig. 5, p. 184), 3 mm. long, the anterior face is flat while the other faces form a rugose pyramid, the transverse ridges of which are dark and prominent and stand out in contrast to the lighter grooves between. The flowers are yellowish. Further research seems necessary to determine the ovarian character in this genus.

LORANTHACEAE.

Loranthus Maidenii Blakely. First record for *Central Australia*, Horse Shoe Bend, August 24, 1931, No. 2,434, on *Acacia tetragonophylla.*

L. quandang Lindl. var. *Bancroftii* Bail. Abminga, August 27, 1931, No. 2,403, on *Acacia Cambagei.* This record now takes the known range some hundred of miles further north; in fact, it extends it almost to the border of Central Australia.

L. Murrayi F. v. M. *et* Tate. Pedirka, August 29, 1932, No. 2,804, on *Acacia cyperophylla.*

CHENOPODIACEAE.

Bassia Andersonii, n. sp. Fruticulus glaber, 20-30 cm. altus; folia sessilia, obtusa, 6-18 mm. longa 1 mm. lata, base anguste alata, in axillis barbata: flores solitarii, axillares; perianthium fructiferum oblongum, subcomplanatum, 3 mm. longum, 1½ mm. latum, limbo juventute erecto et tomentoso, maturitate saepe procurvato et glabro, dimidio longitudinis ad ramulum affixo; spinae saepius 4, 2 divergentes, 5-7 mm. longae, glabrae, patentes, tertia uncinata, 1½ mm. longa, quarta (dum adsit) minuta, ambae inferius collocatae; semen verticale (figs. 1, 2, 3, 4, p. 184).

An erect undershrub of 20 to 30 cm. in height, glabrous. Leaves 6 to 18 mm. long x 1 mm. wide, flat, glabrous (dried specimens are beset with numerous fine longitudinal ridges), point obtuse; sessile, base broad and expanded into narrow membranous wings, a tuft of hairs situated at the point of attachment. Flowers solitary, axillary. Fruiting perianth 3 mm. long x 1½ mm wide, oblong and somewhat flattened, usually 1 or 2 longitudinal ribs on anterior face; limb short, erect and tomentose when young, often curved forward and glabrous when mature; base oblique, areole attached by about half the length of the perianth and hollow; spines usually 4, two divergent and 5 to 7 mm. long straight and glabrous, spreading towards the horizontal, one hooked horizontal either turned in a clockwise or anti-clockwise direction 1½ mm. long, one (sometimes wanting) minute and situated at the base of the former; these two smaller spines are situated below either of the divergent ones; seed vertical.

The nearest affinity is with *B. divaricata* but differs in its shorter spines, erect limb, mode of attachment of fruits, ribbing of perianth and the caducous fruits. From *B. intricata* it differs in its stouter spines, mode of attachment of fruits, ribbed perianth, tapering base and caducous fruits.

Pedirka, No. 2,681, type in author's collection. Named in honour of Mr. R. H. Anderson, B.Sc. (Agr.), Botanical Assistant, Botanic Gardens, Sydney, who revised the genus Bassia in the Proc. Linn. Soc. N.S.W., vol. xlviii. (1923), 317. Collected August 22, 1931.

Specimen No. 2,686, collected at Abminga, is close to the type, and the only difference appears to be that the spines are shorter, the longest being only 4 mm. long, the two smallest spines are much less developed. Collected August 28, 1931.

Kochia tomentosa (Moq.) F. v. M. var. *platyphylla,* n. var. Differt a typo foliis oblanceolatis et tubo obconico; a var. *appressa* foliis oblanceolatis usque 9 mm. longis.

Differs from the type in the oblanceolate leaves and obconical tube; from var. *appressa* in the leaves oblanceolate and up to 9 mm. long.

The slender open nature of this shrub, with leaves unusually wide for a *Kochia*, give it a distinct aspect, but there does not appear to be justification for more than a varietal name, particularly as only one shrub of it was seen. Snake Gully, No. 2,839, September 1, 1932.

Kochia tomentosa (Moq.) F. v. M. var *appressa* (Benth.) J. M. Black. A specimen, No. 2,814, from Snake Gully, has fruits up to 13 mm. diameter and the conical tube sometimes only has one distinct rib with several faint ones or it may be rugose. This specimen also has an unbroken horizontal wing.

K. Georgei Diels. A specimen from Abminga, No. 2,821, has the horizontal wing of the fruit with a slit having the ends imbricate, the tube is longitudinally ribbed or rugose.

K. eriantha F. v. M. The drawing of this species in Mueller's Icon. Salsol. Pl., plate 57, gives the seed as horizontally placed. In a specimen, No. 2,824, from Pedirka, the seed is obliquely placed, although, at first sight, it appears to be horizontal. The seed is placed at an angle of about 60°, and the radicle is pointing downwards. I have not seen fruits with seeds in a vertical position as recorded by Black (Fl. S.A., p. 197). The soft lobes to the wing are not always regular as shown in the above plate, but are decidedly irregular in size and outline.

Amaranthaceae.

Trichinium helipteroides F. v. M. var. *minor* J. M. Black. Additional localities are:—*Central Australia*, Coglin Creek, No. 2,425, August 26, 1931; *South Australia*, Abminga, Nos. 2,413, 2,419, 2,435, August 28, 1931.

T. semilanatum Lindl. Additional localities for our Far North are:—Macumba, No. 2,438, September 2, 1931; Pedirka, No. 2,439, August 22, 1931; Abminga, No. 2,437, August 30, 1931.

Amaranthus Mitchellii Benth. var. *grandiflorus* J. M. Black. First record for *Central Australia*, Horse Shoe Bend, No. 2,453, August 23, 1931.

Aizoaceae.

Trianthema crystallina Vahl. var. *clavata* J. M. Black. First record for *Central Australia*, Horse Shoe Bend, No. 2,467, August 24, 1931.

Portulacaceae.

Calandrinia pumila F. v. M. New locality for our Far North; Abminga, August 27, 1931, Nos. 2,475 and 2,477.

Cruciferae.

Stenopetalum nutans F. v. M. New locality for our Far North; Abminga, August 27, 1931, No. 2,497.

Blennodia pterosperma J. M. Black. New records are:—*Central Australia*, Horse Shoe Bend, August 24, 1931, No. 2,503; Far North, Macumba, September 3, 1931, No. 2,504.

Lepidium papillosum F. v. M. Macumba, September 3, 1931, No. 2,494. The previous furthest north record was Flinders Range, so that the above locality extends its range by another 300 miles.

AUSTRALIAN FUNGI: NOTES AND DESCRIPTIONS. – NO. 9

BY J. BURTON CLELAND, M.D.

Summary

AUSTRALIAN FUNGI: NOTES AND DESCRIPTIONS.—No. 9

By J. Burton Cleland, M.D.

[Read October 12, 1933.]

534. *Amanita cinereo-annulosa*, n. sp.—Pileus 5 ad 8·2 cm., subplanus, interdum subumbonatus vel subumbilicatus, nitidus, interdum veli fragmentis membranaceis, cinereus vel pallidior. Lamellae ad stipem subattingentes, subconfertae, latae ad 1 cm., albae vel cremaceo-albae. Stipes 8·7-13·7 cm., crassus (1·5-2 cm.), subcavus, sub-bulbosus, radicatus, striatus, supra subcinereus, infra albidus et fibrillosus. Volva larga, vaginata. Sporae ellipticae, 8-10 × 6-7 μ. S.A.—Encounter Bay.

535. *Lepiota cervicolor*, n. sp.—Pileus ad 4 cm., usitate ad 2 cm., planus, subumbonatus, tomento fibrilloso deinde squamis fibrillosis vel floccosis, cervicoloratus vel "mikado brown," ad peripherem carneo-cinnamoneus. Lamellae non annectatae, cremaceo-albae. Stipes substriatus, fibrillosus, albidus, supra subcarneus. Sporae ellipticae, 6·4-7 × 3·8 μ. S.A.—Adelaide.

536. *Hygrophorus fuligineo-squamosus*, n. sp.—Pileus 3·1-6·8 cm., irregulariter convexus et planus, subtiliter squamosus vel fibrilloso-floccosus, caryophyllo-brunneus vel cinereo-subniger. Lamellae adnato-arcuatae, adnexae vel fere subsinuatae, subconfertae, angusto-triangulares, subcrassae, glauco-cinereae. Stipes ad 5 cm., infra attenuatus, conico-radicatus, fibrillosus vel fibrilloso-squamulosus, fere araneo-fibrillis subnigris, subcinereo-albidus, fere punctis fuliginosis. Sporae ellipticae, obliquae, 7·5-9 × 4·5-5·5 μ. In terra. S.A.—Mount Lofty, Kinchina, MacDonnell Bay.

537. *Collybia tortipes*, n. sp.—Pileus 1·2-3·7 cm., convexus, subumbilicatus, fibrilloso-laceratus, subniger, luteo-brunneus vel caryophyllo-brunneus. Lamellae sinuatae, ventricosae, subdistantes, albae, in senectute luteo-brunneo-albidae. Stipes 3·1-4·4 cm., subtenuis, tortus, non-radicatus, subnitidus vel subfibrillosus, subcavus, cartilagineus, albidus. Sporae angustae, albae, 8-11 × 4-4·5 μ. In terra arenosa. S.A.—Willunga Hill, Summertown.

538. *C. penetrans*, n. sp.—Pileus 2·5-3·1 cm., e convexo irregulariter planus, interdum repandus, interdum subumbonatus vel subumbilicatus, innato-fibrillosus, interdum radiato-rugosus, russus vel ochraceo-fulvus vel aurantiaco-cinnamoneus. Lamellae subsinuato-adnexae, subconfertae, cinnamoneo-luteae, deinde ochraceo-fulvae. Stipes superans terram 1·8-3·1 cm., tenuis (4 cm.), cavus, pervelutinatus, "argus brown" et "Sudan brown," radice longa (5-7·5 cm.). Caro stibio-flava. Sporae obliquae, angusto-pyriformes, 7·5-8 × 4-4·5 μ. In terra arenosa. S.A.—Encounter Bay.

539. *C. percava*, n. sp.—Pileus 3·7-5 cm., perconvexus, deinde convexus, deinde irregulariter expansus, interdum umbonatus, "Mars brown" deinde russus vel subfulvus. Lamellae sinuato-adnexae, angustae (5 mm.), subconfertae, pallido- ochraceo-luteae. Stipes ad 5 cm., infra inflatus, supra attenuatus, nitidus, percavus, "Sayal brown" vel russus, supra pallidus. Sporae pyriformes, 5 × 3·7 μ. In terra. S.A.—National Park.

540. *C. elegans*, n. sp.—Pileus 1·8-3 cm., campanulato-convexus deinde perconvexus et obtuso-umbonatus, deinde subplanus, subrivulosus, cinnamoneo-rufus, fulvus vel aurantiaco-luteus, exsiccatus "burnt-sienna." Lamellae adnato-adnexae ad adnatae, confertae, angustae, cremaceae. Stipes 3·7-6·5 cm., tenuis

(2-5 mm.), aequalis, nitidus, cartilagineus, solidus, ad basim interdum inflatus, concoloratus. Sporae angustae, 9-11 × 4·5-5·5 μ. In terra inter folia et lignum cariosum. S.A.—National Park, Mount Lofty.

541. *C. fusca,* n. sp.—Pileus 3-9·3 cm., convexus, subumbonatus, fuscus vel fusco-niger. Lamellae sinuatae, vel interdum adnatae, ad 1 cm. latae, subconfertae, pallido-subcinereae. Stipes 3-9·3 cm. × 5-8 mm., supra farinaceus. infra subfibrillosus, aequalis, farctus, subcinereo-pallidus vel subfusco-pallidus. Sporae ovales, subirregulares, 7-9 ×4-5·5 μ. S.A.—Eagle-on-the-Hill, National Park.

542. *Mycena subnigra,* n. sp.—Pileus ad 1·8 cm. altus et latus, campanulatus ad conico-campanulatus, glaber, substriatus, subniger ad "Mummy brown." Lamellae adnatae vel sinuato-adnatae, dentibus subdecurrentibus, subconfertae, ventricosae, subcinereae. Stipes 5 cm. vel major, sursum subattenuatus, supra concoloratus, infra pallidus et perstrigosus. Sporae 7·5-9 × 4·5-5·5 μ. Plantae ad truncos caespitosae. S.A.—Mount Lofty, Caroline State Forest.

543. *M. eucalyptorum,* n. sp.—Pileus 2·5-3·1 cm., lato-conicus vel conico-convexus, deinde convexus et obtuso-umbonatus, glaber, ad marginem substriatus et pallidus, subnigro-cinereus. Lamellae sinuato-adnexae interdum ad collare, subconfertae, angustae, subcinereae. Stipes ad 6·2 cm., tenuis, cavus, ad basim substrigosus, supra pallidus, deinde pallido-brunneus, ad basim subnigro-cinereus. Sporae 9·3 × 5·5 μ. Plantae in truncis prostratis caespitosae. S.A.—Second Valley Forest Reserve, Mount Lofty, National Park, Baker's Gully.

544. *M. Cunninghamiana,* n. sp.—Pileus ad 4·3 cm., convexus, subumbonatus, irregulariter rugosus, flavo-avellaneus, ad apicem brunnior deinde subniger. Lamellae adnatae, subconfertae, subangustae, pallido-vinaceo-luteae. Stipes 7·5 cm., supra glaber, cavus, ad basim perstrigosus et "Verona brown," supra pallidior. Sporae 8-8·5 × 5·5 μ. Plantae in truncis caespitosae. S.A.—Mount Lofty.

545. *M. fusca,* n. sp.—Pileus 1·2-1·8 cm. vel maior, conico-campanulatus vel lato-conicus vel convexus, deinde umbone subacuta subplanus, striatus, ad marginem cinereus vel pallido-cinnamoneo-cinereus vel "wood brown," in medio fuscus vel fusco-subniger vel "bone brown," hygrophanus deinde pallido-brunneus. Lamellae dentibus subdecurrentibus adnatae, subconfertae, cinereo-pallidae. Stipes 3·7-5 cm., tenuis, subfragilis, glaber, cavus, infra pallido-olivaceo-brunneus vel vinaceo-luteus vel "bone brown," supra pallidior, ad basim substrigosus vel submyceliosus. Odor subnitrosus. Sporae 7·5-11 × 3·5-5 μ. Plantae in terra humida vel in foliis putrescentibus solitariae. S.A.—Waterfall Gully, National Park.

546. *M. subcapillaris,* n. sp.—Pileus 3-5 mm., altus 2·5 mm., umbilicatus, sulcatus, albus ad pallido-brunneus. Lamellae adnatae, subdistantes, circa 14, cystidiis horridae, albae. Stipes 2·5-3 cm., pertenuis, subpellucido-albidus, crinibus dispersis, in matricem abrupte penetrans. Sporae subangustae, 7·5 × 3·7 μ. In virgis, frondibus mortuis, etc. S.A.—Mount Lofty.

547. *M. albido-fusca,* n. sp.—Pileus 10 mm., convexo-hemisphericus, umbonatus, substriatus, umbone albido fuscus. Lamellae dentibus decurrentibus adnatae, subdistantes, subcinereae. Stipes 5 cm., pertenuis, ad basim fibrillis paucis, infra brunneus, supra pallidus. Sporae ellipticae, 8 ×5·5 μ. Plantae foliis putrescentibus adhaerentes. S.A.—Mount Lofty.

548. *Omphalia paludicola,* n. sp.—Pileus ad 10 mm., campanulatus, deinde convexus, subumbilicatus, rugoso-striatus, subcinereo-carneo-luteus. Lamellae perdecurrentes, distantes, albae. Stipes 19 mm., tenuis, concoloratus. In palude. S.A.—Mount Lofty.

549. *O. olearis,* n. sp.—Plantae albae vel in pileo creamaceo-albae. Pileus 8 mm., conico-convexus, deinde convexus et interdum subumbonatus, glaber.

Lamellae decurrentes, confertae. Stipes ad 3 cm., undosus, glaber. Plantae ad bases olearum. S.A—Beaumont.

550. *Pleurotus malleeanus*, n. sp.—Pileus ad 11·2 cm., convexus, margine incurvato, glaber vel nodosus et irregularis, cinnamoneo-luteus. Lamellae decurrentes, confertae, 6 mm. latus, carneo-luteae. Stipes 3·1-10 cm., centralis vel excentricus vel lateralis, supra 2·5 cm. latus, aequalis vel deorsum attenuatus, durus, solidus, albus. Caro crassa vel 1·2 cm. Sporae elongatae, 8-10 × 4 μ. Ad bases mallee-truncorum senum. S.A.—Monarto South.

551. *Entoloma reticulata*, n. sp.—Pileus 2·5-5 cm., convexus, subumbilicatus, lineis concentricatis et interdum rimosis reticulatus vel adversum marginem portionibus irregularibus elevatis et fissuris pallidioribus, cinereus. Lamellae dentibus subdecurrentibus subsinuatae, confertae, angustae, cinereo-carneo-luteae. Stipes 1·8 cm., subtenuis, infra striatus, infarctus vel interdum cavus, particulis pallido-fumoso-cinereis, subter subniger. Caro tenuis, albida. Sporae subspherico-pyriformes, subangulatae, subcoloratae, 4·5-5·5 μ. Ad terram. S.A.—Mount Lofty.

552. *E. muscorum*, n. sp.—Pileus ad 3 cm., irregulariter convexus, subumbonatus, luteo-brunneus. Lamellae profundo-sinuato-adnexae, subconfertae, ventricosae, avellaneae. Stipes 3·7 cm., subtenuis, tortus, cavus, corneo-subcinereus. Caro corneo-subcinerea. Sporae irregulariter ellipticae, subcoloratae, 8-8·5 × 6·5 μ. Inter muscos. S.A.—Greenhill Road.

553. *E. serrata*, n. sp.—Pileus 2·5 cm., perconvexus, irregularis, glaber, albus, in centrum subluteus. Lamellae adnexae, paene disjunctae, subascendentes, confertae, angustae, marginibus serratis, subfusco-carneae. Stipes 3·1 cm. × 6 mm., aequalis, substriatus, solidus, subluteo-albidus. Sporae obliquae, 10-11 × 5 μ. In terra paludosa. S.A.—Mount Compass.

554.—*Clitopilus australiana*, n. sp.—Pileus 3 cm., convexus, umbilicatus, pallido-brunneus. Lamellae subdecurrentes, confertae, pallido-brunneae. Stipes 2·5 cm., fibrillosus, pallidus. Sporae pyriformes, subangulatae, subcoloratae, 6·5-7 × 5·5 μ. S.A.—National Park.

555. *Leptonia albida*, n. sp.—Pileus ad 1·8 cm., subirregulariter convexus, deinde planus vel subconcavus, subumbonatus, albus. Lamellae adnatae vel subsinuatae, subconfertae, albidae. Stipes 1·8 cm., tenuis, infra subattenuatus, infarctus vel subcavus, infra fuscus, supra albidus. Sporae subspericales, angulatae, subcoloratae, 6·5 × 3·2 μ, 4·8 μ. S.A.—Kinchina.

556. *L. macrospora*, n. sp.—Pileus ad 2·5 cm., convexus, irregulariter umbilicatus, margine crenato, pallido-subcarneo-brunneus. Lamellae adnatae vel adnato-decurrentes, subconfertae, subtriangulares, pallido-salmoneo-carneae. Stipes ad 2·5 cm., tenuis vel subcrassus, subsericeus, interdum torsus, subcavus, albidus, ad basem mycelio. Sporae carneae, angulatae, 11-16 × 8 μ. Apud muscos. S.A.—Port Lincoln.

557. *L. tabacina*, n. sp.—Pileus 1·8-2·5 cm., convexus, umbilicatus, subfibrillosus, substriatus, tabacinus. Lamellae adnexae, subconfertae, ventricosae, pallido-carneo-cinnamoneae. Stipes 3·7 cm., tenuis, sursum attenuatus, nitidus, subcavus, "bistre" vel luteo-brunneus, supra pallidior. Sporae angulatae, 6·5 μ, 7·5-8 × 5·5 μ. S.A.—Stirling West, Mount Lofty, Eagle-on-the-Hill.

558. *L. radicata* n. sp.—Pileus ad 2·5 cm., irregulariter convexus, umbilicatus, subfibrillosus, subfusco-cinereus. Lamellae subdecurrentes, marginibus subcrassis, salmoneo-cinereae. Stipes 1·8 cm., subtenuis, fibrillosus, supra farinaceus, solidus, pileo pallidior, radice longa attenuata. Sporae pyriformes, subirregulares, subcoloratae, 7·5-8 × 5-5·5 μ. S.A.—Kinchina.

559. *L. fusco-marginata*, n. sp.—Pileus 2·5-3·7 cm., subconvexus vel subplanus, umbilicatus, subfibrillosus, striato-rugosus, margine interdum crenulato, subniger. Lamellae sinuato-adnexae, confertae, angustae, pallido-cinnamoneo-cinereae, marginibus fuscis. Stipes 3·7 cm., tenuis, nitidus, ad basim subbulbosus et albidus, violaceo-subniger. Caro tenuis. Sporae angulatae, 9·5 × 7 μ. S.A.—Back Valley (Encounter Bay).

560.—*Pholiota subtegularis*, n. sp.—Pileus 1·5 cm., convexus, interdum subumbonatus, striatus, subviscidus, ochraceo-luteus vel antimoneo-flavus. Lamellae adnatae, subconfertae, pallido-fulvae, deinde ferrugineo-cinnamoneae. Stipes 3-4 cm., tenuis, subflexuosus, fibrillosus, subcavus, pallido-brunneus. Annulus superior fulvus. Caro tenuis, sub-brunnea. Sporae ellipticae, fulvae, 8-8·5 × 5·5 μ. In terra. S.A.—Mount Burr (S.E.).

561. *Ph. serrulata*, n. sp.—Pileus 1·8-4·3 cm., conico-convexus vel convexus, interdum umbilicatus, interdum umbonatus, hygrophanus, ad marginem striatus, "Verona brown," "Argus brown," fulvus vel ochraceo-fulvus, exsiccatus carneo-luteus vel ochraceo-luteus. Lamellae adnatae vel subdecurrentes, subconfertae, angustae, marginibus serratis, ochraceo-fulvae, "Argus brown" vel "Kaiser brown." Stipes 1·8-3·7 cm., tenuis (ad 3·5 mm.), subaequalis, solidus, albido-fibrillosus, subter fibrillis similiter lamellis coloratis, ad basim albidus. Annulus albidus, praetenuis, subdistans. Sporae ellipticae, flavo-brunneae, 6·5-9 ×4-6 μ. In terra. S.A.—National Park, Mount Lofty, Mylor.

562.—*Ph. graminum*, n. sp.—Pileus 1·2-1·8 cm., convexus vel subhemisphericus vel subplanus, non-striatus, interdum subumbonatus, hygrophanus, rufo-brunneus deinde pallidus. Lamellae adnatae vel dentibus decurrentibus, confertae, ferrugineae, primo pallidiores. Stipes 3·7-4·3 cm., striatus, sub-bulbosus, cavus, pallido-brunneus, ad basim mycelio albido. Annulus subsuperior, membranaceus. Inter gramina. Sporae obliquae, 6·5-8 × 4-5 μ. S.A.—Kinchina, Adelaide.

563. *Ph. imperfecta*, n. sp.—Pileus 1·2-1·8 cm., convexus deinde subplanus, usitate subumbonatus, interdum ad marginem striatus, hygrophanus, ceraceo-flavo-brunneus, exsiccatus "Sayal brown." Lamellae adnatae, subconfertae, rufo-brunneus vel ferrugineo-cinnamoneus. Stipes 2·5 cm., tenuis, solidus vel cavus, fibrillosus, pallidus vel rufo-brunneus. Annulus superior vel subdistans, imperfectus, albidus. Sporae obliquae, subangustae, 7·5-9·5 × 4·5-5 μ. In terra. S.A.—Second Valley Forest Reserve, Beaumont Common, McLaren Vale.

564. *Ph. squarrosipes*, n. sp.—Plantae in terra apud truncos Eucalyptos percaespitosae vel interdum solitariae. Pilei 1·8-7·5 cm., perconvexi, saepe irregulares, interdum umbonati, subviscidi, subglabri vel interdum fibrillosi, ochraceo-fulvi, fulvi, antimoneo-flavi, vel "Empire yellow." Lamellae adnatae vel dentibus decurrentibus, subconfertae, subangustae, fuscae, flavo-ochraceae, "buckthorn brown" vel isabellinae. Stipites 3·7-8 cm., tenues vel subcrassi, deorsum, subattenuati, perfibrilloso-squamosi, solidi, "deep colonial buff" vel antimoneo-flavi. Sporae ellipticae, obliquae, fusco-brunneae, 6·5-8 × 4-4·5 μ. S.A.—Encounter Bay, Upper Tunkalilla Creek.

565. *Cortinarius (Phlegmacium?) lilacino-fulvus*, n. sp.—Pileus 6·2-8·7 cm., irregulariter convexus, in medio interdum concavus, denique subrepandus, viscidus, subfibrillosus, argillaceo-coloratus, in locis pallidior vel brunneus, interdum flavo-ochraceus. Lamellae adnatae vel sinuatae, subconfertae, subventricosae, pallido-brunneae deinde fulvo-olivaceae. Stipes 5-6·2 cm., tenuis vel crassus (ad 1·8 cm. latus), aequalis vel attenuatus infra vel supra, fibrillosus, interdum subcavus, sub-bulbosus, ochraceo-fulvus vestigiis lilacinis. Caro sub-brunneus vestigiis lilacinis. Sporae obliquae, 9-11 × 5·5-7·5 μ. S.A.—Stirling West, Mount Lofty.

566. *C. (Ph.) vinaceo-lamellatus*, n. sp.—Pileus 5 cm., subconico-convexus deinde convexus, usitate umbonatus, denique irregulariter convexus, subviscidus, subfibrillosus, cinnamoneo-luteus vel "Sayal Brown." Lamellae sinuatae dentibus subdecurrentibus, subconfertae, 5 mm. latae, vinaceo-cinereae. Stipes 7·5 cm., crassus (1-1·5 cm.), bulbosus (2·5-3·5 cm.), supra attenuatus, non-viscidus, sericeo-fibrillosus, solidus, brunneo-pallidus. Velum albidum. Caro subviolacea. Sporae obliquae, 9-11 × 4·5-5 μ. S.A.—Mount Lofty.

567. *C. (Ph.) ochraceo-fulvus*, n. sp.—Pileus 4·3-6·2 cm., subconvexus, irregularis, subumbonatus, subtiliter fibrillosus, fulvo-olivaceus vel ochraceo-fulvus. Lamellae subsinuatae, subconfertae, subventricosae, fulvo-olivaceae. Stipes 6·2 × 0·6-1 cm., subaequalis, ad basim sub-bulbosus, fibrillosus, infarctus, sub-brunneus. Caro pallido-brunnea. Sporae obliquae, fulvo-brunneae, 9-11 × 5-6·5 μ. S.A.—Stirling West.

568. *C. (Ph.) fragilipes*, n. sp.—Pileus 2·5-8·7 cm., convexus, deinde subconvexus vel irregulariter planus vel repandus, usitate subumbonatus, radiato-fibrillosus, subviscidus, ochraceo-fulvus, fulvus, russus vel aureo-fulvus. Lamellae adnatae dentibus subdecurrentibus, subconfertae, ad 1 cm. latae, carneo-lutaceae deinde fulvo-olivaceae. Stipes 7·5-10 cm., subtenuis, saepe flexuosus, aequalis, fragilis, sericeo-fibrillosus, subcavus, concolorus. Sporae obliquae, flavo-brunneae, 9·3-13-15·5 × 6-7 μ. Plantae subcaespitosae. S.A.—National Park, Mount Lofty, Kuitpo, Second Valley.

569. *C. (Ph.) radicatus*, n. sp.—Pileus 8·7 cm., irregulariter convexus, usitate subgibbosus, deinde irregulariter expansus, viscidus, ad marginem subfibrilloso-striatus, pallidus vestigiis flavo-cinnamoneis, in senectute flavo-cinnamoneus vel deusto-brunneus. Lamellae adnatae vel adnato-subdecurrentes, ad 6 mm. latae, subconfertae, non ventricosae, albidae deinde cinnamoneae. Stipes supra terram 1·2-3·7 cm., bulbosus, radice conica longa (5 cm.), crassus (1·2-2·3 cm.), solidus, albidus, in senectute vestigiis sublilacinis. Caro alba, vestigiis sublilacinis. Velum albidum. Sporae obliquo-ellipticae, 9-13 × 5·5-7 μ. S.A.—Willunga Hill, Waitpinga, Mount Compass, Mount Lofty, Kinchina.

570. *C. (Myxamicium) sinapicolor*, n. sp.—Pileus 5-7·5 cm., subconvexus, subumbonatus, glutinosus, ad marginem sinapicolor, in medio succino-brunneus. Lamellae sinuato-adnexae, subconfertae, 7 mm. latae, "Buckthorn Brown." Stipes 6·2 cm., subcrassus (1 cm.), supra fibrillosus, sub-bulbosus, subflavus. Vellum pallido-flavum. Sporae obliquo-ellipticae, subasperae, 7·5 × 4 μ. S.A.—National Park.

571. *C. (M.) microarcheri*, n. sp.—Pileus 1·8-6·2 cm., convexus vel subplanus, substriatus, glutinosus, perviolaceus vel violaceo-brunneus, exsiccatus-tabacino-brunneus vel succino-brunneus. Lamellae subsinuatae vel adnexae, subconfertae, pallido-violaceae vel violaceo-brunneae, deinde tabacino-brunneae. Stipes 3·1-5 cm., subtenuis, ad basim subcrassus, fibrillosus, subcavus vel solidus, pallidus vel pallido-violaceus. Caro subviolacea vel albida. Sporae obliquae, subglobosae, glabrae, 5·5-8·4 × 4·5-5 μ. S.A.—Mount Lofty, Eagle-on-the-Hill.

572. *C. (M.) albidus*, n. sp.—Pileus 3·7-6·2 cm., convexus, deinde planus, subumbonatus, glutinosus, glaber, deinde subfibrillosus, albidus, deinde pallido-luteus. Lamellae sinuato-adnexae, ventricosae, 9 mm. latae, subconfertae, pallido-ochraceo-luteae vel ochraceo-luteae. Stipes 6·2 cm., subcrassus (1·2 cm.), aequalis vel sub-bulbosus, fibrillosus, albidus vestigiis subviolaceis. Caro tenuis, albida vestigiis subviolaceis. Velum sub-brunneum. Odor "of curry powder." Sporae obliquae, flavo-brunneae, 9·5-13 × 6 μ. S.A.—National Park.

573. *C. (Inoloma) areolato-imbricatus*, n. sp.—Pileus 7·5-15 cm., perconvexus, subirregularis, siccus, squamis subfibrillosis subcarneo-luteis vel pallidis

(in medio subareolatis, ad marginem imbricatis), ochraceo-luteus vel cinnamoneo-luteus. Lamellae adnatae vel adnexae, interdum subsinuatae, subconfertae, ad 1 cm. latae, ochraceo-luteae vel cinnamoneo-luteae et ochraceo-fulvae. Stipes 5·6-6·2 cm., crassus (1·8-3·1 cm.), subaequalis vel in medio inflatus, ad basim attenuatus, fibrillosus, approxime "Warm Buff." Caro firma, in medio 1 cm. lata, alba. Velum albidum. Sporae obliquae, flavo-brunneae, 9 × 4·5 μ. Plantae caespitosae. S.A.—Willunga Hill.

574. *Inocybe serrata*, n. sp.—Pileus 1·2 cm., convexus, fibrillosus, Verona-brunneus vel pallido-brunneus. Lamellae adnatae, marginibus serratis et interdum pallidioribus, tabacino-brunneae vel ligno-brunneae. Stipes 1·8-3 cm., tenuis, attenuatus, fibrillosus, approxime "Warm Buff." Caro firma, in medio 1 cm. lata, farinaceus, pallido-brunneus. Sporae glabrae, obliquae, pallido-flavo-brunneae, 7·5-9 × 4·5-5 μ. Cystidia fusiformes vel ampulliformes, 27-56 × 11-13 μ. Plantae gregariosae vel subcaespitosae, basibus villosis. S.A.—Mount Lofty, Upper Tunkalilla Creek.

575. *I. fulvo-olivaceae*, n. sp.—Pileus 1·2 cm., perconvexus (magis minusve), subfibrillosus, fulvo-olivaceus. Lamellae adnatae, ascendentes, subconfertae, pallidiores quam "Saccardo's Umber." Stipes 2·5 cm., tenuis, granulosus, subcavus, pallido-brunneus, saepe supra subroseus. Sporae subtriangulares, perobliquae, 6·5-7 × 4 μ. Cystidia subventricosa, 45 × 15 μ, 65 × 17 μ. S.A.—Belair.

576. *I. granulosipes*, n. sp.—Pileus 1·2-1·8 cm., convexus, umbonatus, fibrillosus, tabacino-brunneus ad "Bister." Lamellae adnatae, subconfertae, subventricosae, tabacino-brunneae. Stipes 1·8-2·5 cm., subtenuis, e farcto subcavus, aequalis, sub-bulbosus, "Bister" granulis albidis farinaceis vel fibrillosis. Caro pertenuis. Sporae obliquae, 8·5 × 5 μ. Cystidia inflata ad angusto-fusiformia, 45 × 19 μ, 50 × 9 μ. Plantae gregariosae. S.A.—Stirling West, Mount Lofty.

577. *I. Murrayana*, n. sp.—Pileus ad 1·6 cm., conicus, deinde expansus, umbonatus magis minusve, subtili-fibrillosus vel fibrilloso-squamosus, sericeo-nitidus, cinnamoneo-brunneus vel "Buckthorn Brown" vel "Dresden Brown" vel russus. Lamellae adnatae vel adnexae, subconfertae, marginibus subserratis, tabacino-brunneus vel avellaneus. Stipes 2·5 cm., aequalis, subtili-striatus vel fibrillosus vel farinaceus, solidus, tabacino-brunneus vel brunneo-pallidus. Sporae obliquae, pallido-brunneae, 9-11-13 × 5·2-5·5 μ. Cystidia acuminata basi inflata vel ventricosa, 85 × 11 μ. S.A.—Kinchina.

578. *Astrosporina emergens*, n. sp.—Pileus ad 3 cm., ad 1·5 cm. procerus, irregulariter lato-conicus, subfibrillosus vel subglaber, pallido-luteus. Lamellae adnatae vel adnexae, confertae, pallido-brunneae. Stipes ad 2·5 cm., subcrassus, ad basim sub-bulbosus, albus, deinde sub-brunneo-albidus. Sporae angulatae, pallido-brunneae, 7·5 × 4 μ. Cystidia ampullaformia apicibus asperis, 25-37 × 13 μ. S.A.—Kinchina.

579. *A. exigua*, n. sp.—Pileus ad 1·2 cm., convexus vel campanulatus, subfibrillosus, cinnamoneo-brunneus. Lamellae adnatae, subconfertae, subcinnamoneae. Stipes 1·2 cm., subfibrillosus, albidus. Sporae nodosae, 8-8·5 μ. Cystidia pauca ampullaformia apicibus glabris. S.A.—Hope Valley.

580. *A. discissa*, n. sp.—Pileus 2·5 cm., convexus, umbonatus, perfibrillosus, discissus, brunneus. Lamellae liberae, ventricosae, brunneae. Stipes 2·5 cm., subtenuis, primitus subpruinosus deinde glaber, aequalis, ad basim sub-bulbosus, albidus vel pallido-brunneus. Sporae nodosae, brunneae, 9 × 6 μ. S.A.—Upper Tunkalilla Creek.

581. *A. imbricata*, n. sp.—Pileus ad 16 mm., convexus vel subconico-campanulatus, fibrillis adpressis umbricatis, fusco-brunneus. Lamellae adnatae, deinde secedentes, subconfertae, subventricosae, fusco-brunneae. Stipes 16 mm.,

subtenuis, aequalis, infarctus, fibrillosus, pallido-brunneus. Caro pilei pallida, stipis sub-brunnea. Sporae angulatae, 9-11 × 5·5 μ. S.A.—Kinchina.

582. *Flammula punctata*, n. sp.—Pileus 2 cm., convexus, interdum sub-umbonatus, dum humido viscidus, rubro-fulvo-brunneus. Lamellae adnatae vel emarginato-adnatae, subconfertae, pallido-cinnamoneae. Stipes 1·8-2·5 cm., tenuis, solidus, pallidus squamoso-fibrillis fuscis, carne subcartilaginea. Sporae obliquo-ellipticae, pallido-flavo-brunneae, 7·5 × 4 μ. S.A.—Back Valley, off Inman Valley.

583. *F. cincta*, n. sp.—Pileus 1·2-3·1 cm., convexus, deinde planus, denique repandus, dum humidus viscidus et ceraceo-brunneus, hygrophanus, exsiccatus carneo-lutaceus, primitus ex velo albo-farinaceus. Lamellae adnatae vel adnato-decurrentes, subconfertae, subangustae, primitus minute serratae, pallido-cinnamoneae deinde brunneo-cinnamoneae. Stipes 2·5-3·1 cm., subtenuis, aequalis vel infra attenuatus, sub-bulbosus, subfarinaceo-fibrillosus, subcavus, albidus deinde sub-brunneo-albidus. Primitus velo universali albido farinaceo. Sporae ellipticae, pallido-brunneae, 8-8·5 × 4·5 μ. In ligno carioso cum mycelio albido agglutinante. S.A.—Back Valley, off Inman Valley.

584. *F. brevipes*, n. sp.—Pileus, 5-6·7 cm., irregulariter convexus, repandus, ochraceo-fulvus vel fulvus. Lamellae adnatae, subconfertae, ventricosae, 10 mm. latae, ochraceo-fulvae vel fulvae. Stipes perbrevis, 18 mm., striatus, brunneo-fibrillosus, pallido-flavus. Sporae obliquae, flavo-brunneae, 9 × 5·5 μ, rariter 11·5 × 7·5 μ. In terra. S.A.—Kalangadoo.

585. *Naucoria arenacolens*, n. sp.—Pileus 2·5-4·4 cm., convexus, deinde expansus, subirregularis, innato-fibrillosus, "Sayal Brown." Lamellae sinuatae, subconfertae, perventricosae, 3-5 mm. latae, marginibus pallidioribus et minute serratis, tabacino-brunneae. Stipes 2·5-3·7 cm., subcrassus (8-10 mm.), aequalis, fibrillosus, solidus, subcarneo-alutaceo-pallidus. Sporae pallido-brunneae, elongatae, 9·5-13 × 4 μ. S.A.—Encounter Bay.

586. *Psalliota vinacea*, n. sp.—Pileus ad 10 cm., e conico-hemispherico convexus, deinde expandens, fibrillis vel fibrilloso-squamis adpressis, cinnamoneo-cinereus vel vinaceo-brunneus. Lamellae liberae, subconfertae, primitus pallidae, deinde pallido-vinaceo-cervinae. Stipes 7·5-8·7 cm., crassus (1·2 cm.), fibrillis floccosis, interdum ad basim sub-bulbosus, solidus vel subcavus, albidus. Velum album. Annulus amplus, subdistans. Caro sub-brunnea. Sporae purpureo-brunnea, 5·5 × 3·5 μ. Sub Eucalyptus. S.A.—National Park.

587. *Panaeolus paludosus*, n. sp.—Pileus 4·3 cm., conico-hemisphericus, deinde convexus, glaber, subrivulosus, fuscus, medio exsiccato pallidiore ad peripherem zonatus. Lamellae adnexae, subconfertae, ventricosae, nubilo-cinereae. Stipes ad 10 cm., tenuis, subflexuosus, subpruinosus, subfibrillosus, subcavus, infra fuscus, supra pallidior. Sporae limoniformes, subnigrae, 10-11 × 7·5 μ. In terra paludosa. S.A.—Mount Compass.

588. *Russula persanguinea*, n. sp.—Pileus 3-10 cm., subconvexus medio concavo, denique interdum subrepandus, usitate ad peripherem substriatus vel tuberculo-rugosus, viscidus, sanguineus. Lamellae adnexae, ad stipem attenuatae, aequales, raro furcatae, subangustae (6 mm.), confertae, albae. Stipes 3·7-5 cm., crassus, glaber vel substriatus vel subrugosus, solidus vel cavus, albus. Caro tenuis, fragilis. Sapor mitis vel sub-piperatus. Sporae verrucosae, albae, 7·5-11 μ, 9 × 7·5 μ. Cystidia in pileo acuminata basibus latis, 19-38 × 7·5 μ. S.A.—Mount Lofty, Morialta.

589. *R. viridis*, n. sp.—Pileus 5-6·2 cm., convexus medio subdepresso, non-striatus, pelle separabili, subviscidus, viridis. Lamellae aequales, ad stipem attenuatae, subconfertae, angustae, interdum proxime stipem furcatae, cremaceo-

albae. Stipes 3·7-4·4 × 1·6 cm., subrugosus, infra inflatus, supra attenuatus vel aequalis, solidus albus. Caro fragilis, alba. Sapor mitis. Sporae spherico-pyriformes, subtiliter verrucosae, albae vel subcremaceo-albae. 7·5-9 × 5·5-6·5 μ. Cystidia in pileo nulla. S.A.—Mount Lofty.

590. *Coprinus arenacolens*, n. sp.—Pileus 4·4 cm., subhemisphericus, deinde convexus, striatus, pallido-brunneus. Lamellae adscendentes, subadnexae, latae, cinereae. Stipes 3·7-15 cm., crassus, sursum attenuatus, substriatus, fibrosus, solidus, annulo aspero elevato distante, albidus deinde substramineo-albidus. Sporae ellipticae, nigrae, 13-17 × 7·5 μ. In arena pura. S.A.—Davenport Creek (E.P.).

591. *C. virgulacolens*, n. sp.—Pileus 1·2-2·5 cm., 16 mm. altus, cylindrico-conicus ad lato-conicus, deinde se expandens, membranaceus, disco glabro sub-convexo fusco, striato-plicatus, pallido-furfuraceo-granulosus, cinereo-brunneus. Lamellae subadnexae vel adnatae, primum adscendentes, confertae, angustae, albidae, deinde purpureo-brunneae. Stipes 3·7-6·2 cm., granulosus et striatus, deinde glaber, concavus, sub-bulbosus, albus. Caro pertenuis, brunnea. Sporae obliquae, fuscae, 7·5-9 μ, interdum 11 × 4-5 μ. Plantae in terra virgulis applicatae. S.A.—Mount Lofty.

592. *Dictyolus australis*, n. sp.—Planta alutaceo-brunnea. Pileus spathulatus vel flabelliformis, 6 mm. latus et longus, glaber, interdum subsulcatus. Lamellae decurrentes, subdistantes, furcatae, marginibus crassis. Stipes 6 mm., lateralis, deorsum subattenuatus, glaber. In terra muscosa. S.A. -Kinchina.

593. *Paxillus psammophilus*, n. sp.—Pileus 8·7 cm., flabelliforme-dimidiatus, subfibrillosus, deinde rimosus, brunneus. Lamellae decurrentes, confertae, ad stipem reticulatae, sub-brunneae. Stipes brevis (2·5 cm.), sublateralis, tenuis, radice longa angusta. Sporae elongatae, albae, 13-13·5 × 4 μ. In arena. S.A.—Elliston.

ON MAMMALS FROM THE LAKE EYRE BASIN
PART I – THE DASYURIDAE

BY H. H. FINLAYSON

Summary

The reappearance, of *Caloprymnus campestris,* in 1931 in the eastern portions of the Lake Eyre Basin, was not an isolated episode in the history of the local mammals, but was rather the outcome of causes largely connected with the passing of drought conditions, which by restoring herbage over large denuded areas, led to a sudden marked increase in the numbers of most of the smaller mammals and culminated in one of the now familiar migratory rodent plagues.

ON MAMMALS FROM THE LAKE EYRE BASIN.

PART I.—THE DASYURIDAE.

By H. H. Finlayson,
Hon. Curator of Mammals, South Australian Museum.

[Read October 12, 1933.]

The reappearance of *Caloprymnus campestris*, in 1931,[1] in the eastern portions of the Lake Eyre Basin, was not an isolated episode in the history of the local mammals, but was rather the outcome of causes largely connected with the passing of drought conditions, which by restoring herbage over large denuded areas, led to a sudden marked increase in the numbers of most of the smaller mammals and culminated in one of the now familiar migratory rodent plagues.

While matters appertaining to *Caloprymnus* were the chief pre-occupation of the writer while there, no opportunities were lost of obtaining a representative collection of all the local mammals, and since my departure, several generous correspondents have made important additions both of material and data. For services in this connection I am particularly indebted to Mr. L. Reese, to Mr. H. R. Adamson of Elder, Smith & Co., to Mr. Shelton, of Cordillo, Master Dick Scobie, Constable John Finn, Mr. George Aiston and Mr. D. N. George.

While the collections so formed fall far short of that necessary for an adequate survey of the mammals of this remarkable area, they have brought to light several new forms, and in other cases adequate series of specimens have enabled me to add to knowledge of animals, formerly obscure, owing to their rarity in collections.

The area from which most of the data and specimens herein recorded were derived, comprises the extreme north-eastern corner of the State of South Australia, and may be approximately defined by producing the western and southern boundaries of Queensland into South Australian territory until they meet, near the south-eastern corner of Lake Eyre North. Within this square, again, work was concentrated largely on the tracts between the Barcoo and Diamantina, which for various reasons are more suitable for collecting.

Hitherto, collecting here has been of a desultory and incidental character and, owing to the insignificance numerically, of its mammal population in normal years, to the decline of the blacks and consequent loss of expert aid, and the rigours of climate, the country is not one of many attractions to the mammalogist. It is, nevertheless, an area of great interest ecologically and, on the rare occasions of a resurgence of life, well repays the considerable amount of energy which one must spend upon it in order to get results.

The Physical features of the area are highly characteristic, and together constitute a type of environment distinct from other parts of the centre. Four main physiographical units may be recognised which, to a slight extent, are valid also as zones of distribution.

(1) Parallel sand ridges, usually north and south in direction and frequently of great linear extent, but disposed in narrow belts seldom more than a mile or so wide and frequently limited to a single ridge, which may extend unbroken for 20 or 30 miles. These long ridges are permanent and are, indeed, not sandhills

(1) Trans. Roy. Soc. S. Aust., vol lvi. (1932), pp. 148-167.

proper, but loamy elevations blanketed to varying depths with loose sand. Near the east shores of the Lake, however, and south of the Barcoo, are true drifting dunes with no firmer core.

(2) Loamy flats. These may take the form of long strips constituting the interspaces of the sand ridge belts or may be more extensive depressed areas or basins, like Goyder's lagoon. In the former case the surface supports small herbaceous plants only, but in the latter there is usually a fairly dense growth of the so-called lignum *(Muehlenbeckia Cunninghamii)*, which sometimes attains 10 feet in height, and then constitutes the nearest approach to a thicket to be found in the district.

(3) The gibber plains. In their surfaces these vary in texture from a loose rubble, which may support a small bush flora, to closely arranged pavements from which are excluded all but the grasses, which, however, are only in evidence after heavy rains. In extent, they may range from a few acres, to huge expanses like Sturt's Stony Desert, extending 120 miles north and south and width up to 35 miles.

(4) The river channels. Although the first three types of country alternate with one another so as to account for the greater part of the land surface, the river channels of the Diamantina and Barcoo, while involving but trifling areas in their normal courses, are, nevertheless, of interest as affording the only permanent waters of the area and the only considerable belts of timber, their banks being lined with Coolibah and *Bauhinia*. From the point of view of distribution these features form a minor but sharply defined habitat zone, to which the single aquatic and the single arboreal mammal of the area are exclusively restricted.

Away from the river channels, the whole surface, sandhills, flats and gibber plains is characterised by excessive aridity and high temperatures throughout the greater part of the year. The vegetation, which has been dealt with in detail by Cleland, Black, and Reese,[2] is sparse, made up almost entirely of very small species, and so scattered as to leave the ground surface nearly naked. In spite of this quantitative deficiency, however, there is a large percentage of good fodder plants, and nominally the whole area is taken up for pastoral purposes, but this enterprise is not carried on with sufficient concentration to affect the flora and fauna appreciably, except in a few restricted localities.

The almost complete absence, away from the channels, of arborescent plants or of species forming moderately compact communities, is a striking feature, and the resulting absence of shade and shelter is, no doubt, largely responsible for the elimination from the mammals, of almost all but strictly fossorial forms.

The conditions mentioned impose upon the area a strongly developed eremian character, which, however, is curiously modified in certain parts from time to time, by the flooding of the Diamantina and Barcoo by rains in the Queensland hills, 700 miles away. At such times large areas of the loamy flats contiguous to the channels are inundated, and may remain so for weeks at a time. When the water is absorbed herbage is quickly restored on a scale of unwonted lavishness, which leads in turn to a corresponding increase in animal life, similar (if more localized) to that which follows a general rain.

In the portions of the district remote from these influences, the prevailing colour of the gibbers and the sand alike is a rich ferruginous brown, but in the flooded areas this becomes bleached to a pale drab. The flooded country is but a small fraction of the total area of the Basin, but is, nevertheless, its chief mammal station, and the colour change mentioned is a significant one in local bionomies, since there is little doubt that the curious ochraceous pallor which distinguishes

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(2) Trans. Roy. Soc. S. Aust., vol. xlix. (1925), p. 103.

the colouration of nearly all its small mammals, is a character adapted to the prevailing tone of the landscapes.

The rivers have a further interest in that they tend in some measure to break down the geographic isolation of the Basin, and they are, potentially at least, intermittent lines of communication linking this portion of the Eremian Sub-region with the Torresian half of the Euronotian belt. Although they are no longer regular lines of migration so far as the mammals are concerned, it is probable that two species of rodents gained access to the Lake Eyre Basin by this route at no very distant time.

Sminthopsis crassicaudata centralis (Thomas).

"Nilee" of the Wonkonguroo.(3)

Ordinarily, apparently, an uncommon or even rare animal in the district, but multiplying to an extraordinary extent during the mouse plagues of 1930-1932 and following the migratory waves of *Mus musculus* from north to south throughout the area. At the same time local increases in the numbers of the typical variety took place in the settled districts, as for example at Mildura and Renmark on the Murray.

There seems no reason for doubt that at these times it forsakes its ordinary insectivorous habit and becomes truly carnivorous and predatory. Though I cannot vouch personally for any instances of its killing mice, stories of its enterprise and ferocity in so doing are admiringly told by blacks and whites alike. At the height of the plague in 1931, Mr. Reese took scores of Nilees inadvertently in improvised kerosene tin mouse traps, and when so caught it at once proclaims its presence by its remarkably loud shrill hissing cry.

Throughout the summer of 1931 it lived in shallow burrows on all types of country, but Mr. Aiston tells me that in the early part of 1932, at Mulka, while breeding freely, it was found in nests on the surface. With the subsidence of the mouse plagues it disappeared as suddenly as its prey, but the taking of specimens from holes in the following winter, in a sluggish condition very different from its usual vivacity, suggests that a partial hibernation may partly explain the mystery, though attempts to induce hibernation in this and allied species, in captivity, have met with no success.

The general colour of the type of the variety *centralis*, which came from Killalpannina on the Barcoo, was stated by Thomas, to be a pale isabella finely grizzled with brown, but the ground colour of the dorsum, in the present series of 22, is remarkably inconstant, and varies from a curious brassy "olive buff" through several shades of buffy grey to a rich vinaceous cinnamon. The differences do not appear altogether capriciously, however, but represent to some extent at least, adaptations to the prevailing colour of the environment during periods when the *Sminthopsis* population is stationary. The paler forms appear in the bleached sandhill-claypan country near the channels, and the richer pink forms in the red gibber plains.

From *S. crassicaudata*, as it occurs in the South-Eastern district of South Australia (where it is more plentiful, normally, than elsewhere in the State), the variety *centralis* differs markedly, not only in its brighter colouration but in some structural features as well.

The bodily size is very variable in both localities, but the central form is lighter in build and with longer limbs and appendages. The ear is not only pro-

(3) The aboriginal names quoted are, in most cases, those used by Wonkonguroo hunters, but in many cases are not original to that people but have been borrowed from the Yalliyandas, Yaurorkas and Dieries.

portionately much longer[4] but is broader as well, and the total area of the pinna is thus greatly increased. The tip, moreover, is more sharply pointed and the whole feature more prominent than in the south. The curious trizoned pigmentation of the epidermis of the ear, apparently characteristic of the species over the whole of its range, is on the same pattern as in true *crassicaudata* but is much more marked, as are also the similar pigmented areas on the mystical sites of the muzzle. The tail is from 50-60% longer. Its incrassation in this species, in all parts of South and Central Australia, is so variable as to render it useless as a diagnostic feature, but in *centralis* its maximum development is greater than in the southern form. In life the epidermis of the tail is pigmented a dark slate, but in alcohol this fades rather quickly.

The manus shows little change, but the pes is larger; its naked granular portion extends obliquely as a wedge-shaped strip from a point just proximal to the hallux, to the bases of the nails. A feebly developed hallucal pad is sometimes present. The main interdigital pads are granular, but there is a distinct tendency for the midline of their surfaces to be occupied by a single longitudinal series of enlarged granules, whereas in the southern form the pads are more finely granulated and without any regular arrangement of granules.[5]

It has not been expedient to extract skulls from the whole series, but 6 have been examined, and these would appear to indicate that in *centralis* the canine is slightly longer, the disproportion in size of the premolars less, and the posterior margins of the nasals more sharply angulated, than in the southern *crassicaudata*. These differences are slight, however, and the chief skull measurements may be merged with those of the southern animal.

The skull of one of the largest males gives:—Basal length, 23·3; zygomatic breadth, 13·3; nasals length, 9·9; intertemporal, 4·7; palate length, 12·8; M^{s1-3}, 4·5.

In the series examined (22), males outnumber females by 2 to 1.

Mammae either 8 or 10.

The form of *S. crassicaudata*, which occurs in the south-east of South Australia, may apparently be reconciled with the typical variety of Gould's original description. The differences which separate it from *centralis*, over 1,000 miles north in a very different environment, are so marked as to suggest the propriety of separating the latter specifically from the earlier known animal.

In testing the grounds on which such a step might be taken, I have been led to examine all the specimens in the South Australian Museum (some 50 in all), which come from intermediate and still more northerly localities. While there is a considerable individual variation which is responsible for the occasional appearance of similar individuals at widely sundered places, the chief result of this analysis has been to reveal a steady change in colouration, and in the length of tail and ear, as one proceeds from south to north, together with the retention, almost unmodified, of skull characters, foot structure and pattern of markings.

The intergrading of the variable features is so complete as to leave little doubt as to the derivative relations of the whole series, and anything more than subspecific distinctions are thus unjustified.

(4) The form from the southern parts of the State was stated by Wood-Jones to be longer eared than that from more arid Northern districts (Mammals of S. Aust., vol. i., p. 114). I am unable to confirm this, however, by reference to the series preserved here, and the specimens from the Adelaide district, of which measurements are given, have a proportionately much shorter ear than the form now under consideration (in the ratio of 14 : 20·4).

(5) Occasionally a single large granule may occur on the surface of the pad, but the disproportion between it and its fellows is usually not great and it does not always occur on the point of contact of the pad with the ground—it is an aberration, rather than a functional specialization such as occurs in *S. larapinta*.

Beginning in the south-eastern district with a cold, ashy grey, short eared and very short tailed form, there is, on coming north, a steady increase both of the fulvous colours of the coat and of the length of ear and tail. In the northern mallee, and on Yorke and Eyre Peninsula, distinctly yellowish forms are already met with which, at Kooringa, Kingoonya, Copley and Farina, on saltbush table-lands, change to a bright tan, noticeably long-tailed form, and the trend culminates in the Macdonnell Range with the production of a brilliant ferruginous phase,[6] with distinctly yellowish ventral fur and dimensions identical with those of the Diamantina specimens.

In point of colour the pallid buff and vinaceous tones of the latter stand somewhat apart from this sequence, and have obviously been developed in response to the peculiar conditions of the Basin. If, therefore, the name *centralis* is retained for the pallid form of this area, it will be necessary to accord an equal degree of distinction to the richly-coloured variety which diffuses south from the Macdonnells and which is equally distinct from the true *crassicaudata* of the south.

It may be called, provisionally, *Sminthopsis crassicaudata ferruginea,* but a detailed diagnosis is deferred pending further investigation.

Mr. Troughton has recently called attention to the doubts which may arise as to the specific uniformity of some small mammals which in the past have been accorded very wide ranges in Australia. No doubt there is room for close scrutiny in all such cases, but it would be regrettable if an over-free use of specific names were allowed to obscure the fact that several adaptable marsupials have successfully colonised huge tracts presenting a wide range of ecological conditions, without undergoing important structural changes in so doing. That *S. crassicaudata* is one such, I hold to be certain.

Dimensions of *S. crassicaudata centralis,* in mm.

	Mean of 13 ♂.	Mean of 7 ♀.	Largest ♂.	Largest ♀.
Head and body - -	70·9	74·0	83	83
Tail - - - -	70·1	67·3	66	64
Pes - - - -	16·0	15·3	16	15
Ear - - - -	20·4	20·4	21	21

Sminthopsis larapinta (Spencer) (var.?)

"Melatjhanie."

This species appears to be much less numerous than the "Nilee," from which, however, it does not seem to be distinguished by any important features of habits or distribution, though it should be observed that such matters tend to be obscured in a time of general increase. It was stated by Mr. Byrne that at Charlotte Waters *larapinta* lives on the stony tablelands, and *crassicaudata* on the sandhills and creeks.

In a superficial view it comes rather close to *crassicaudata centralis,* and dorsal colour, face and ear-markings are almost exactly as in the intermediate specimens of the latter. From this animal, however, it is sharply separated at all stages of growth by its much longer tail, which exceeds the head and body by 25-30%, by the shorter, more rounded ear, and especially by the interdigital pads of the pes which are always surmounted by a large oval tubercle, exceeding the granules which surround it by 3 or 4 diameters. They are smooth or very obscurely striate.

Mammae 8.

(6) Co-existing, however, with duller individuals.

On comparing it with the typical *larapinta* described by Sir Baldwin Spencer from Charlotte Waters, I have been able to support his description by examination of a series of six in the South Australian Museum from an unknown locality,(7) and of four from the type locality, kindly made available by Mr. Brazenor, of the National Museum, Melbourne. In the chief structural features, the correspondence with the animal from the Lake Eyre Basin is close. The incrassation of the tail and its resulting shape, however, are much less characteristic than Spencer supposed. In two examples from the Diamantina the tail is as slender as it is in *murina* and in two others in which it is incrassated, it is not very differently shaped from that of *crassicaudata.*

The hallucal pad of Spencer's animal is not a prominent feature in the present series, and the V-shaped smooth elevation surmounting the basal pad of the manus is less sharply sculptured, and its arms tend to coalesce across the intervening space. The differences in colouration between the two series are much the same as those separating the forms of *crassicaudata* from the same localities; *i.e.,* those from the Lake Eyre Basin are paler, with a pure white rather than cream belly, and the brown and tan shades of Spencer's animal are here replaced by pinker hues of ocraceous buff.

The skull of the Lake Eyre animal does not differ in any constant way from that from Charlotte Waters; it is strongly built and more densely ossified than in *crassicaudata* and in old specimens develops distinct crests; the disparity in size of the premolars is also more marked, than in *crassicaudata.*

Dimensions of the largest ♂ and ♀ examined:—Head and body, 90, 83; tail, 110, 105; pes, 18·5, 17; ear, 18, 17.

The skull of the largest male gives:—basal length, 26·5; width, 25·2; nasals, 10·0; palate, 14·1; $M^{s\,1-3}$, 4·6.

Five specimens examined.

So little is known of the range of *S. larapinta*, and the few specimens examined have come from such restricted areas, that I do not feel justified at present in claiming the animal as a definite variety, though it is quite probable that such is the case.

The probability of its occurrence in South Australia was pointed out by Wood-Jones,(8) but the above notice is the first definite record of the animal in this State.

Chaetocercus cristicauda hillieri (Thomas).

"Mudagoora."

This beautiful dasyurid, which until now has been known from a single skin in the British Museum, is apparently widely distributed in the area, but during my time there, was not plentiful. It makes its rather shallow burrows chiefly in the sandhill country, and although many were excavated, most of them proved to be deserted, and only a single specimen was then obtained (at Cooncherie). Some few months later, however, its numbers had greatly increased, and seven more examples were forwarded by Mr. G. Aiston, from Mulka, and Mr. D. N. George, from Puttaburra. Moreover, examination of the entire *chaetocercus* collection of the South Australian Museum has brought to light further specimens taken in the same district in 1905, so that altogether 16 have been available for examination.

In their pallid buff colouration, these agree very well with Thomas' *hillieri*, except that the under-surface of the tail is jet black for two-thirds its length and

(7) These were probably obtained (together with some other Dasyurids) from Sir B. Spencer, by exchange, by the late Mr. Zietz, and they probably represent part of the original collection from Charlotte Waters.

(8) Mammals of S. Aust., vol. i., p. 111.

not simply "indistinctly darker," as stated. In estimating its relation to the typical *cristicauda* of the more westerly districts of the Centre, I have had an excellent series of 104 examples of the latter from as far north as Tennant's Creek, south to Ooldea, and west to about 124 E. longitude, in Gibson's Desert. Examination of the whole of this material shows definitely that (1) all specimens reliably localised in the Lake Eyre Basin show the *hillieri* pelage characters very constantly; (2) west of the Basin, *cristicauda* is very variable, but is nearly always much darker and more grizzled, and even its palest phases are more richly coloured and have a more strongly contrasted tail base than in *hillieri;* (3) the two colour types do not co-exist in any part of the range of the species as at present ascertained.

These results leave little doubt, therefore, that Thomas' animal constitutes a valid geographical race of constant pelage characters within the limited area to the east of Lake Eyre, from which it has so far been taken.

Structurally, the present form seems to be practically identical with the western animal, or at least it presents a range of variation in structural features which can be merged in that of the latter. When the skulls of the four largest examples of *hillieri*, taken in the winter of 1932, are compared statistically with a long series of adults of the western form, some small *proportional* differences emerge; thus (1) the degree of intertemporal constriction is greater; (2) the palatal vacuities are larger; (3) the canine is longer; and (4) the molar dentition is slightly weaker, than in *typica*. The differences are slight, however, and do not afford sufficient grounds for founding specific distinctions upon, and the animal is best regarded as a well-marked variety of Krefft's species.

It does not seem to have been noted previously that the unworn canine of *chaetocercus* usually carries a small but distinct cusp upon its posterior carinate margin. The feature is reminiscent of that seen in some bats, and is present in both sub-species.

With regard to dimensions, it is unfortunate that the almost incredible variation in adult size and to a lesser extent in proportions, which is especially characteristic of *Chaetocercus* amongst the Central mammals, largely stultifies any attempt to define the two forms by mensuration. The series of 7 males, taken during the winter of 1932, are far larger and bulkier than any which I have examined from the western areas, but that superior size is not a distinguishing character of *hillieri* is proved, on the one hand by the fact that adults taken in 1905 are very much smaller than 1932 examples, and on the other by the existence of Spencer's record of a giant *typica* male from Charlotte Waters with a head and body length of 220 mm., which greatly exceeds the largest of my *hillieris*.

Flesh Dimensions.—Range of 8 ♂, taken in 1933: Head and body, 164-190; tail, 113-130; pes, 34-37; ear, 26·5-28. Range of 4 ♂, taken in 1905:[9] Head and body, 123-141; tail, 85-109; pes, 29-31; ear, 22-25.

Skull Dimensions.—Range of 4 ♂ taken in 1932, followed by two ♀ taken in 1905:—

Basal length: 39·5-42·2, 35·3-37·1; zygomatic breadth: 28·2-30·3, 25·2-25·8; nasals length: 14·3-16·0, 13·2-14; nasals breadth: 5·6-6·7, 4·5-5·0; constriction: 7·0-7·5, 7·1-7·2; palate length: 21·2-23·2, 20·0-20·5; palate breadth outside M^3: 14·1-15·0, 13·3-13·6; palatal foramina: 2·5-3·0, 2·5-2·8; palatal vacuities: 6·5-7·0, 5·5; height of canine: 4·7-6·8, 4·5; Ms^{1-3}: 8·2-8·8; 8·2-8·5; Max. breadth of M^3: 3·5-3·6, 3·5-3·6.

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[9] Although no females were taken in 1932, it is almost certain that differences in dimensions shown are seasonal rather than sexual. In the western race sexual differences, though present, are not very marked.

Sir Baldwin Spencer states[10] that females of *chaetocercus cristicauda typica* were much more plentiful than males, but this is not borne out by the results of my own observation on this race, and in *hillieri* the position is reversed, as of the 17 specimens now known, 12 are males, and, as mentioned, during the last period of their plenty, only males were taken. Without more detailed knowledge of the life histories and habits than is at present available, however, the determination of sex ratios by simple examination of series of wild, caught specimens is not very satisfactory.

During the rodent plagues, the animal appears to be almost entirely carnivorous, and the stomach contents of all those examined consisted largely of finely comminuted fleshy matter with only a sparse representation of insect debris. Like its larger relative *Sarcophilus* it crushes and ingests large quantities of bone, but the fur which is commonly found in large quantities in the stomach of the latter, is conspicuously absent.[11]

Dasyuroides byrnei pallidor (Thomas).

"Kauäri."

Well known to both the settlers and blacks, but apparently a comparatively rare form which has not participated in the general increase in numbers. No specimen was taken, and the single example of the species in the South Australian Museum represents the darker typical race.

The Dieries, on the Barcoo, speak of a spotted animal, the Yikaura, which was a rare form when they were boys, and which has not been seen for many years; it was, no doubt, a *Dasyurus* species. With this exception no definite accounts could be obtained of any other members of the family, though it is probable that *Antechinomys* occurs here.

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(10) Horn Expedition Reports, Mammalia, p. 25.

(11) Cf. Wood-Jones Mammals of S. Aust., pt. i., p. 108.

ON THE EREMIAN REPRESENTATIVE OF MYRMECOBIUS FASCIATUS (WATERHOUSE).

BY H. H. FINLAYSON

Summary

The status of *Myrmecobius fasciatus* beyond the south-western districts of Western Australia, which until now have been considered to be its chief stronghold, has long been a matter of uncertainty. Its presence in the centre was first established by the work of the Elder Expedition[(1)] but that it formerly exended very much further south, almost, in fact, to the coastal districts of the State of South Australia, is attested by the statements of Sir George Grey and the early settlers here, and confirmed by the presence of specimens from the southern part of this State, in the British and South Australian Museums. No definite records of the animal from the southeastern portions of its range have been obtained for many years, and since most of this area is more or less closely settled, it is also unlikely (as Wood-Jones has opined) that it still survives here.

ON THE EREMIAN REPRESENTATIVE OF MYRMECOBIUS FASCIATUS (WATERHOUSE).

By H. H. Finlayson.
Hon. Curator of Mammals, South Australian Museum.

[Read October 12, 1933.]

The status of *Myrmecobius fasciatus* beyond the south-western districts of Western Australia, which until now have been considered to be its chief stronghold, has long been a matter of uncertainty.

Its presence in the centre was first established by the work of the Elder Expedition,(1) but that it formerly exended very much further south, almost, in fact, to the coastal districts of the State of South Australia, is attested by the statements of Sir George Grey and the early settlers here, and confirmed by the presence of specimens from the southern part of this State, in the British and South Australian Museums. No definite records of the animal from the south-eastern portions of its range have been obtained for many years, and since most of this area is more or less closely settled, it is also unlikely (as Wood-Jones has opined) that it still survives here.

Recent field work, by the writer, in the far north-west of this State (in a typical eremian environment) has shown, however, that *Myrmecobius* still has a wide distribution in the south-west parts of the centre beyond the limits of pastoral settlement, and in some localities is by no means uncommon. It is possible that these colonies actually link up with the far south-western ones in Western Australia in a continuous band of distribution,(2) and enquiry into these and related matters is proceeding and will be dealt with later in a general account of the Luritja mammals.

But for the present, as an excellent series of the central animal is now available, comparisons have at once been made with a series from south-west Western Australia, and these show that the former, while structurally identical with the typical race, constitutes a distinct colour variety, which I propose to separate under the name

Myrmecobius fasciatus var. rufus.

Size, apparently averaging slightly less than in the typical race, with which, however, it agrees closely in all essential structural features, both external and cranial. As the subspecies is founded entirely on pelage characters, it may be sufficiently defined by listing the points in which it differs from the better-known animal.

(1) The whole of the dorsum is more strongly suffused with rufous. This is particularly noticeable on the crown of the head and the fore-part of the back, where the colouration is constantly a rich uniform brick red (about Ridgway's

(1) Trans. Roy. Soc. S. Aust., vol. xvi, (1892-1896), p. 154.

(2) This is implied by le Souef (Wild Animals of Australia), who gives the range of the animal as extending from "Port August to about the latitude of Perth." But as no detailed records of the species in the intermediate tracts seem to have been published, and as much of the country is quite untouched so far as systematic collecting goes, I presume that Mr. le Souef, in this statement, is estimating the probabilities of the case, rather than stating an ascertained fact.

orange rufous to Sanford brown) sparsely pencilled with pure white, but without black hairs and presenting a very different appearance to the same areas in the typical variety, where (even in the most richly-coloured specimens) these parts are grizzled with white, red, and black.

(2) The transverse light bands of the posterior back may be either pure white or cream and, as regard number, breadth and spacing, they show about the same range of variation as in *typicus,* but in adults there is a constant difference in the colour of the areas which they enclose. In the western form these areas culminate in broad rump bands which are either dark grey or jet black, but in variety *rufus* they are constantly a rich brown (about Ridgway's Mars brown to bay). This colour is subject to marked change on long preservation in alcohol, and in the longest kept examples (taken in 1903) the brown has faded to a ferruginous red, scarcely differentiated from the colour of the foreback. Such examples show the white bands traversing an almost uniform red field, and are strikingly different from fresh examples of either race.

(3) In *rufus,* even in midwinter, the coat shows a much scantier underfur and, as a result, seems more adpressed and somewhat coarser.

(4) The outer surface of the ear is clothed with bright rufous hairs, from base to tip, whereas in *typicus* the ear at the base has a fine grizzle of yellow and black, grading out to pure black at the tip. A good distinction at all stages.

(5) The ventral surface is more variable than the dorsum, but is always some shade of ochraceous tawny and never white as it frequently is in the typical form.[3]

The colour is richer in young animals than in old.

(6) Colouration in the var. *rufus* is much more constant than in *typicus.* All the examples obtained were almost exactly alike dorsally, whereas in the south-west, even in much more restricted localities, scarcely two examples of *typicus* can be got which are closely matched.

Sexual differences in colour and size are negligible.

Skull and *dentition* as is the typical form.

Dimensions.—Range in apparently adult specimens of both sexes; head and body, 200-270; tail, 130-170; pes, 44-47; ear, 25-29.

Skull Dimensions of the co-type M. 3061, ♀; basal length, 53·8; greatest breadth, 29·9; nasals length, 22·8; nasals greatest breadth, 12·5; nasals least breadth, 3·2; intertemporal breadth, 18·0; interorbital breadth, 14·8; palate length, 41·5; palate breadth outside M^1, 11·6; anterior palatal foramen, 3·0; height of canine, 2·7; length of M^3 (worn), 1·7.

Co-types of Subspecies.—Adult ♀, South Australian Museum; registered number, M. 3061 (skin and skull); and adult ♀, South Australian Museum; registered number, M. 3759 (alcohol).

Type Locality.—Mulga sand dunes, south and south-west of the Everard Range, far north-west of State of South Australia.

Range.—At present apparently not north of about 25° S. lat., nor east of 132° 30′ E. long. To the south and west as yet undetermined. Formerly as far south as Adelaide, and probably ranging east into the Victorian and New South Wales mallee areas.

Seventeen individuals examined.

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(3) This was attributed by Thomas to fading, but is not necessarily so.

Although it is very likely that it intergrades with the typical variety in the western portions of its range, this beautiful animal, the most brilliantly coloured of all the marsupials, is so distinct in the type locality that it undoubtedly merits recognition as a subspecies. Knowledge that the eastern forms of *Myrmecobius* are redder than the western, seems to be due primarily to Major Thomas Mitchell, upon whose meagre accounts Waterhouse[4] founded the *nomen nudum, Myrmecobius rufus.*

The name was ignored by Thomas in the catalogue of 1888, although a South Australian specimen was included in the British Museum collection at that time, but was reintroduced by Wood-Jones, who in 1923 published a preliminary description with figures of the skull, of South Australian specimens, from the Murray and from near Adelaide.

In estimating the relation of the central animal to the south-eastern one described by Professor Wood-Jones, I have had to rely for external characters on a single mounted specimen taken in the Murray Scrubs in 1863, and for cranial characters, on two very immature skulls. This material, though insufficient for a proper comparison, seems to me to indicate strongly that in this State the South-eastern and north-western animals are one and the same, and that this form is not specifically separable from that of the karri, jarra and wandoo belts of Western Australia.

The three districts from which specimens have now been examined are widely sundered and show considerable differences in climate and vegetation, but *Myrmecobius,* like its Ornithodelphian analogue *Echidna,* is apparently too strongly committed to a specialized diet, which it finds almost unaltered over the whole of its range, to make any structural response to such changes in physical conditions.

My thanks are due to Professor Wood-Jones and Mr. L. G. Glauert for valuable data and the loan of specimens.

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(4) Jardine's Naturalists' Library, vol. xxiv. (1855), p. 149.

GEOLOGICAL NOTES ON THE COCKATOO CREEK AND MOUNT LIEBIG COUNTRY, CENTRAL AUSTRALIA.

BY NORMAN B. TINDALE, B.SC.

Summary

During the fourth and fifth Adelaide University and South Australian Museum Anthropological Expeditions to Central Australia in August of 1931 and 1932, opportunities arose for making brief geological and physiographical notes on the country traversed.

Apart from the work of the members of the Horn Expedition at Haast Bluff Range, the principal geological observers who have made records of the areas discussed herein are Dr. Chas. Chewings (1), who mapped the country from Ellery Creek to Mount Liebig, in 1885, and visited it on three other occasions, and Mr. C. T. Madigan (2), who flew over the country south of Haast Bluff during the course of his extensive researches in the country further east in the MacDonnell Ranges. The country along the Overland Telegraph Line, which we also traversed, has been visited by many geologists and has, therefore, not been referred to in much detail.

Acknowledgments are made of the assistance rendered by the various members of the Expedition, especially to Dr. H. K. Fry, who discussed many of the problems in the field. Dr. Chewings courteously supplied all possible information concerning his observations. The officials of the Property and Survey Branch, Department of the Interior, Canberra (under the supervision of Mr. P. Hossfeld), compiled a map from the then available records for the use of the 1932 Expedition.

We are indebted to Sir Douglas Mawson, Professor of Geology, Adelaide University, and to Mr. C. T. Madigan, for advice and criticism and for the loan of some equipment for the use of the Expeditions. Examination of, and comparative work on, the materials gathered was partly carried out in the Geological Laboratory of the University.

The anthropological researches of the University and Museum were assisted by a grant from the Australian National Research Council.

As in previous accounts the native names have been used, wherever possible, for unnamed physcial features.

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[Read April 13, 1933.]

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I. INTRODUCTION.

During the fourth and fifth Adelaide University and South Australian Museum Anthropological Expeditions to Central Australia in August of 1931 and 1932, opportunities arose for making brief geological and physiographical notes on the country traversed.

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II. HANN RANGE TO COCKATOO CREEK, 1931.

The Expedition left Alice Springs early in August and travelled along the main "Darwin track" to Hann Range. The geology of this strip of country, and, to some extent, of the Reynolds Range, is known, and need not be considered in any great detail. Some particulars that were gathered are noteworthy. Boulders of ilmenitic grit are present on the plain about one quarter of a mile south of Hann Range, and these apparently indicate a junction of the Hann Range conglomerate beds with the underlying Archaean granite gneisses and schists. Dr. Chewings informs me that "greenish-blue slates underlie the Hann Range sandstones, grits, etc. A well was sunk in these slates, 50 or more feet deep, on the south side of and close to the Native Well Gap. One mile south of this Gap is a large area of granite with a waterhole." Specimens have been examined which indicate that this junction extends along the south side of Hann Range and its continuation westward in the Stuart Bluff Range, to beyond West Bluff, and suggests that these hills are the southern marginal beds which form a shallow synclinal fold, the Ngalia Syncline, which varies from eight miles in width at the place where we crossed it to thirty miles further west, and which may extend east and west for some 120 miles, namely, from Hann Range nearly to Mount Davenport. The conglomerate beds at Hann Range consist of a fine arkose sandstone, containing quartz pebbles, up to 10 mm. in diameter. Capping the conglomerate is a medium-grained white sandstone, somewhat felspathic, which is deeply ferruginised where it has been exposed to weathering. Beyond Ryan Well there are three alternative routes to Cockatoo Creek. The particular one followed turns westward along the southern flank of Mount Boothby (Iritjapunja), and then northward to the Woodforde Well, on the Woodforde Creek, at a soakage water called Ilyawa. During the return journey a track passing along the north and east sides of Mount Boothby was followed. The debris in Woodforde Creek, coming down from the north-eastern face of the Reynolds Range, consists of mica-schists and quartz-schist.

From Ilyawa the track goes west for fifteen miles, skirting along the northern flank of the Reynolds Range. This range extends in an almost unbroken line from Mount Airy in the south-east to Mount Gardiner in the north-west. A parallel range running from east of Mount Finnis to beyond Mount Stafford forms the northern side of an almost straight valley, which continues for fifty miles in a north-westerly direction between these two ranges. The Mount Finnis Range is composed of mica-schist, hornblende-schist, and highly metamorphosed quartzite (or quartz schist), whose planes of schistosity dip at a high angle (70°) to the north-east.

Isolated outcrops of gneissic granite are present on the headwaters of the Hanson, which we crossed as we travelled in a north-westerly direction to Rembi Soak, near the southern face of Mount Finnis. A few miles further north-west the track winds up and around schistose outcrops and granite rises to the top of a low divide, the Lander-Hanson divide, which leads across to the headwaters of the Lander Creek. On the return journey a brief opportunity enabled a visit to be made nearly to the crest of the Mount Finnis Range.

The Lander Valley is occupied by a portion of a granite batholith, of which the Mount Finnis Range metamorphic series marks the north-eastern margin. Roof-pendants of schist and augen-gneiss occur. The intruded rocks are apparently highly altered sediments. Quartzites or grits appear to have been ironed out into flat laminae; mica-schist, amphibolites and augen-gneisses are also present, and these are intruded by coarse pegmatite and microgranite dykes. Similar aplites, microgranites and pegmatites occur as dykes in the granite a few miles west, near Lokatja Soak.

Some fifteen miles north-west of Lokatja the track leaves the western bank of the Lander and turns W. 10° S. towards a two-mile-wide wind-gap which appears in the Giles Range. Passing through this a broad vista is obtained of the headwaters of the Warburton Creek. To the south-east the Mount Reynolds-Mount Thomas Ridge is seen to terminate rather abruptly in Mount Gardiner. A low range, decreasing in importance to the south-east, laps against the north-eastern face of the main Mount Thomas Ridge. To the west of the wind-gap this low range becomes higher and, as the Giles Range, continues W. 30° N. for at least twenty miles. The Warburton Creek cuts through the Giles Range some ten miles to the west.

The beds forming Giles Range are micaceous shales, laminated gritty shales, micaceous sandstones, and coarse quartzites, probably aggregating several thousand feet in thickness. They dip N. 30° E. at an angle of approximately 60°, and maintain a similar strike and dip for at least 15 miles to the north-west. They also extend south-eastwards as far as Mount Thomas. The base of these beds is obscured by alluvium where we crossed them, but a quarter of a mile south-west of the Gap gneissic granite, containing large porphyritic crystals of orthoclase, is present as a peneplaned pavement, and these conditions were noted to continue at intervals thereafter nearly to Coniston Station.

During the return journey the following section of beds, listed in descending order, was examined while climbing to the top of the Giles Range at the Wind-gap, and the thicknesses were then estimated:—

	Feet.
Purple shales with some thin quartzites, etc.	500+
Hard quartzite (forms crest of range)	20
Sandstone	80
Hard quartzite	10
Coarse sandstone	90
Indurated micaceous sandstone	100
Gritty sandstone	100
Micaceous shales	400
Finely laminated gritty shale	50
Shale	50+
Unconformity	
Gneissic granite	

To the north of the main ridge the purple shales gradually die away into the Lander Plain, being supported by some minor harder quartzite beds which were not examined.

The Giles Range Series appears to be a narrow down-faulted block of somewhat metamorphosed sediments younger than the highly metamorphic Archaean rocks intruded by the granite. The course of the Lander down to the Warburton junction appears to mark a fault-line, for everywhere to the north of the line are gneisses and schists of the Archaean metamorphic series.

From the top of the Giles Range, Mounts Denison, Leichhardt, and Stafford appear as massive blocks to the north. Mount Stafford marks the western extremity of the Mount Finnis Range just before it dies away opposite the Lander-Warburton junction.

Coniston Station is situated at the Mamba soakage water on Warburton Creek, in the centre of a wide peneplane. The creek is half a mile wide at the station and the banks are some forty feet high, composed of consolidated river-wash conglomerate and alluvium. The junction of Tower Creek with the main stream is about a mile up-stream from Coniston. The tributary is bringing down dark-blue quartz-schist, muscovite-granite and hard sugary-quartzite boulders and pebbles from the region immediately to the south of the Mount Gardiner-Mount Thomas Range. The contributions of the Warburton, which flows from the south and south-west, are largely granitic in character, with some quartzites of the type found at Hann Range.

Some six miles south-west of Mamba is Crown Hill, an isolated table-topped hill with a massive horizontally bedded quartzite capping. Crown Hill stands 460 feet above the plain and is an outlier of the Uldirra (or Sliding Hill) Range further south, where the same beds dip, at an angle of 40° southward, beneath the plain. Beyond Crown Hill, on the far southern horizon, is the long line of bluffs that constitute the Stuart Bluff Range. Stuart Bluff Range is cut across at remarkably regular intervals by wide consequent valleys. The Sliding Hill Range (Uldirra) marks the present watershed-divide of the two inland drainage basins represented by the Lander and Lake Bennett depressions.

From Coniston the track goes west to Brooke Soak, crossing Crown Creek after five miles. Debris in this creek consists of pebbles of gneiss, quartzite and sandstone. Low granite outcrops appear at intervals on the plain, and elsewhere that rock is evidently only thinly covered by a mantle of alluvium. Four miles east of Brooke Soak there is a small hill about 100 feet in height composed of vertically-bedded white quartzite and green amphibolite, striking east and west. This appears to be an indurated roof pendant of Archaean metamorphosed sediments. Just west of Brooke Soak are the twin peaks of Mount Treachery, standing about 1,000 feet above the plain (this mount is locally known as Naval Action). The southern side of Mount Treachery is composed of highly metamorphosed sericitic schists; five miles further west similar beds strike a little south of west, and dip northward at 60°. Para-gneiss and highly altered quartzites are present. To the south there is a low massive granite dome, barely denuded of sedimentary covering, which extends for ten miles east and west and is probably at least five miles wide. The track follows a low, narrow plain (cut in schistose rocks), which lies between the granite and the Mount Treachery beds. An unnamed consequent creek drains the northern side of the granite and cuts its way northward through the Mount Treachery Range near this point.

After crossing Inga Creek, which also drains the northern side of this granite region, the track passes a gigantic highly altered white quartzite outcrop, forming an oval hill two hundred feet high and a quarter of a mile long. Soon afterwards it reaches Aknatalya Soakage, on Cockatoo Creek (22° 10′ south lat. x 132° 5′ east long.). A well had just been sunk here, near the site of the native soakage. The Expedition Base-camp was placed on the banks of the creek a hundred yards south-east of a low hill, composed of kyanite schist, which, to the native mind, represents the petrified ancestral kangaroo man of Aknatalya. A hill (situated a mile west of the camp) which is some 400 feet in height is also composed of kyanite schist, striking a little south of west. A mile south of the camp, across a red-soil plain, porphyritic granite, somewhat gneissic in character, outcrops in low domes; further north the plain is composed of schists and para-gneisses. Granite extends beneath the plain and is exposed at intervals to Ponjina, north-west of Quartz Hill (Yaluwa), where futile effort has been made by a prospective station-owner in blasting out a well through 40 feet of it. Rather fresh examples of biotite-granite were secured here. Large black tourmalines are present in quartz-pegmatites in the vicinity, but were not found *in situ*.

The country immediately south of Quartz Hill was visited by one of the Expedition members, who reported that there were low granite outcrops on the plain and that some five miles further south there was a low range with a northern scarp. Viewed from the top at Aknatalya, this ridge was seen to trend away west towards the Treuer Range, and it is evidently identical with the Mount Eclipse Range of Warburton. The granitic country extends westward to beyond Rock Hill. A visit to the low hills five miles north-west of the Base-camp revealed a ridge of para-gneiss, flanked by schists, on the adjacent plain.

III. NOTES ON THE FORMATIONS OF THE HANN RANGE-COCKATOO CREEK AREA.

The following geological series appear to be represented in the area between Hann Range and Cockatoo Creek:—

A. Metamorphic series, of Archaean age.

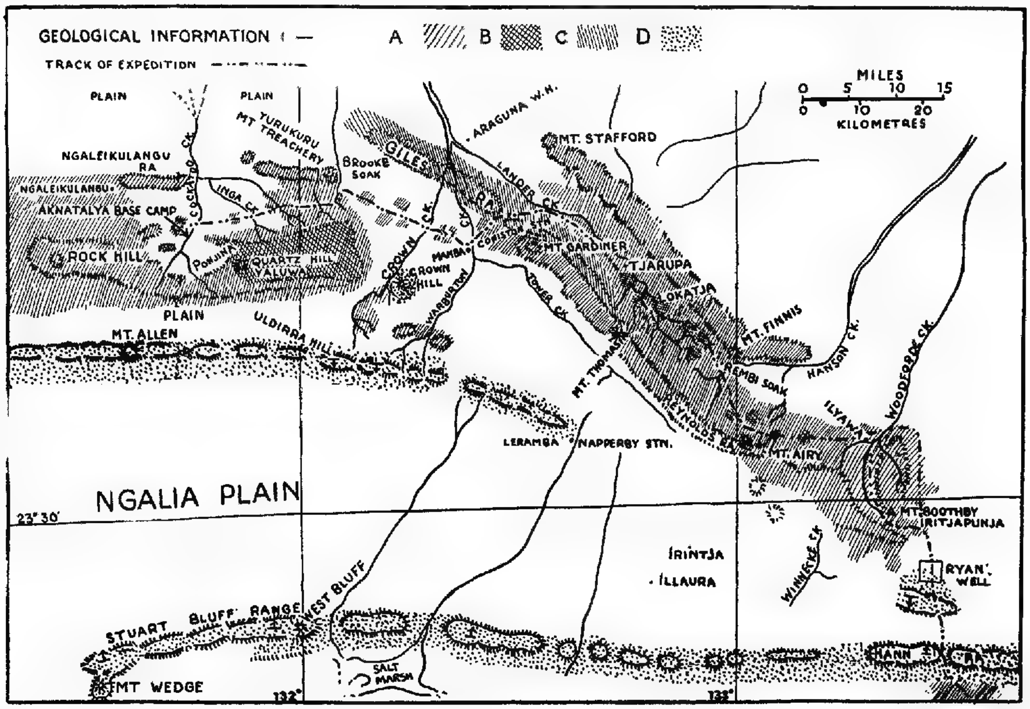
B. Granites intruded into the Archaean rocks.

C. Giles Range series. These are tentatively considered to be of Older Proterozoic Age, and may represent the northern equivalents of the Pertaknurra series as defined by Mawson and Madigan (3) and by Madigan (4).

D. Hann Range-Uldirra Hill-Crown Hill series of unmetamorphosed quartzites, arkose grits and conglomerate.

E. Consolidated grits and recent fluvial deposits of Mamba plain, Ngalia plain, and the Lander Valley.

The grain of the country runs south-east to north-west from Mount Boothby to Mount Thomas, after which it swings around gradually to the west until at Cockatoo Creek the axis is approximately W. 5° S. On a previous journey it was observed that east of the Telegraph Line the trend of the tectonic axis is south-east



through the country near, and to the north of, the Strangways Ranges, where it turns eastward again along the trend of the Hart Range. In a previous paper (5) mention was made of the occurrence of granite stocks and granite-porphyry dykes, on the Archaean plateau of the Waite, Fraser, and Bundey Creeks.

The Archaean metamorphic rocks in the vicinity of the granite intrusions in the Cockatoo Creek area appear to have developed marked peripheral schistosity.

The granite intrusions preceded the formation of the Giles Range beds, for these were laid down on a peneplaned surface of granites, gneisses and schists, in a similar manner to the basal beds of the Mopunja Range 170 miles further east.

Few lithological similarities can be traced between the Giles Range sediments and the Pertaknurra series as seen at Heavitree Gap, but there are similarities with the basal beds of the Mopunja Range, namely, in the presence in both of freely alternating beds of shale, gritty sandstones and quartzites, and in the presence of purplish shales, but they differ in the comparative absence of the felspathic grits in the case of the Giles Range series.

The Hann Range series is less metamorphosed and has been less intensely folded and faulted than the Giles Range series. It may therefore be tentatively suggested that they are younger than the Giles Range and the earliest beds of the Mopunja Range.

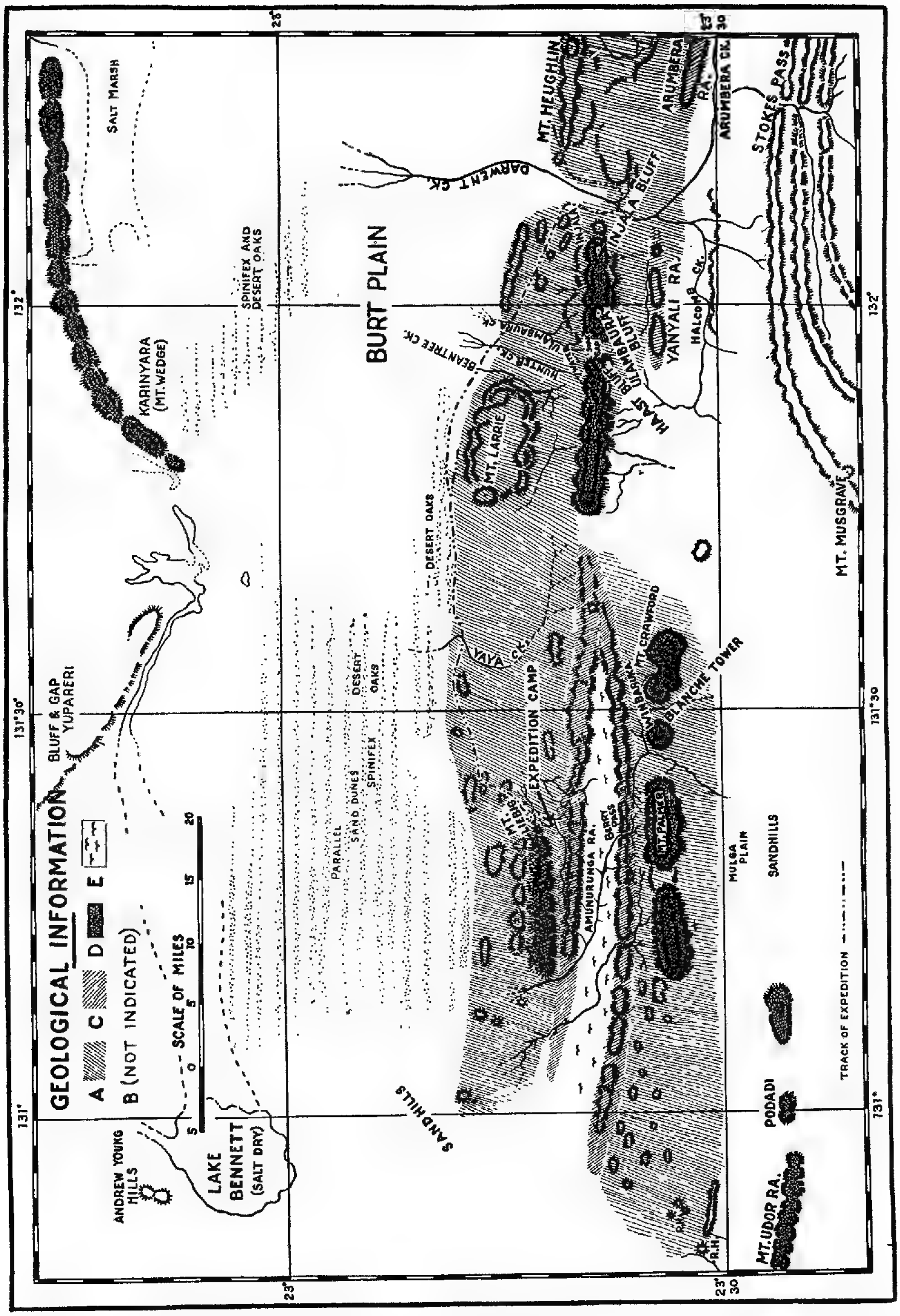
IV. PAINTA SPRINGS TO MOUNT LIEBIG, 1932.

Leaving the Telegraph Line at the top of Alice Springs Pass, we turned westward and skirted along the northern side of the MacDonnell Range. Archaean rocks of the Aruntan complex here rise almost vertically from the level pene-planed Burt Plain, and run due east and west for over a hundred miles. In places where granite forms the northern face of the range the red soil extends right up to the steep face without a very appreciable slope, so that it is possible to drive for miles within a few feet of the rock-face or even to stand with one foot on the flat plain and the other on an almost vertical granite wall. Gneissic granites, intruding hornblende schists, are the predominating rock types. An association of a greenish epidotised siliceous rock (probably an altered sediment) with hornblende-schist is characteristic of the vicinity of Painta Springs, and the two types reappear together over one hundred and fifty miles to the westward, on the northern slopes of Mount Liebig. The schists occur as planed-off surface outcrops on the plain, and in that form extend northward from the steep walls of the main range for many miles. In places they form ridges as in the low Adla Range, which runs parallel to the main range and joints with the Mount Hay Range further west.

A bore recently put down by the Works Department indicates that a considerable thickness of unconsolidated sediments may exist in the eastern portion of the Burt Plain, for, on a site about a mile north of the range, opposite Mount Everard, subartesian water has been obtained, without reaching bed-rock, at a depth of 678 feet. This bore passed through about twenty feet of surface limestone, beneath which were only unconsolidated sands and silts. A bed of argillaceous lignite was met with near the bottom of the well. Dr. Chewings states that the Lower Hanson is a similar valley-like depression, filled with sediments.

After skirting the head-waters of the Charley Creek the track passes north-west across a wide alluvial plain to the Mount Hay Well (and Dam), on Hamilton Downs Station. Here again a depth of about 100 feet of soft sediments, principally arkose sand and silt has been proved. Mount Hay Range is 800 feet above the plain, and runs east and west for more than 25 miles. A low flat-topped shelf, about 50 feet in height, skirts its south-western flank where it is truncated by the wide channel of the Charley Creek. According to Dr. C. Chewings the shelf is composed principally of white calcareous sandstone and limestone and is evidently of fluviatile origin. It is, geologically, quite young—perhaps Pleistocene or Pliocene. It may represent the uppermost portion of the sediments that fill the ancient depressions, or valleys, in which freshwater wells are obtainable over the schist area of the Arunta shield.

West of Mount Hay Well the road crosses a broad flood-plain, swampy in parts, and then returns to the foot of the main range. Near Redbank Station, due south of the Mount Chapple Range, there is a low divide of Archaean schists separating the watersheds of the Charley and Halleem Creeks. Mount Chapple Range strikes west for fifteen miles from the western side of the Charley Creek,



and then veers away to the north-west. Opposite Redbank Station, where a brief examination was possible, the rocks were Archaean gneisses and schists. Mount Chapple is high, standing probably some 1,200 feet above the plateau. After crossing the Halleem, the track continues west-north-west for many miles over a featureless plain, largely covered with dense mulga scrub. The north side of Mount Zeil appears from a distance as a solid mass of gneiss or gneissic-granite, rising abruptly from the flat sandy plain. The Dashwood Creek comes out of the Mount Zeil Range from the south-west as a considerable gum-creek carrying gneiss and schist pebbles and coarse arkose sand. After leaving the Dashwood the track passes closely along the northern face of the Mount Heughlin Range, which also rises steeply from the plain. A noteworthy feature here and at Mount Zeil is the absence of defined drainage from the steep northern slopes. To the north is a vast level mulga-covered plain, extending without a break to central Mount Wedge, forty miles north-west.

A low wind-gap near the western extremity of the Mount Heughlin Range yields a passage to the south side; the paragneiss of this range strikes west and has a plane of schistosity 80° north.

Across the wide detritus filled valley of the Darwent Creek the high Haast Bluff Range stands over 2,000 feet above the plain. It runs east and west and has three principal peaks. Colonel Warburton (6, 7), on May 2, 1873, supposed the eastern one of these peaks to be Haast Bluff, and on July 2, 1873, W. C. Gosse (8) saw the western one and identified it as the mountain which Giles had named. Giles himself seems to have seen the western portion of the range from Mount Tate on September 15, 1872, and named it the Liebig Mountains. Ever since Warburton's and Gosse's time the range has been known as the Haast Bluff Range, the western mountain as Gosse's Haast Bluff and the eastern as Warburton's Haast Bluff. The western summit is the highest and is marked as Haast Bluff on the latest small-scale map (North and Central Australia Pastoral Map, December 11, 1930). In the present account the native names Injala and Ulambaura are used, respectively, for the eastern and central peaks. This is the Belt Range of the Horn Expedition, in which account the three peaks are named, respectively, as Mounts Edward, William, and Francis, but the old name holds sway. From the Mount Heughlin wind-gap the track leads southward for six miles to the Darwent, crossing where low banks and a bar of gneissic rock, with a plane of schistosity 80° N. facilitates a passage across the Darwent Creek. Further down stream the creek flows between vertical walls of alluvium up to thirty feet in height. At the crossing a small tributary from the east brings down gneiss and schist pebbles from the low ranges to the east and south-east. The main creek is loaded with debris, which includes para-gneiss, schist, purplish felspathic grits, fine-grained quartzites, and quartzites containing fragments of undetermined fossil Pelecypods.

An examination of the talus at the base of Injala Bluff, and an ascent of the front of the range to a height of some 800 feet above the plain, showed that the cap on the Injala mountain of the Haast Bluff Range is composed of a considerable thickness (some 500-600 feet) of purplish laminated felspathic quartzite. The quartzite beds dip north at about 30°. Tate and Watt (9) described this considerable and relatively horizontal capping of sandstone and quartzite, and considered it to be of Ordovician age. Chewings (10) regards it as much older. It rests on a massive pedestal of para-gneiss and schists whose plane of schistosity is 65° N. A six feet wide snow-white quartz-felspar pegmatite dyke is a conspicuous feature in the gneisses at the eastern extremity of Injala. The view to the south from this point shows the continuous line of the Mount Musgrave Ridge, or ranges, across the horizon. Viewed from this direction the vertical northern scarp of these steeply dipping Larapintine quartzites, as described by Madigan, closely resembles a vast flat-topped tableland, and it is so described on a recent map. Nearer at hand is Yanyali Ridge, the capping of which, as indicated by Chewings, is a detached segment of the Pertaknurra quartzite. Beyond Halcomb Creek there appears to be a broad and low shelf about one hundred feet high, which extends nearly to the foot of the Mount Musgrave Ridge. From Injala the track goes north for six miles across claypans and flood-flats of the Darwent Creek, and then turns west-north-west over a wide, shallow sand-plain, studded here and there with low ridges of para-gneiss and schist, with westerly trend. The dip of the plane of schistosity here is less, approximating to 45° N. at the places examined. After crossing the Ulambaura, Hunter, and Bean-tree Creeks (which drain the northern scarp of Haast Bluff Range and spread out and lose themselves on the northern plain), the track skirts the relatively low but extensive Mount Larrie Range, which is principally composed of granitic gneiss. Here the track follows along the crest of the first of a series of sand dunes which run parallel to, and north of, the range.

These low east and west running sandhills are a characteristic physiographical feature of the country for many miles north and for over one hundred miles in an east to west direction. They are approximately one mile apart, and from thirty to fifty feet high, covered with spinifex and low mallee scrub, with desert oaks *(Casuarina Decaesniana)* in patches. The ascent on to the sand ridges is usually gradual; there may or may not be a moving crest of loose sand. The country between them is densely covered with mulga scrub. The dunes form a belt from 15 to 20 miles wide and are succeeded on the northern side by claypans, broken limestone flats, and terraces, indicating a former extension of the terminal drainage basin (Lake Bennett). At its maximum this dry salt lake must have been over one hundred miles long and not less than fifteen wide. At present the drainage into it from the higher country is insufficient to maintain defined channels across the sand barriers. Yaya Creek, which we now approached, is typical of numbers of these flood channels, which fan out and lose themselves in the dunes soon after they leave the schist platforms at the foot of the ranges. The Yaya flows from the northern side of the eastern extension of Amunurunga Range and travels across the northern plain between walls of red soil from twenty to thirty feet high. The bed is choked with coarse sand containing large pebbles and gravel in abundance. Close-grained quartzite pebbles predominate; all are worn and well rounded; pebbles and boulders of gneiss are also present, together with irregular pieces of red limestone-conglomerate.

West of the crossing at Yaya Creek there is a broad red-soil plain covered with mulga scrub. Four or five miles west of Yaya Creek there is an isolated low hill composed of coarse-grained quartz-schist dipping 60° N. This is the northernmost visible extension of the Archaean rocks in the vicinity. The track now veers to the south-west with Mount Liebig forming a prominent feature directly ahead. Low hills of gneissic character become more common but their presence does not seem to impair the regularity, or general direction, of the parallel dunes. The southernmost of these dunes is passed about six miles north of the main Liebig Range. Approaching Mount Liebig the track traverses some six miles of rising ground thinly covered in alluvium; this slope affords excellent exposures for a typical section of the Aruntan metamorphic rocks in this region.

The camp of the Expedition was placed under the shadow of the eastern end of Mount Liebig, on an old native camp, situated about three-quarters of a mile north of the main water on Amunurunga (Mount Liebig Pass) Ridge, and just north of the junction between the Arunta complex and Pertaknurra sedimentary series.

A geological examination of the district proceeded as opportunity offered during intervals in anthropological work. Through the co-operation of various members of the Expedition preliminary samples were brought in from all neighbouring places visited.

V. NOTES ON THE FORMATIONS OF MOUNT LIEBIG AND VICINITY.

Four principal series of rocks were observed in the Mount Liebig district and during the journey from the vicinity of Painta Springs.

A. *Arunta Complex of Archaean Age.*—These rocks consist largely of para-gneisses, amphibolites and quartz schists. An extensive suite of specimens was collected and are available for study. Quartz schists are common: epidotised siliceous sediments, amphibolites, and augen-gneisses are represented in considerable variety.

B. *Granites* and associated pegmatite dykes intruded into the rocks of the Arunta Complex. The granite of the Mount Liebig area is not well developed, appearing in isolated stocks at wide intervals. The tectonic axes are due east and west from the vicinity of Mount Zeil to beyond Mount Liebig. A few aplitic dykes and acid pegmatites are present.

C. *The Amunurunga Range Series.*—This series consists of quartzites, sandstones, conglomerates and highly altered shales, approximately 10,000 feet in thickness (estimated). As first indicated by Chewings, they are downfolded into the Aruntan rocks and occupy a synclinal basin overfolded towards the south. West of Mount Liebig the limbs of this fold diverge slightly and gradually dip beneath the plain. To the eastward they converge and the northern limb approaches the southern.

An examination of the sediments of Amunurunga Range was made at the Amunurunga Pass, five miles east of Mount Liebig summit. The last-named summit is situated on a much higher range which runs parallel to the Amunurunga Range some two miles further north.

The principal beds noted at Amunurunga Pass and the thicknesses estimated after rough pacing were, in descending order:—

	Feet.
Yellow sandstone	2,500
Upper (white) quartzite	2,600
Lower (fine-grained grey) quartzite	1,900
Metamorphosed shale	700
Grit Beds	800
Basal conglomerates and conglomeratic grits	1,500
Unconformity	
Arunta Complex	

The basal conglomerate contains rolled-out quartz pebbles up to 20 cm. in diameter. The conglomerate is succeeded by grit beds containing occasional pebbles. These beds have all been metamorphosed and are penetrated by a network of quartz veins from 1-5 mm. wide.

The metamorphosed shales which succeed them weather out as a trough along the northern face of the quartzite ridge, the trough being due to the differential erosion between the grits and shales, and the intensely hard lower quartzite, here overfolded to such an extent as to form a protective capping to the sandstones which are stratigraphically above them. Watercourses have cut narrow and deep gorges at regular intervals across this hard quartzite, and it is in these narrow clefts that the changing dip is best seen. In addition to the major folds individual beds are intensely folded, the weathering of these has revealed remarkable examples of multiple overfolding. Wave ripple-marks are a feature of the fine-grained quartzite; owing to the over-turning of the beds they are present as moulds on the faces of the rocks.

The upper quartzites are slightly less compact than the lower ones and are succeeded by a great thickness of reddish-yellow sandstone composed of well-rounded grains of remarkably even grade.

Limestones are conspicuous by their absence, but some may be concealed under the wide alluvium-filled valley immediately to the south. On the ground of the lithological resemblances between these Amunurunga beds and the Heavitree Gap beds (notably the presence of the dense white quartzite and associated beds, which resemble the quartzite of Heavitree Gap) they are equated with the Pertaknurra Series (Madigan's Older Proterozoic).

D. *Mount Liebig Capping Beds.*—The beds capping Mount Liebig dip N. 5° W. at an angle of approximately 20 to 30° from the horizon; they rest unconformably on the upturned edges of para-gneiss, amphibolites, and quartz schists, of which the northern foothills are composed.

The explorer Gosse (8) apparently noticed these capping beds when he climbed Mount Liebig in 1873. He described the Mount as composed of basalt and gneiss, and sandstone, with strike E. and dip 14° S. It seems likely that 14° S. is an error for 14° N. in the dip of the capping beds only. Chewings did not have the opportunity of examining them.

At a point a quarter of a mile east of the summit cairn, erected by Gosse, the capping beds, in descending order, are estimated as follows:—

	Feet.
Felspathic quartzite	20+
Finely laminated sandstone	80
Laminated felspathic purple grit	200
Gritty conglomerate	200
Unconformity	
Arunta complex	

The basal conglomerate is not a strong feature. It shows undeformed quartz pebbles up to 4 cm. in diameter imbedded in a coarse grit composed of quartz and kaolinised felspar. Some pebbles, apparently weathered out of this basal bed, which were picked up on the scree below the junction with the metamorphic rocks, are composed of quartz schist.

The conglomerate beds merge upwards into a purplish-coloured, laminated, felspathic grit. The laminae consist of regular varve-like alternations of coarser purplish grits and fine-grained light-coloured sand, almost of silt grade. The coarse bands have an average thickness of 7 mm., the usual range being from 4 to 15 mm. The finer-grained laminae are more variable and show minor banding of very fine-grained constituents. They range from 3-20 mm. in thickness with an average of 10 mm.; the minor banding is of the order of 1 mm.

The possibility should be borne in mind that the presence of these varved sediments may indicate fluvio-glacial conditions during the formation of these beds.

The series, as a whole, shows no sign of deformation or metamorphism; a few thin quartz veins are apparent, these frequently bear minute crystals of iron pyrites. In this they are in strong contrast with the Amunurunga Range beds, the basal beds of which are honeycombed by a network of such veins.

The purple grits merge almost insensibly into fine-grained sandstones of a lighter purplish colour. The varve-like banding continues but the coarser bands are narrow, ranging from 1-4 mm. in thickness. The finer bands are definitely of silt grade and range from 3-15 mm. in thickness. They also show traces of the above-mentioned minor lamination.

Near the summit of Mount Liebig the beds are of white quartzite, superficially hardened by secondary silicification.

The purple-coloured capping-beds of the eastern end of Haast Bluff Range are similar in character to the Mount Liebig ones and show identical lamination. Their strike and dip is also similar. It is evident at Mount Liebig that marks of greater disturbance, higher state of metamorphism, and nearly vertical disposition of the (Older Proterozoic) sediments that form the southern half of the Liebig mountain-mass (Amunurunga Range) as compared with the capping beds, show such strong lithological and structural contrasts and the beds of each present such a wide angle of discordance that they must belong to two different series, separated by a vast hiatus in geological time.

South of Berry Pass similar beds to the Liebig capping beds have been described by Chewings as forming Mounts Palmer, Crawford, Peculiar, and Blanche Tower. At these places they are practically horizontally bedded. They stand on Archaean rock in a similar manner to the Mount Liebig and Injala Bluff occurrences.

These mountains and the Liebig capping are survivors of an extensive series, of which further traces may be expected when the table-topped hills west and north-west of Mount Liebig are examined.

E. *Tertiary to Recent.*—Under this somewhat indefinite classification may be placed the sand dunes of Burt Plain and the limestones now forming in the occasional waterholes through the agency of lime-depositing *Chara*-like algae. The red limestone conglomerate washed down Yaya Creek may also be tentatively classified here. Extensive calcareous silt deposits are present on the former terraces of Lake Bennett. Transported fragments of this white argillaceous limestone are plentiful in native camps. According to Mr. T. Strehlow, the present shores of Lake Bennett are covered with salt deposits and sun-baked mud.

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EXPLANATION OF PLATE X.

Fig. 1. View north-west from the summit of Mount Liebig: The northern foothills composed of Aruntan gneisses and schists with the sandhill-covered Burt Plain beyond.

Fig. 2. Amunurunga Range, looking south-west from the summit of Mount Liebig. Basal grey quartzite of the Amunurunga Range Series appears as wall in middle distance. The junction with the Aruntan gneisses is at about the middle of the low foreground. Mounts Palmer and Peculiar on the skyline; Mount Liebig Capping Beds in extreme right foreground.

Fig. 3. Mount Liebig from the south-east: Vertical southern scarp of Capping Beds resting on Aruntan gneiss and schist platform. Junction of Aruntan and Amunurunga Range series in middle distance. The grey quartzite wall of latter series in left foreground.

ABSTRACT OF PROCEEDINGS

Summary

ABSTRACT OF THE PROCEEDINGS

OF THE

ROYAL SOCIETY OF SOUTH AUSTRALIA
(Incorporated).

FOR THE YEAR FROM NOVEMBER 1, 1932, TO OCTOBER 31, 1933.

ORDINARY MEETING, NOVEMBER 10, 1932.

The President (Professor J. A. Prescott) in the chair, and 21 Members were present.

Minutes of the Annual Meeting, held October 13, 1932, were read and confirmed.

Apologies were received from the Rev. N. H. Louwyck and Mr. J. H. Gosse.

The formal resignation as Treasurer of the Society was received from Mr. B. S. Roach. The President expressed regret at the decision of Mr. Roach. It was moved by Professor J. Burton Cleland, seconded by Mr. J. M. Black and carried, that the resignation be received with sincere regret.

The President then called for nominations for the office of Treasurer. Professor T. Harvey Johnston moved, and Mr. W. J. Kimber seconded, that Dr. Chas. Fenner be invited to act as Treasurer. There being no other nominations, the President declared Dr. Chas. Fenner elected, if willing to act.

Dr. Chas. Fenner intimated that he accepted with pleasure the invitation extended to him to fill this important office.

PAPER—

"The Dead Rivers of South Australia, Part II.," by Professor Walter Howchin, F.G.S. Dr. Chas. Fenner, Dr. L. Keith Ward, and the President took part in the discussion of the paper.

EXHIBITS—

Mr. B. C. Cotton exhibited some fossil shells which had been recently presented to the S.A. Museum by Mr. W. J. Kimber.

Mr. A. G. Edquist exhibited a bowl of poppy blossoms which have originated as garden varieties in his garden at Glenelg. These blossoms, of wonderful size, colour and form, are the result of hybridization. Some of them appeared in this world for the first time this year.

Mr. W. J. Kimber exhibited some fossil shells from a well 80 feet deep at Campbelltown, where there is a large deposit of them, including at least three species of cephalopods, casts of *Cardium*, foraminifera, and fragments of lignite.

Professor J. Burton Cleland read a note on behalf of Dr. A. M. Morgan, who reported that in May, four years ago, he placed black coloured fruits of *Loranthus exocarpi*, parasite on *Lagunaria Patersoni*, on branches of oleander. Some of these grew and flowered sparingly in the third year, and vigorously in the fourth year (1932). The black fruits planted yielded some plants with yellow and green flowers and red fruits, and some with red and green flowers and black fruits like the original.

The President exhibited some aerial photographs of part of the Murray River in the region of Berri, which had been taken by the Royal Australian Air Force. Also a stereoscopic aerial photograph of part of the Ninety Mile Desert.

Dr. L. Keith Ward gave an interesting account of the occurrence of occluded gases occuring in various rocks in South Australia, which are released during the process of boring when carried out under a head of water. His remarks were illustrated by a number of lantern slides.

Ordinary Meeting, April 13, 1933.

The President (Professor J. A. Prescott) in the chair and 31 Members were present.

Minutes of the Ordinary Meeting, held November 10, 1932, were read and confirmed.

Apologies were received from Rev. N. H. Louwyck, Dr. James Davidson, Mr. A. G. Paul, and Mr. J. H. Gosse.

The President extended a hearty welcome to Sir T. Edgeworth David, an Honorary Fellow of the Society, and the third recipient of the Müeller Medal, and invited Sir Edgeworth to enlighten the Members on the origin of the medal, and the circumstances connected with the award having been made to Mr. J. M. Black.

Sir Edgeworth David thanked the President for the welcome extended to him, and then gave a brief resumé of the history of the Müeller Medal, and the reason why the award had been made to Mr. Black at the last meeting of the A.N.Z.A.A.S. in Sydney.

The President, in making the presentation, said:—"It is my privilege this evening to present to Mr. J. M. Black, our distinguished Vice-President, the Müeller Memorial Medal of the Australian and New Zealand Association for the Advancement of Science, a privilege and welcome task which I have been asked to undertake on behalf of Sir Herbert Murray, the President of the Association. I have no need to remind Members of the services to botanical science in Australia which have been rendered by Mr. Black. His "Flora of South Australia" has become a standard and indispensable work of reference to all botanical workers in the southern areas of Australia, and we have ourselves honoured him through our own Verco Medal. The Müeller Medal was founded in 1902 and was first awarded in 1904. It is awarded in recognition of 'Important contributions to Anthropological, Botanical, Geological or Zoological Science, published originally within His Majesty's Dominions, preference being always given to work having special reference to Australia.' Mr. Black is the fourth Fellow of this Society to receive the medal, previous awards having been to Professor Walter Howchin (1913), Professor Wood-Jones (1926) and to Sir Douglas Mawson (1930). Thirteen medals on twelve occasions have been awarded. We are proud of the fact that Mr. Black is one of our Fellows, and I hope he will accept with it our heartiest congratulations and best wishes."

Mr. J. M. Black, in acknowledgment, thanked Sir Edgeworth David and the President for their kind remarks, and referred to the increased interest taken in Botany in South Australia at the present time compared with 20 or 30 years ago, and the valuable collections which had recently been made by botanists and plant lovers in various districts.

Nominations as Fellows.—Mark Ledingham Mitchell, Lecturer, Fitzroy Terrace, Prospect; George H. Clarke, B.Sc., Lecturer in Botany, Roseworthy Agricultural College; Alfred William Kleeman, 12 Ningana Avenue, King's Park; Michael Schneider, M.B., B.S., Medical Practitioner, 175 North Terrace, Adelaide; Thomas Alfred Barnes, B.Sc., Student, 13 Leah Street, Forestville; Kathleen de Brett Magarey, B.A., B.Sc., Teacher, 38 Winchester Street, Malvern; Herbert Womersley, F.E.S., A.L.S., Entomologist, S.A. Museum, and 36 Wattle Street, Fullarton Estate.

PAPERS—

"Inflammable Gases Occluded in Pre-Palaeozoic Rocks of S.A.," by L. Keith Ward, B.A., B.E., D.Sc. Sir T. Edgeworth David and Mr. C. T. Madigan discussed various points in connection with the paper. The President thanked Dr. Ward for giving this Society the privilege of printing his important paper.

"Geological Notes of the Cockatoo Creek and Mount Liebig Country, Central Australia," by Norman B. Tindale. The following Members took part in the discussion:—Dr. C. Chewings, Mr. C. T. Madigan, Dr. L. Keith Ward, and Dr. Chas. Fenner.

EXHIBITS—

Mr. E. H. Ising exhibited *Loranthus miraculosus* Miq., var. *Melaleucae* Tate, and said this was the second record of the occurrence of the order Loranthaceae on Kangaroo Island. It was collected by the exhibitor in 1922 and found growing on *Melaleuca*, sp., which was situated on the edge of a salt lagoon at MacGillivray, about 10 miles south of Kingscote. This mistletoe has only been observed on *Melaleuca* species, two of which, *M. pauperiflora* and *M. parviflora*, are recorded in the Flora of South Australia, p. 171, where also the distribution on the mainland is shown to be the southern districts, chiefly along the coast, Eyre Peninsula and west to Fowler's Bay, Murray Lands, and the South-East. No representatives of the order Loranthaceae have yet been found in Tasmania. The above variety appears to be endemic to South Australia.

ORDINARY MEETING, MAY 11, 1933.

The President (Professor J. A. Prescott) in the chair and 34 members and visitors were present.

Minutes of the Ordinary Meeting, held April 13, 1933, were read and confirmed.

An apology was received from Mr. C. T. Madigan.

The President extended a welcome to Mr. Chalmers and his daughter from MacDonnell Downs, Central Australia, and Mr. Koehncke, as visitors.

The President then drew the attention of the Members to the loss sustained by the Society in the death of Mr. W. W. Weidenbach. On the motion of Dr. L. Keith Ward, the Society recorded its appreciation of the value of the work of the late Mr. Weidenbach, and its regret at his passing. Mr. Weidenbach left a fine record of work as a geological draughtsman, and the many maps drawn by him gave evidence of his fine artistic sense as well as of his sound knowledge of structural geology. He spared no effort to attain the maximum degree of accuracy in all that he did, and this meticulous care enhanced the value of all the work carried out by him. Mr. Weidenbach had a thorough knowledge of mining and the occurrence of underground water, and was better able than most to think in three dimensions. The President asked those present to indicate their approval of the motion by standing for a moment in silence.

NOMINATION AS FELLOW.—Allan Donald Service, Chemist, c/o Colonial Sugar Refinery, Glanville.

ELECTION AS FELLOWS.—Mark Ledingham Mitchell; George H. Clarke, B.Sc.; Alfred William Kleeman; Michael Schneider, M.B., B.S.; Thomas Alfred Barnes, B.Sc.; Kathleen de Brett Magarey, B.A., B.Sc.; Herbert Womersley, F.E.S., A.L.S.

A ballot was taken and the above-named were declared elected. Mr. Clarke and Mr. Womersley, being present, were welcomed as Fellows by the President.

LECTURE—

Mr. H. M. Hale and Professor T. Harvey Johnston delivered an exceptionally interesting and instructive lecture on "Australian Water Animals and their Shift for a Living." Mr. Hale illustrated his remarks with a very fine series of lantern slides and a number of specimens. Mr. W. H. Selway and Dr. L. Keith Ward discussed various points in connection with the lecture. The President expressed the thanks and gratitude of the Members to Mr. Hale and Professor Harvey Johnston for their very interesting lectures.

Exhibits—

Mr. N. B. Tindale exhibited a number of geological specimens collected by him in Central Australia, and said that these should have been brought forward at the last meeting to illustrate his remarks when presenting his paper.

Miss Nellie Woods exhibited a series of clover, ranging from the normal three-leaf to the perfect five-leaf, which had been collected in the garden of her home in the hills, and remarked that the only period of the year that the perfect five-leaf clover had been found by her was at the present time. Miss Woods asked if any Botanist could inform her if this range was due to cultivation.

Professor J. Burton Cleland showed a collection of seeds of plants used by the natives of Central Australia for food purposes. These had been collected by Miss Jess Chalmers of MacDonnell Downs, 160 miles north-eastward of Alice Springs. The seeds were winnowed by the natives, and included a number of grass seeds, acacia seeds, and the minute seeds of *Chenopodium rhadinostachyum* and of *Portulaca oleracea.* Some of these seeds had been given to Mr. Greaves, Director of the Botanic Gardens, and pot plants were shown of the *Chenopodium* and of *Acacia aneura* (mulga) and *A. Kempeana* (witchetty bush). He also showed pot plants of a small *Nicotiana* growing on the sandhills in Central Australia, and used by the natives for chewing purposes, and for comparison with this, a stout form of *Nicotiana suaveolens* grown from seed from Hallett's Cove. Both specimens of *Nicotiana* had been grown by the Director of the Botanic Gardens. For chewing purposes the natives prefer the large *Nicotiana excelsior* growing amongst rocks, to the sandhills species.

Ordinary Meeting, June 8, 1933.

The President (Professor J. A. Prescott) in the chair and 28 Fellows and visitors were present.

Minutes of the Ordinary Meeting, held May 11, 1933, were read and confirmed.

The President announced that on the next lecture evening the subject would be "Modern Genetics."

Nomination as Fellow.—Harold Greaves, Director, Botanic Garden, Adelaide.

Election of Fellow.—Allan Donald Service, Chemist.

A ballot was taken and Mr. Service was declared elected, and, being present, was then welcomed by the President who also extended a welcome to Miss Magarey and any other new Fellows who may be present.

Papers—

"A Preliminary Account of the *Collembola-Arthropleona of Australia,*" by H. Womersley, F.E.S., A.L.S. In the discussion that followed Mr. W. J. Kimber remarked that these insects attacked celery, and as large quantities of this vegetable were exported to the Eastern States from South Australia, it was a matter of great importance that it be kept in check. Professor J. Burton Cleland and the President also spoke.

"Notes on the Flora of South Australia, with a Description of a New Species, No. 1," by E. H. Ising. The paper was concerned with species of *Bassia,* one of which was new and was named after Mr. J. M. Black, Senior Vice-President, to honour him for his botanical work in this State. The species was called *Bassia Blackiana.* Mr. J. M. Black, Dr. Chas. Fenner, Professor J. Burton Cleland and the President congratulated the author on his work.

"Two New Danthonias," by A. B. Cashmore (communicated by J. M. Black, A.L.S.). The species were named *Danthonia Duttoniana* and *D. Richardsonii* and were both of economic importance. The President pointed out the value of the paper, which clearly defined two grasses which had been known but not described.

"A Revision of the Eurymelini (Homoptera Bythoscopidae)," by J. W. Evans, M.A.

Exhibits—

Professor J. Burton Cleland exhibited a specimen of *Loranthus pendulus,* which was parasitic on the golden wattle *Acacia pycnantha* and also on *Acacia rhetinodes,* and *Loranthus Preissii* growing on *Acacia rhetinodes* and *A. melanoxylon* and *Loranthus Exocarpi* growing on *L. Preissii.* All the specimens were collected at Tweedvale on June 5, 1933.

Mr. J. M. Black exhibited some botanical specimens sent by Mrs. V. Petherick, Naracoorte, and included *Epacris impressa* (heath) and *Leucopogon ericoides,* which was a more northerly site than had been previously recorded.

Ordinary Meeting, July 13, 1933.

The President (Professor J. A. Prescott) in the chair and 28 Members were present.

Minutes of the Ordinary Meeting, held June 8, 1933, were read and confirmed.

The president read a draft of the clauses recommended by the Council in connection with the constitution of the Endowment and Scientific Research Fund.

Dr. Chas. Fenner then moved a notice of motion that the recommendation of the Council be adopted. Seconded by Dr. T. D. Campbell.

Professor T. Harvey Johnston moved, and Mr. J. M. Black seconded, that the discussion of the notice of motion be deferred until the Ordinary Meeting to be held in September. Carried.

It was then moved by Mr. O. A. Glastonbury, seconded by Dr. Chas. Fenner, that the full text of the notice of motion be circularized. Carried.

Nomination as Fellows.—James Hugo Gray, M.B., B.S., Medical Practitioner, Adelaide Hospital; David Hugh Le Messurier, B.Sc., Student, 133 Mills Terrace, North Adelaide.

The President announced that the Council has received the resignation of Mr. A. M. Ludbrook, as Librarian, and moved that the appreciation of the Fellows be extended to Mr. Ludbrook for his 20 years' service, and that the thanks of the Society be recorded in the Minutes. Dr. Chas. Fenner, in seconding the motion, referred to the valuable work performed by Mr. Ludbrook during his tenure of office. The motion was carried with acclamation.

Paper—

"Distribution of Myoporaceae in Central Australia," by T. T. Colquhoun, M.Sc. The paper was presented by Professor J. Burton Cleland, who apologized for the absence of the author, and said that the paper was a technical one. The President congratulated the author on his contribution.

Exhibits—

The President exhibited a coloured plate of Australian soil types, the colour work of which was very good and true to the originals. The printing had been done in Leipsig.

Mr. B. C. Cotton exhibited a number of shells from the Museum collection showing three kinds of design. The tendency for the whorls to separate causing the spiral to become elongate. The occurrence of forms, where the shell turns to the left instead of the right. Also malformation due to breakages.

Dr. Chas. Fenner exhibited fulgurites collected from the sandhills at Port Noarlunga, and from Morton's Bay, Queensland.

Dr. T. D. Campbell exhibited the heel bone of an Aborigine in which is embedded the tooth of a shark. Apparently the native had been seized by the foot by a shark while swimming. It seems likely that the native must have died soon after, otherwise pathologic changes in the bone surrounding the tooth would have been apparent.

Mr. H. H. Finlayson exhibited panoramic photographs of the north face of Ayers Rock, and the west face of Mount Olga, taken by him in February, 1932. He stated that the difficulties of conveying an adequate idea of the impressiveness of these two features in photographs was very considerable, owing to their great lateral extent, and the absence of convenient vantage points commanding the two aspects mentioned, at a suitable distance, to include the whole in one exposure. The pictures shown were obtained by making three exposures at fairly close range and joining the three resulting films. Though the results were not technically good, he considered that the method gave a truer record of these remarkable rocks than most of those which had been published. He also exhibited specimens of the rocks from the same outcrops. The President congratulated Mr. Finlayson on obtaining such good pictures of these two natural features.

Mr. G. H. Clarke exhibited *Loranthus Preissii* growing on *Cassia Sturtii* (from near Roseworthy College). *Loranthus Exocarpi* growing on *Casuarina stricta* (from Cockatoo Valley). *Loranthus Exocarpi* growing on *Loranthus Miquelii,* the latter in turn parasitising *Eucalyptus rostrata* (from Cockatoo Valley.) An *Oxalis,* possibly a mutant form of *Oxalis cernua* (Soursob) which appears each year in one of the paddocks at Roseworthy College. It differs from *O. cernua,* mainly in the hairiness of the leaflets, the flattened petioles, the shorter and somewhat flattened peduncles, and in the relative lengths of style and stamens. In the form exhibited the stigmas occupy the middle position, midway between the inner and outer stamens. In certain other plants the styles are long and the stigmas are at the uppermost level, the inner and outer stamens occupying the middle and lowest levels, respectively. A pathological condition of *Sonchus oleraceus,* suggestive of the "Witches Brooms" formed by certain plants as a result of parasitic infection; in this case the condition is probably due to a high concentration of salts in the soil. The plants have been observed to show this abnormality only in two situations, both known to be of high saline concentration. At a given level the plant endeavours to form the flower head. It produces an involucre and the primordia of florets. Some of the latter may develop a corolla, and in some cases a whorl of stamens, but are unable to produce carpels. In lieu of carpels, the floral axes grow erect into a series of peduncles and the whole process is repeated at a higher level, leading to the corymbose branching structure seen in the specimen.

Mr. Herbert M. Hale exhibited the following specimens:—The cast of a Mirror Dory *(Zenopsis nebulosus)* which was taken from a specimen recently caught off Kangaroo Island. The specimen exhibited constitutes the first record of the species in South Australian waters. It occurs off the coasts of Japan and the eastern coast of Australia. He also showed various reptilian monstrosities, including multiple tails, double headedness, siamese twins, albinism and duplication of limbs.

Professor J. Burton Cleland read the following extract from a despatch of Governor Gipps from Sydney, dated November 30, 1840, recently quoted by

Mr. J. F. Campbell in the Journal and Proceedings of the Royal Australian Historical Society (xvii., pt. vi., 1933, p. 339), which shows that over 90 years ago the advantage of placing grain in hermetically sealed silos had been discovered. During the last years of the Great War, at the time of the mouse plague, the same measures were adopted with success in Australia:—"The quantity of wheat now stored in the underground granaries, or silos, which were excavated last year at Cockatoo Island, is 20,000 bushels, but additional silos are in progress, and if the price of wheat continues as low as it now is in Sydney, I propose to increase the Government stores to any amount not exceeding 100,000 bushels. The silos, of which I have spoken, are excavations in the solid (sandstone) rock shaped like a large bottle, and capable of holding from 3,000 to 5,000 bushels each. Being hermetically sealed, grain of any kind may be preserved in them for years. The total exclusion of air also entirely destroys any weevil or other insects that may be in the grain at the time it is placed in the silos. This we found to be the case in the wheat which was received from India. It was much infected with weevil when put into the silos in December, 1839, but there was not a living insect in it of any kind when taken again from the silos in March last."

Ordinary Meeting, August 10, 1933.

The President (Professor J. A. Prescott) in the chair and 39 Members and Visitors were present.

Minutes of the Ordinary Meetnig, held July 13, 1933, were read and confirmed.

The President extended a welcome to Sir Douglas Mawson on his return from abroad, and also to Mr. Southam, the Editor of the Royal Society of Western Australia.

The President noted the recent death of Mr. M. S. Hawker, a Fellow of this Society, famous as a South Australian Pastoralist, and who was associated with the Fauna and Flora Board of South Australia; and then announced that the greatest personal loss the Society had suffered was the passing of Sir Joseph Verco. Professor Prescott gave a brief resumé of Sir Joseph's years of activities and services to the Society, and informed the Members that an obituary notice would be prepared and published in the Transactions of the Society. He asked those present to stand in silence for a few seconds as an expression of deepest sympathy.

Nomination as Fellow.—Herbert Clifton Hosking, B.A., Chief Inspector of Schools, S.A., 24 Northcote Terrace, Gilberton.

Election of Fellows.—Harold Greaves, Director, Botanic Garden, Adelaide; James Hugo Gray, M.B., B.S., Adelaide Hospital; David Hugh Le Messurier, B.Sc., Student, 133 Mills Terrace, North Adelaide. A ballot was taken and the President declared them duly elected.

Papers—

"A Preliminary Account of the Bdellidae (Snout Mites) of Australia," by H. Womersley, A.L.S., F.E.S. The President congratulated Mr. Womersley on presenting an important paper on a new group of insects to this Society.

"Contributions to the Orchidology of Australia," by R. S. Rogers, M.A., M.D., F.L.S.

The President then informed the Fellows that, owing to the death of Sir Joseph Verco, it was necessary, according to the Rules and By-Laws of the Society, to elect another Member on the Council. Sir Douglas Mawson nominated Dr. L. Keith Ward. The nomination was supported by Professor Walter Howchin. There being no other nominations, the President declared Dr. Ward duly elected.

A very instructive and interesting lecture was delivered by Dr. Ivan F. Phipps on "Heredity as we see it today," which was illustrated with a number of lantern slides. The following took part in the discussion which followed:—Mr. J. M. Black, Mr. W. H. Selway, and Dr. W. Christie. The President expressed the thanks of the Members to Dr. Phipps for his fine exposition of a very difficult but interesting subject.

Ordinary Meeting, September 14, 1933.

The Senior Vice-President (Mr. J. M. Black) occupied the chair and 24 Members were present.

Minutes of the Ordinary Meeting, held on August 10, 1933, were read and confirmed.

The following Notice of Motion was then moved by Dr. Chas. Fenner, seconded by Mr. C. T. Madigan:—

(a) That the Fund as set out on pages 212 and 213 of the Transactions and Proceedings, vol. lvi., 1932, be entitled the Endowment Fund.

(b) That from the interest therefrom each year a sum not exceeding £20 (as the Council may from time to time determine) be paid into a separate account in the Savings Bank of S.A., which with its accumulated interest will be entitled the "Royal Society of S.A., Inc., Research Fund," and which will be devoted to grants in aid of research work by members of the Society for work done in Australia.

(c) That the balance of the interest from the Endowment Fund be utilized for the cost of printing and publication of the Transactions and Proceedings of the Society, and other general purposes.

(d) That additions to the Endowment Fund may be made by the Council from time to time from the general revenue of the Society.

(e) That applications for grants in aid of research shall set out in writing the nature of the work to be attempted and that all such grants shall be considered and reported on to the Council by a Research Grants Committee, consisting of the President, Secretary, Treasurer, and one other Member nominated by the Council from time to time.

(f) That these clauses be inserted in the By-Laws of the Society.

Professor T. Harvey Johnston moved as an amendment that sections *b, c, d, e,* and *f,* be struck out, seconded by Sir Douglas Mawson. The amendment was put to the meeting and declared lost. Professor Walter Howchin moved as an amendment that further consideration should be postponed until the next meeting, seconded by Mr. W. H. Selway. The amendment was put to the meeting and declared lost.

The original motion was then put to the meeting and declared carried.

The Chairman extended a welcome to Mr. Le Messurier as a new Fellow.

Nominations as Fellows.—Allan Walkley, B.Sc., B.A., Ph.D., Research Chemist, Waite Agricultural Research Institute, and 8 Ralston Grove, Mrytle Bank; Joan Eileen Walkley, B.Sc. (Lon.), 8 Ralston Grove, Myrtle Bank.

Papers—

"The Ecology of the Aborigines of Central Australia, Botanical Notes," by Professors J. Burton Cleland, M.D., and T. Harvey Johnston.

"Tantanoola Caves, Geological and Physiographical Notes," by N. B. Tindale.

"On *Mastacomys fuscus,*" by H. H. Finlayson.

"On some Acarina from Australia and South Africa," by H. Womersley, F.E.S., A.L.S.

The Chairman announced that applications were being called for the position of Curator of the Tasmanian Museum.

Professor T. Harvey Johnston then put forward a suggestion for the consideration of the Council, that a portrait of the late Sir Joseph C. Verco should be placed on the walls of the Society's Rooms.

Annual Meeting, October 12, 1933.

The President (Professor J. A. Prescott) in the chair and 29 Members were present.

Minutes of the Ordinary Meeting, held September 14, 1933, were read and confirmed.

Apologies were received from Mr. C. T. Madigan and Mr. F. C. Martin.

The President read a communication received from the Secretary, Tasmanian Museum, asking for subscriptions toward the Clive Lord Memorial Fund.

Election of Fellows.—Herbert Clifton Hosking, B.A., Chief Inspector of Schools, 24 Northcote Terrace, Gilberton; Allan Walkley, B.Sc., B.A., Ph.D., Research Chemist, Waite Agricultural Research Institute, and 8 Ralston Grove, Myrtle Bank; Joan Eileen Walkley, B.Sc. (Lon.), 8 Ralston Grove, Myrtle Bank. A ballot was taken and the President declared the above as duly elected. Mr. Hosking, being present, was welcomed by the President as a new Fellow.

Nominations as Fellows.—Constance Margaret Eardley, B.Sc., Curator of University Herbarium, 68 Wattle Street, Fullarton Estate; Violet Taylor, Accountant, 40 Eton Street, Malvern.

The President announced that a special sub-committee had recommended that the next award of the Sir Joseph C. Verco Medal be made to Professor J. Burton Cleland. Professor T. Harvey Johnston, in moving that the recommendation be endorsed, gave a brief resumé of Professor Cleland's outstanding qualifications and research work. The motion was seconded by Mr. G. Samuel and carried with acclamation. Professor Cleland suitably responded.

The Annual Report of the Council was read by the Secretary. It was moved by Mr. J. M. Black, seconded by Dr. L. Keith Ward, and carried, that the Report be adopted.

The Financial Statement was presented by the Treasurer. It was moved by Dr. W. Christie, seconded by Mr. E. H. Ising, and carried, that the Financial Statement be adopted.

Election of Officers for the Year 1933-34.—The President read the following nominations which had been received:—President, Mr. J. M. Black, A.L.S.; Senior Vice-President, Dr. T. D. Campbell; Junior Vice-President, Mr. C. T. Madigan, M.A., B.E.; Treasurer, Dr. W. Christie; Secretary, Mr. Ralph W. Segnit, M.A., B.Sc.; Editor, Professor Walter Howchin, F.G.S.; Members of the Council: Dr. L. Keith Ward, B.A., B.E., Dr. H. K. Fry, D.S.O., B.Sc.; Auditors: Mr. W. C. Hackett and Mr. O. A. Glastonbury. As no ballot was necessary, the retiring President declared the persons abovementioned as duly elected.

Professor Prescott thanked Dr. Chas. Fenner for the services he had rendered during the past year as Treasurer.

Professor Howchin informed the Fellows that he desired to be relieved of the duties as Editor, which he had first carried out 50 years ago. He felt that he must devote the whole time of the coming days to the preparation of geological papers which he desired to have published. He intimated that he was willing to carry on until the current volume of the Transactions was published. The retiring President thanked Professor Howchin for the valuable services he had rendered to the Society for so many years, and assured him that the Council would give serious considerations to his request.

A welcome was extended to Dr. Wm. Christie and Dr. H. K. Fry as new Members of the Council.

Papers—

"Additions to the Flora of South Australia, No. 31," by J. M. Black, A.L.S.

"Australian Fungi: Notes and Descriptions, No. 9," by Professor J. Burton Cleland, M.D.

"On the Eremian Representative of *Myrmecobius fasciatus* (Waterhouse)," by H. H. Finlayson.

"On Mammals from the Lake Eyre Basin, Part I, Dasyuridae," by H. H. Finlayson.

"Notes on the Flora of South Australia, No. 2," by E. H. Ising.

"New Australian Lepidoptera," by A. Jefferis Turner, M.D., F.E.S.

The retiring President drew attention to the first Album of Officers of the Society, which has now been completed and contains practically the whole of the office-bearers since the foundation of the Society.

ANNUAL REPORT.

Presented at the Annual Meeting on October 12, 1933.

The average attendance of Fellows at the meetings held during the year has been 29.

At the meeting held in April, the President handed to Mr. J. M. Black the Müeller Medal, awarded to him by the Australian and New Zealand Association for the Advancement of Science at the meeting held in Sydney, 1932.

The President extended a welcome to Professor Sir Douglas Mawson on his return from abroad.

Professor Sir T. W. Edgeworth David, an Honorary Fellow of the Society, was present at the meeting held in April.

Dr. L. Keith Ward was elected to fill the vacancy on the Council caused by the death of Sir Joseph C. Verco.

The following Fellows took part in the Adelaide University and Museum Anthropological Expedition to Central Australia:—Professor J. Burton Cleland (Leader), Professor T. Harvey Johnston, Mr. H. M. Hale, Dr. H. K. Fry, and Mr. N. B. Tindale.

Mr. B. S. Roach resigned from the office of Treasurer which he occupied for 12 years, and Dr. Chas. Fenner was elected to fill the vacancy.

Mr. A. M. Ludbrook resigned from the position of Librarian after 20 years' service, and Mr. P. E. Madigan was appointed to that position.

During the year two of the Ordinary Meetings of the Society were devoted to special subjects, in the form of lectures, which were well attended. The first was delivered by Mr. H. M. Hale and Professor T. Harvey Johnston on "Australian Water Animals and their Shift for a Living." The second was by Dr. Ivan F. Phipps on "Heredity as we see it Today." Both lectures were illustrated by lantern slides, and the former by a number of characteristic specimens.

Geological papers were read by Professor Walter Howchin, Dr. L. Keith Ward, and two by Mr. N. B. Tindale.

Entomological papers were presented by Mr. J. W. Evans, Dr. A. Jefferis Turner, and three by Mr. H. Womersley.

Three Zoological papers were read by Mr. H. H. Finlayson.

Botanical papers were contributed by Mr. J. M. Black, Mr. A. B. Cashmore (communicated by Mr. J. M. Black), Mr. T. T. Colquhoun, Dr. R. S. Rogers, two by Professor J. Burton Cleland and two by Mr. E. H. Ising.

During the year the Society has suffered loss by death of three Fellows, Mr. W. W. Weidenbach, who was elected in 1920, and Mr. M. S. Hawker, who was elected in 1928.

Sir Joseph C. Verco, a Founder of the Society, and a Past President, died in August. An Obituary Notice (with portrait) of Sir Joseph C. Verco appears on page v.

The Membership of the Society shows an increase. The number of Fellows elected during the year being 14. Five Fellows resigned, and 3 died. The Membership Roll at the close of the financial year is:—Honorary Fellows, 5; Fellows, 166; Associates, 1. Total, 172.

J. A. Prescott, President.
Ralph W. Segnit, Secretary.

THE SIR JOSEPH VERCO MEDAL.

The Council, on August 23, 1928, having resolved to recommend to the Fellows of the Society that a medal should be founded to give honorary distinction for scientific research, and that it should be designated the Sir Joseph Verco

Medal, was submitted to the Society at the evening meeting of October 11, 1928, and at a later meeting, held on November 8, 1928, when the recommendation of the Council was confirmed on the following terms:—

Regulations.

XI.—The medal shall be of bronze, and shall be known as the Sir Joseph Verco Medal, in recognition of the important service that gentleman has rendered to the Royal Society of South Australia. On the obverse side of the medal shall be these words: 'The Sir Joseph Verco Medal of the Royal Society of South Australia,' surrounding the modelled portrait of Sir Joseph Verco, while on the reverse side of the medal there shall be a surrounding wreath of eucalypt, with the words: 'Awarded to...for Research in Science,' the name of the recipient, and the year of the award. The Council shall select the person to whom it is suggested that the medal shall be awarded, and that name shall be submitted to the Fellows at an Ordinary Meeting to confirm, or otherwise, the selection of the Council, by ballot or show of hands. The medal shall be awarded for distinguished scientific work published by a Member of the Royal Society of South Australia."

Awards.

1929 Prof. Walter Howchin, F.G.S.
1930 John McC. Black.
1931 Prof. Sir Douglas Mawson, B.E., D.Sc., F.R.S.
1933 Prof. J. Burton Cleland, M.D.

BALANCE SHEETS

Summary

to the Society for so many years, and assured him that the Council would give serious considerations to his request.

A welcome was extended to Dr. Wm. Christie and Dr. H. K. Fry as new Members of the Council.

Papers—

"Additions to the Flora of South Australia, No. 31," by J. M. Black, A.L.S.

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ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

Receipts and Payments for the Year ended September 30, 1933.

RECEIPTS.

	£ s. d.	£ s. d.
To Balance, October 1, 1932		705 0 4
,, Subscriptions		157 10 4
,, Use of Room by other Societies	3 2 6	
,, Sale of Publications	6 19 11	
,, Exchange	0 5 1	
,, Librarian, Petties	0 8 6	
		10 16 0
,, Donation towards Publishing Paper— C. T. Madigan		7 0 0
,, Interest—		
Savings Bank Account	17 10 4	
Transferred from Endowment Fund	145 2 1	
		162 12 5
		£1,042 19 1

PAYMENTS.

		£ s. d.	£ s. d.
By Transactions—			
Printing		157 16 10	
Illustrating		28 8 6	
Publishing		7 19 11	
			194 5 3
,, Library—			
Librarian		42 8 9	
Bookbinding		9 8 0	
			51 16 9
,, Sundries—			
Cleaning and Lighting		11 1 10	
Printing, Postages and Stationery		32 0 0	
Petties		2 16 8	
Insurance		6 15 0	
			52 13 6
,, Balance, September 30, 1933—			
Savings Bank of S.A.		724 7 1	
Bank of Australasia	£40 17 11		
Less Outstanding Cheques	21 1 5		
		19 16 6	
			744 3 7
			£1,042 19 1

Audited and found correct,

W. CHAMPION HACKETT } Hon.
O. GLASTONBURY, A.A.I.S., A.F.I.A. } Auditors.

CHARLES FENNER, Hon. Treasurer.

Adelaide, October 10, 1933.

ROYAL SOCIETY OF SOUTH AUSTRALIA (INCORPORATED).

ENDOWMENT FUND.

As at September 30, 1933.

(Capital £4,286 13 7d.)

	£ s. d.	£ s. d.
1932—October 1.		
To Balance—		
Australian Consolidated Stock	4,280 0 0	
Savings Bank of S.A.	6 13 7	
		4,286 13 7
„ Interest Received		145 2 1
		£4,431 15 8

	£ s. d.	£ s. d.
1933—September 30.		
By Revenue Account		145 2 1
„ Australian Consolidated Stock at Face Value	4,280 0 0	
„ Savings Bank Account	6 13 7	
		4,286 13 7
		£4,431 15 8

Audited and found correct,

W. CHAMPION HACKETT }
O. GLASTONBURY, A.A.I.S., A.F.I.A. } Hon. Auditors.

CHARLES FENNER, Hon. Treasurer.

Adelaide, October 10, 1933.

THE ENDOWMENT FUND

Summary

THE ENDOWMENT FUND.

1902.—On the motion of the late Samuel Dixon it was resolved that steps be taken for the incorporation of the Society and the establishment of an Endowment and Scientific Research Fund. Vol. xxvi., pp. 327-8.

1903.—The incorporation of the Society was duly effected and announced. Vol. xxvii., pp. 314-5.

1905.—The President (Dr. J. C. Verco) offered to give £1,000 to the Fund on certain conditions. Vol. xxix., p. 339.

1929.—The following are particulars of the contributions received and other sources of revenue in support of the Fund up to date:—

SUMMARY OF THE ENDOWMENT FUND.

(Capital £4,069 6s. 10d.)

Contributions.

	£	s.	d.	£	s.	d.	£	s.	d.
Donations—									
1908, Dr. J. C. Verco	1,000	0	0						
1908, Thomas Scarfe	1,000	0	0						
1911, Dr. Verco	150	0	0						
1913, Dr. Verco	120	0	0						
Mrs. Ellen Peterswald	100	0	0						
Small Sums	6	0	0	2,376	0	0			
Bequests—									
1917, R. Barr Smith	1,005	16	8						
1920, Sir Edwin Smith	200	0	0	1,205	16	8			
Life Members' Subscriptions				225	0	0			
*Interest and Discounts				156	3	10			
From Current Account				106	6	4	4,069	6	10

*Interest on investments has, in the main, been transferred to general revenue for the publication of scientific papers. See Balance-sheets.

GRANTS MADE IN AID OF SCIENTIFIC RESEARCH.

	£	s.	d.
1916, G. H. Hardy, "Investigations into the Flight of Birds"	15	0	0
1916, Miss H. A. Rennie, "Biology of *Lobelia gibbosa*"	2	2	0
1921, F. R. Marston, "Possibility of obtaining from Azine precipitate samples of pure Proteolytic Enzymes"	30	0	0
1921, Prof. Wood Jones, "Investigations of the Fauna and Flora of Nuyts Archipelago"	44	16	7

DONATIONS TO THE LIBRARY IN EXCHANGE

Summary

ROYAL SOCIETY LIBRARY.

List of Governments, Societies and Editors with whom Exchanges of Publications are made.

AUSTRALIA.

Australasian Institute of Mining and Metallurgy, Melbourne.
Bureau of Census and Statistics, Canberra.
Council for Scientific and Industrial Research, Melbourne.
Library of Commonwealth Parliament.

SOUTH AUSTRALIA.

Botanic Garden, Adelaide.
Mines Department, Adelaide.
Public Library, Museum, and Art Gallery of South Australia.
Royal Geographical Society of Australasia (S.A. Branch).
South Australian Institutes Association, Adelaide.
South Australian Museum, Adelaide.
South Australian Naturalist, Adelaide.
South Australian Ornithologist, Adelaide.
South Australian Parliamentary Library.
University of Adelaide.
Waite Agricultural Research Institute, Glen Osmond.

NEW SOUTH WALES.

Australian Museum, Sydney.
Botanic Gardens, Sydney.
Department of Agriculture, Sydney.
Linnean Society of New South Wales.
Mines Department, Sydney.
Public Library of New South Wales.
Royal Society of New South Wales.
Royal Zoological Society of New South Wales.
School of Public Health and Tropical Medicine, Sydney.
Technological Museum, Sydney.
University of Sydney.

QUEENSLAND.

Department of Agriculture, Brisbane.
Geological Survey, Brisbane.
Queensland Museum, Brisbane.
Public Library of Queensland, Brisbane.
Royal Society of Queensland, Brisbane.
University of Queensland, Brisbane.

TASMANIA.

Government Geologist, Mines Department, Hobart.
Public Library of Tasmania, Hobart.
Royal Society of Tasmania, Hobart.
University of Tasmania, Hobart.

VICTORIA.

Field Naturalists' Club of Victoria, Melbourne.
Government Botanist, National Herbarium, Melbourne.
Mines Department, Melbourne.
National Museum, Melbourne.
Public Library of Victoria, Melbourne.
Royal Society of Victoria, Melbourne.
University of Melbourne.

WESTERN AUSTRALIA.

Geological Survey Department, Perth.
Public Library of Western Australia, Perth.
Royal Society of Western Australia, Perth.
University of Western Australia, Perth.

ENGLAND.

British Museum Library, London.
British Museum (Natural History), South Kensington.
Cambridge Philosophical Society.
Cambridge University Library.
Conchological Society of Great Britain and Ireland.
Entomological Society of London.
Geological Society of London.
Geologists' Association, London.
Hill Museum, Witley, Surrey.
Imperial Institute, South Kensington.
Imperial Institute of Entomology, London.
Linnean Society of London.
Liverpool Biological Society.
Manchester Literary and Philosophical Society.
National Physical Laboratory, Teddington.
Rhodes House Library, Oxford.
Rothamsted Experimental Station, Harpenden.
Royal Botanic Gardens, Kew.
Royal Empire Society, London.
Royal Geographical Society, London.
Royal Microscopical Society, London.
Royal Society, London.
Science Museum, South Kensington.
Zoological Museum, Tring, Herts.
Zoological Society of London.

SCOTLAND.

Edinburgh Geological Society.
Geological Society of Glasgow.
Royal Society of Edinburgh.

IRELAND.

Royal Dublin Society.
Royal Irish Academy, Dublin.

ARGENTINE REPUBLIC.

Academia Nacional de Ciencias, Cordoba.
Facultad de Ciencias Medicas, Buenos Aires.

AUSTRIA.

Akademie der Wissenschaften, Vienna.
Geologische Bundesanstalt, Vienna.
Naturhistorisches Museum, Vienna.
Zoologisch-Botanische Gesellschaft, Vienna.

BELGIUM.

Académie Royale de Belgique, Brussels.
Instituts Solvay, Brussels.
Musée Royale d'Histoire Naturelle de Belgique, Brussels.
Société Entomologique de Belgique, Ghent.
Société Royale de Botanique de Belgique, Brussels.
Société Royale des Sciences de Liège.
Société Royale Zoologique de Belgique, Brussels.

BRAZIL.

Instituto Oswaldo Cruz, Rio de Janeiro.
Museu Paulista, Sao Paulo.

CANADA.

Canadian Geological Survey, Ottawa.
Department of Agriculture, Ottawa.
National Research Council of Canada, Ottawa.
Nova Scotian Institute of Science, Halifax.
Royal Canadian Institute, Toronto.
Royal Society of Canada, Ottawa.
University of British Columbia, Vancouver.

CHINA.

Geological Survey of China, Peiping.
Institute of Biology, National Library of Peiping.

CZECHO-SLOVAKIA.

Ceskoslovenska Botanicka Spolecnost, Prague.

DENMARK.

Conseil Permanent International pour l'Exploration de la Mer.
Danske Naturhistorisk Forening. Copenhagen.
Kobenhavn Universitets Zoologiske Museum.
K. Danske Videnskabernes Selskabs. Copenhagen.

ESTHONIA.

Universitas Tartuensis, Tartu (Dorpat).

FINLAND.

Academia Scientiarum Fennica, Helsinki.
Societas Entomologica Helsingforsiensis.
Societas Scientiarum Fennica, Helsingfors.

FRANCE.

Muséum National d'Histoire Naturelle, Paris.
Société Bourguignonne d'Histoire Naturelle et de Préhistoire, Toulouse.
Société des Sciences Naturelles de l'Ouest de la France, Nantes.

Société Entomologique de France, Paris.
Société Géologique de France, Paris.
Société Linnéenne de Bordeaux.
Societe Linnéenne de Normandie, Caen.

GERMANY.

Bayerische Akademie der Wissenschaften zu München.
Berliner Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte.
Bibliothek der Botanischen Gartens und Museums, Berlin.
Fedde, F.: Repertorium specierum novarum regni vegetabilis, Berlin.
Gesellschaft der Wissenschaften zu Göttingen.
Gesellschaft für Erdkunde zu Berlin.
K. Leopoldinische Deutsche Akademie de Naturforscher, Halle.
Naturforschende Gesellschaft, Freiburg.
Preussische Akademie der Wissenschaften, Berlin.
Senckenbergische Bibliothek, Frankfürt a. M.
Zoologische Museum der Universitat, Berlin.
Zoologische Staatsinstitut und Zoologische Museum, Hamburg.

HAWAIIAN ISLANDS.

Bernice Pauahi Bishop Museum, Honolulu.
Hawaiian Entomological Society, Honolulu.

HOLLAND.

Musée Teyler, Haarlem.
Rijks Herbarium, Leiden.

HUNGARY.

Hydrological Dept., Hungarian Geological Soc., Budapest.
Musée National Hongrois, Budapest.

INDIA.

Colombo Museum.
Government Museum, Madras.
Geological Survey of India, Calcutta.
Royal Asiatic Society, Bombay Branch and Malayan Br.
Zoological Survey of India, Calcutta.

ITALY.

Laboratorio di Entomologia, Bologna.
Laboratorio di Zoologia Agraria, Milan.
Laboratorio di Zoologia Generale e Agraria, Portici.
Società di Scienze Naturali ed Economiche, Palermo.
Società Entomologica Italiana, Genova.
Società Italiana di Scienze Naturali, Milano.
Società Toscana di Scienze Naturali, Pisa.

JAPAN.

Hiroshima University.
Kyōto Imperial University.
Ohara Institute for Agricultural Research, Kurashiki.
Taihoku Imperial University.
Tokyo Imperial University.

MEXICO.

Instituto de Biologia, Chapultepec.
Instituto Geológico de Mexico.
Sociedad Cientifica "Antonio Alzate," Mexico.

NEW ZEALAND.

Auckland Institute and Museum.
Dominion Museum, Wellington.
New Zealand Institute, Wellington.
Otago University Museum, Dunedin.
Philosophical Institute of Canterbury, Christchurch.

NORWAY.

Bergens Museum, Bergen.
Kongelige Norske Videnskabers Selskabs, Trondheim.
Tromso Museum.

PHILIPPINE ISLANDS.

Philippine Journal of Science, Manila.

POLAND.

Société Botanique de Pologne, Warszawa.
Société Polonaise des Naturalistes "Kopernik," Lwow.

RUSSIA.

Academie of Sciences, Leningrad.
Comité Géologique de Russie, Leningrade.
Institute of Plant Industry, Leningrad.
Siberian Mining Institute Library, Irkutsk.

SPAIN.

Instituto Nacional de Segunda Ensenanza de Valencia.
Real Academia de Ciencias y Artes, Barcelona.

SWEDEN.

Entomologiska Föreningen i Stockholm.
Geologiska Föreningen, Stockholm.
Stockholm's Hōgskolas Bibliotek, Stockholm.
Regia Societas Scientiarum Upsaliensis, Upsala.

SWITZERLAND.

Naturforschende Gesellschaft, Basel.
Société de Physique et d'Histoire Naturelle de Genève.
Société Neuchâteloise des Sciences Naturelles, Neuchâtel.
Société Vaudoise des Sciences Naturelles, Lausanne.
Zentralbibliothek, Zürich.

UNION OF SOUTH AFRICA.

Albany Museum, Grahamstown.
Geological Society of South Africa, Johannesburg.
Royal Society of South Africa, Cape Town.
South African Museum, Cape Town.
South African Association for the Advancement of Science, Johannesburg.

UNITED STATES.

Academy of Natural Sciences of Philadelphia.
Academy of Science of St. Louis.
American Academy of Arts and Sciences, Boston.
American Chemical Society, Columbus, O.
American Geographical Society, New York.
American Microscopical Society, Manhattan, Kans.
American Museum of Natural History, New York.
American Philosophical Society, Philadelphia.
Arnold Arboretum, Jamaica Plain, Mass.
Biological Survey of the Mount Desert Region, Bar Harbour, Me.
Boston Society of Natural History, Boston, Mass.
Brooklyn Institute of Arts and Sciences.
California Academy of Sciences, San Francisco.
Californian State Mining Bureau, San Francisco.
California, University of, Berkeley, Cal.
Chicago Academy of Sciences.
Citrus Experiment Station, Riverside, Cal.
Connecticut State Library, Hartford, Conn.
Cornell University, Ithaca, N.Y.
Denison Scientific Association, Granville, O.
Field Museum of Natural History, Chicago, Ill.
Franklin Institute of the State of Pennsylvania, Philad.
Harvard Museum of Comparative Zoology, Cambridge, Mass.
Illinois State Natural History Survey, Urbana, Ill.
Illinois University Library, Urbana, Ill.
Indiana Academy of Science, Indianapolis.
Johns Hopkins University, Baltimore, Md.
Kansas University, Lawrence, Kans.
Marine Biological Laboratory, Wood's Hole, Mass.
Maryland Geological Survey, Baltimore, Md.
Michigan University, Chicago.
Missouri Botanical Garden Library, St. Louis, Mo.
Missouri, University of, Columbia.
National Academy of Science, Washington, D.C.
National Geographic Society, Washington, D.C.
New York Academy of Sciences, New York.
New York Public Library.
New York State Library, Albany, N.Y.
Ohio State University Library, Columbus, O.
Princeton University, Princeton, N.J.
San Diego Society of Natural History, San Diego, Cal.
Smithsonian Institution and Bureau of Ethnology, Washington.
United States Department of Agriculture, Washington, D.C.
United States Geological Survey, Washington, D.C.
United States National Museum, Washington, D.C.
Wagner Free Institute of Science, Philadelphia, Pa.
Washington University, St. Louis, Mo.
Yale University Library, New Haven, Conn.

URUGUAY.

Museo de Historia Natural de Montevideo.

LIST OF FELLOWS, MEMBERS, ETC

Summary

LIST OF FELLOWS, MEMBERS, ETC.

AS EXISTING ON SEPTEMBER 30, 1933.

Those marked with an asterisk (*) have contributed papers published in the Society's Transactions. Those marked with a dagger (†) are Life Members.

Any change in address or any other changes should be notified to the Secretary.

Note.—The publications of the Society will not be sent to those whose subscriptions are in arrear.

Date of Election.

HONORARY FELLOWS.

1910. *BRAGG, SIR W. H., O.M., K.B.E., M.A., D.C.L., LL.D., D.Sc., F.R.S., Director of the Royal Institution, Albemarle Street, London (Fellow 1886).
1926. *CHAPMAN, F., A.L.S., National Museum. Melbourne.
1897. *DAVID, SIR T. W. EDGEWORTH, K.B.E., C.M.G., D.S.O., B.A., D.Sc., F.R.S., F.G.S., Emeritus Professor of Geology, University of Sydney, Coringah, Sherbroke Road, Hornsby, N.S.W.
1898. *MEYRICK, E. T., B.A., F.R.S., F.Z.S., Thornhanger, Marlborough, Wilts, England.
1894. *WILSON, J. T., M.D., Ch.M., F.R.S., Professor of Anatomy, Cambridge University, England.

FELLOWS.

1926. ABEL, L. M., Chapman Camp, British Columbia.
1925. ADEY, W. J., 32 High Street, Burnside, S.A.
1927. *ALDERMAN, A. R., M.Sc., F.G.S., West Terrace, Kensington Gardens, S.A.
1931. ANDREW, REV. J. R., Woodside.
1929. ANGEL FRANK M., Box 1327G, G.P.O., Adelaide.
1895. †*ASHBY, EDWIN, F.L.S., M.B.O.U., Blackwood, S.A.—**Council,** 1900-19; **Vice-President,** 1919-21.
1902. *BAKER, W. H., King's Park, S.A.
1930. BARNES, T. A., B.Sc., 13 Leah Street, Forestville.
1926. BECK, B. B., 127 Fullarton Road, Myrtle Bank, S.A.
1932. BEGG, P. R., B.D.Sc., L.D.S., 219 North Terrace, Adelaide.
1928. BEST, R. J., M.Sc., A.A.C.I., Waite Agricultural Research Institute, Glen Osmond.
1928. *BEST, Mrs. E. W., M.Sc., Claremont, Glen Osmond.
1931. BIRCH, H. McL., M.R.C.S., M.R.C.P., D.P.M., Mental Hospital, Parkside.
1930. BIRKS, W. R., B.Sc., 7 Kensington Road, Kensington.
1907. *BLACK, J. M., A.L.S., 82 Brougham Place, North Adelaide—**Sir Joseph Verco Medal,** 1930; **Council,** 1927-1931; **President,** 1933-; **Vice-President,** 1931-33.
1924. BROWNE, J. W., B.Ch., 169 North Terrace, Adelaide.
1916. *BULL, LIONEL B., D.V.Sc., Laboratory, Adelaide Hospital
1923. BURDON, ROY S., B.Sc., University of Adelaide.
1921. BURTON, R. J., c/o P.O., Kalgoorlie, W.A.
1922. *CAMPBELL, T. D., D.D.Sc., Dental Dept., Adelaide Hospital, Frome Road, Adelaide—**Rep.-Governor,** 1932-; **Council,** 1928-32; **Vice-President,** 1932-.
1907. *CHAPMAN, R. W., C.M.G., M.A., B.C.E., F.R.A.S., Professor of Engineering and Mechanics, University, Adelaide—**Council,** 1914-22.
1931. *CHEWINGS, CHAS., Ph.D., F.G.S., "Alverstroke," Glen Osmond.
1929. CHRISTIE, W., M.B., B.S., Education Department, Flinders Street, Adelaide—**Treasurer,** 1933-.
1930. CLARKE, G. H., B.Sc., Agricultural College, Roseworthy.
1895. *CLELAND, JOHN B., M.D., Professor of Pathology, University, Adelaide—**Council,** 1921-26, 1932-; **President,** 1927-28; **Vice-President,** 1926-27.
1930. COLLINS, F. V., B.V.Sc., Green Road, Woodville.
1930. *COLQUHOUN, T. T., M.Sc., University, Adelaide.
1907. *COOKE, W. T., D.Sc., A.A.C.I., Lecturer, University of Adelaide.
1929. *COTTON, BERNARD C., S.A. Museum, Adelaide.
1924. DE CRESPIGNY, C. T. C., D.S.O., M.D., 219 North Terrace, Adelaide.
1929. DAVIDSON, JAMES, D.Sc., Waite Agricultural Research Institute, Glen Osmond—**Council,** 1932-.
1928. DAVIES, J. G., B.Sc., Ph. D., Waite Agricultural Research Institute, Glen Osmond.
1927. *DAVIES, Prof. E. HAROLD, Mus.Doc., The University, Adelaide.
1927. DAWSON, BERNARD, M.D., F.R.C.S., Otago University, Dunedin, New Zealand.
1930. DIX, E. V., Glynde Road, Firle.
1915. *DODD, ALAN P., Prickly Pear Laboratory, Sherwood, Brisbane.
1932. DUNSTONE, H. E., M.B., B.S., J.P., 124 Payneham Road, St. Peters.
1921. DUTTON, G. H., B.Sc., Agricultural High School. Murray Bridge.

Date of Election.

1931. DWYER, J. M., M.B., B.S., Adelaide Hospital.
1902. *EDQUIST, A. G., 19 Farrell Street, Glenelg.
1918. *ELSTON, A. H., F.E.S., "Llandyssil," Aldgate.
1925. ENGLAND, H. N., B.Sc., Commonwealth Research Station, Griffith, N.S.W.
1932. *EVANS, J. W., M.A., Waite Agricultural Research Institute, Glen Osmond.
1917. *FENNER, CHAS. A. E., D.Sc., 42 Alexander Avenue, Rose Park—**Rep.-Governor,** 1929-31; **Council,** 1925-28; **President,** 1930-31; **Vice-President,** 1928-30; **Secretary,** 1924-25; **Treasurer,** 1932-33; **Editor,** 1934.
1927. *FINLAYSON, H. H., The University of Adelaide.
1929. FRENEY, M. RAPHAEL.
1929. FRENEY, M. RICHARD.
1931. FREWIN, O. W., M.B., B.S., Woodville.
1923. *FRY, H. K., D.S.O., M.B., B.S., B.Sc., Glen Osmond Road, Parkside—**Council,** 1933-.
1930. GARRETT, S. D., B.A., Waite Agricultural Research Institute, Glen Osmond.
1932. *GIBSON, E. S. H., B.Sc., 297 Cross Roads, Clarence Gardens.
1919. †GLASTONBURY, O. A., Adelaide Cement Co., Brookman Buildings, Grenfell Street.
1923. GLOVER, C. R. J., Stanley Street, North Adelaide.
1927. GODFREY, F. K., Robert Street, Payneham, S.A.
1904. GORDON, DAVID, 72 Third Avenue, St. Peters.
1925. †GOSSE, J. H., Gilbert House, Gilbert Place, Adelaide.
1880. *GOYDER, GEORGE, A.M., B.Sc., F.G.S., 232 East Terrace, Adelaide.
1910. *GRANT, KERR, M.Sc., Professor of Physics, University, Adelaide—**Council,** 1912-15.
1930. GRAY, JAMES H., M.B., B.S., Adelaide Hospital.
1931. GRAY, JAMES T., Orroroo, S.A.
1930. GREAVES, H., Director, Botanic Garden, Adelaide.
1904. GRIFFITH, H., Hove, Brighton.
1916. HACKETT, W. CHAMPION, 35 Dequetteville Terrace, Kent Town.
1927. *HACKETT, Dr. C. J., 196 Prospect Road, Prospect, S.A.
1922. *HALE, H. M., The Director, S.A. Museum, Adelaide—**Council,** 1931-.
1930. HALL, F. J., Adelaide Electric Supply Coy., Ltd., Adelaide.
1922. *HAM, WILLIAM, F.R.E.S., 112 Edward Street, Norwood.
1916. †HANCOCK, H. LIPSON, A.M.I.C.E., M.I.M.M., A.Am.I.M.E., Bewdley, 66 Beresford Road, Bellevue Hill, Rose Bay, Sydney.
1924. HAWKER, Captain C. A. S., M.A., M.H.R., Dillowie, Hallett, South Australia.
1923. HILL, FLORENCE MCCOY M., B.S., M.D., Elizabeth Street, Sydney, N.S.W.
1927. HOLDEN, E. W., B.Sc., Dequetteville Terrace, Kent Town, S.A.
1930. HOSKING, H. C., B.A., 24 Northcote Terrace, Gilberton.
1929. HOSKING, JOHN W., 77 Sydenham Road, Norwood.
1930. HOSKING, J. S., B.Sc., Waite Agricultural Research Institute, Glen Osmond.
1924. *HOSSFELD, PAUL S., M.Sc., Office of Home and Territories, Canberra.
1883. *HOWCHIN, PROFESSOR WALTER, F.G.S., "Stonycroft," Goodwood East—**Sir Joseph Verco Medal,** 1929; **Rep.-Governor,** 1901-22; **Council,** 1883-84, 1887-89, 1890-94, 1902-; **President,** 1894-96; **Vice-President,** 1884-87, 1889-90, 1896-1902; **Editor,** 1883-88, 1893-94, 1895-96, 1901-1933.
1928. HURCOMBE, Miss J. C., 95 Unley Road, New Parkside.
1928. IFOULD, PERCY, Kurralta, Burnside.
1918. *ISING, ERNEST H., c/o Comptroller's Office, S.A. Railways, Adelaide.
1918. *JENNISON, Rev. J. C., 7 Frew Street, Fullarton Estate.
1910. *JOHNSON, E. A., M.D., M.R.C.S., Town Hall, Adelaide.
1921. *JOHNSTON, PROFESSOR T. HARVEY, M.A., D.Sc., University, Adelaide—**Rep.-Governor,** 1927-29; **Council,** 1926-28; **Vice-President,** 1928-31; **President,** 1931-32.
1929. JOHNSTON, W. C., Government Agricultural Inspector, Riverton.
1920. *JONES, PROFESSOR F. WOOD, M.B., B.S., M.R.C.S., L.R.C.P., D.Sc., F.R.S., University, Melbourne—**Rep.-Governor,** 1922-27; **Council,** 1921-25; **President,** 1926-27; **Vice-President,** 1925-26.
1926. JULIUS, EDWARD, Conservator of Forests, Adelaide.
1918. KIMBER, W. J., 28 Second Avenue, Joslin.
1930. KLEEMAN, A. W., 12 Ningara Avenue, Kings Park.
1915. *LAURIE, D. F., Agricultural Department, Flinders Street, Adelaide.
1930. LE MESSURIER, D. H., B.Sc., 133 Mills Terrace, North Adelaide.
1884. LENDON, A. A., M.D., M.R.C.S., 66 Brougham Place, North Adelaide.
1922. LENDON, GUY A., M.B., B.S., M.R.C.P., North Terrace.
1925. LEWIS, A. S., M.D., B.S., The Maudsley Hospital, Denmark Hill, London, S.E. 5.
1930. LOUWYCK, REV. N. H., The Rectory, Yankalilla.
1922. *MADIGAN, C. T., M.A., B.E., F.G.S., University of Adelaide—**Council,** 1930-33; **Vice-President,** 1933-.

Date of Election.

1923. Marshall, J. C., Darrock, Payneham.
1928. *Maegraith, B. G., M.B., B.S., Magdalen College, Oxford, England.
1930. Magarey, Miss K. de B., B.A., B.Sc., 38 Winchester Street, Malvern.
1932. Mann, E. A., C/o Bank of Adelaide, Adelaide.
1929. Martin, F. C., B.A., Technical High School, Thebarton.
1905. *Mawson, Sir Douglas, D.Sc., B.E., F.R.S., Professor of Geology, University, Adelaide **Sir Joseph Verco Medal**, 1931; **President**, 1924-25; **Vice-President**, 1923-24, 1925-26.
1919. Mayo, Helen M., M.D., 47 Melbourne Street, North Adelaide.
1920. Mayo, Herbert, LL.B., K.C., 16 Pirie Street, Adelaide.
1929. McLaughlin, E., M.B., B.S., M.R.C.P., Adelaide Hospital (removed in error from last list).
1907. Melrose, Robert T., Mount Pleasant.
1930. Miller, J. L., 18 Ralston Street, Largs Bay.
1925. †Mitchell, Professor Sir William, K.C.M.G., M.A., D.Sc., The University, Adelaide.
1930. Mitchell, Miss U. H., B.Sc., Presbyterian Girls' College, Glen Osmond.
1930. Mitchell, M. L., B.Sc., Fitzroy Terrace, Prospect.
1897. *Morgan, A. M., M.B., Ch.B., 215 Brougham Place, North Adelaide.
1924. Morison, A. J., Deputy Town Clerk, Town Hall, Adelaide.
1930. Morris, L. G., Beehive Buildings, King William Street, Adelaide.
1921. Moulden, Owen M., M.B., B.S., Unley Road, Unley.
1925. †Murray, Hon. Sir George, K.C.M.G., B.A., LL.M., Magill, S.A.
1925. North, Rev. Wm. O., Methodist Manse, Netherby.
1930. Ockenden, G. P., Public School, Streaky Bay, S.A.
1932. Oliphant, H. R., University, Adelaide.
1913. *Osborn, T. G. B., D.Sc., Professor of Botany, University, Sydney—**Council**, 1915-20, 1922-24; **President**, 1925-26; **Vice-President**, 1924-25, 1926-27.
1927. Paltridge, T. B., B.Sc., Koonamore, via Waukaringa, S.A
1929. Pank, Harold G., 75 Rundle Street, Adelaide.
1929. Paull, Alec. G., B.A., B.Sc., 10 Milton Avenue, Fullarton Estate.
1924. Pearce, C., Happy Valley Reservoir, O'Halloran Hill.
1924. Perkins, A. J., Director of Agriculture, Flinders Street, Adelaide.
1928. Phipps, Ivan F., Ph.D., Waite Agricultural Research Institute, Glen Osmond.
1926. *Piper, C. S., M.Sc., Waite Agricultural Research Institute, Glen Osmond.
1925. *Prescott, Professor J. A., D.Sc., A.I.C., Waite Agricultural Research Institute, Glen Osmond—**Council**, 1927-30; **Vice-President**, 1930-32; **President**, 1932-.
1926. Price, A. Grenfell, M.A., D.Sc., F.R.G.S., St. Mark's College, North Adelaide.
1907. †*Pulleine Robert H., M.B., Ch.M., North Terrace, Adelaide—**Council**, 1914-19, 1932-; **President**, 1922-24; **Vice-President**, 1912-14, 1919-22, 1924-25; **Secretary**, 1909-12, 1925-30.
1925. Richardson, Professor A. E. V., M.A., D.Sc., "Urrbrae," Glen Osmond, S.A.
1926. *Riddell, P. D., Technical College, Newcastle, N.S.W.
1911. *Roach, B. S., 81 Kent Terrace, Kent Town—**Treasurer**, 1920-32.
1925. Rogers, L. S., B.D.Sc., 192 North Terrace, Adelaide.
1905. *Rogers, R. S., M.A., M.D., 52 Hutt Street, Adelaide—**Council**, 1907-14, 1919-21; **President**, 1921-22; **Vice-President**, 1914-19, 1922-24.
1931. Rudd, E. A., 10 Church Street, Highgate.
1922. *Samuel, Geoffrey, M.Sc., University of Adelaide.
1928 Scott, A. E., B.Sc., Waite Agricultural Research Institute, Glen Osmond.
1930. Schneider, M., M.B., B.S., 175 North Terrace, Adelaide.
1924. *Segnit, Ralph W., M.A., B.Sc., Assistant Government Geologist, Flinders Street, Adelaide—**Secretary**, 1930-.
1891. Selway, W. H., 14 Frederick Street, Gilberton—**Council**, 1893-1909.
1930. Service, A. D., c/o Colonial Sugar Refinery Co., New Farm, Brisbane.
1926. *Sheard, Harold, Nuriootpa.
1928. Showell, H., 27 Dutton Terrace, Medindie.
1920. Simpson, A. A., C.M.G., C.B.E., F.R.G.S., Lockwood Road, Burnside.
1924. Simpson, Fred. N., Pirie Street, Adelaide.
1925. †Smith, T. E. Barr, B.A., 25 Currie Street, Adelaide.
1927. Stapleton, P. S., Henley Beach, South Australia.
1922. Sutton, J., Fullarton Road, Netherby.
1932. Swan, D. C., B.Sc., Waite Agricultural Research Institute, Glen Osmond.
1925. Symons, Ivor G., Church Street, Highgate.
1929. *Taylor, John K., B.A., M.Sc., Waite Agricutural Research Institute, Glen Osmond.
1929. Tee, Sidney F., Adelaide Hospital.
1923. *Thomas, R. G., B.Sc., 29 Carter Street, Thorngate, S.A.
1923. *Tindale, N. B., South Australian Museum, Adelaide.
1894. *Turner, A. Jefferis, M.D., F.E.S., Wickham Terrace, Brisbane, Queensland.

Date of Election.

1925. TURNER, DUDLEY C., National Chambers, King William Street, Adelaide.
1930. WALKLEY, A., B.A., B.Sc., Ph.D., 8 Ralston Grove, Myrtle Bank.
1930. WALKLEY, MRS. J. E., B.Sc., (Lon.), 8 Ralston Grove, Myrtle Bank.
1924. WALKER, W. D., M.B., B.S., B.Sc., c/o National Bank, King William Street.
1929. WALTERS, LANCE S., 157 Buxton Street, North Adelaide.
1912. *WARD, L. KEITH, B.A., B.E., D.Sc., Govt. Geologist, Flinders Street, Adelaide—**Council**, 1924-27, 1933-; **President**, 1928-30; **Vice-President**, 1927-28.
1930. WHITELAW, A. J., B.Sc., Norwood High School, Kensington.
1930. WILKINSON, PROFESSOR H. J., B.A., Ch.M., M.D., University, Adelaide.
1931. WILSON, CHAS. E. C., M.B., B.S., "Woodfield," Fisher Street, Fullarton.
1920. *WILTON, Professor J. R., D.Sc., University of Adelaide.
1930. *WOMERSLEY, H., F.E.S., A.L.S., S.A. Museum, Adelaide.
1923. *WOOD, J. G., D.Sc., Ph.D., University of Adelaide.
1931. *WOODS, MISS N. H., M.A., Mount Torrens.

ASSOCIATE.

1929. CLELAND, W. PATON, 31 Wattle Street, Fullarton.

PAST AND PRESENT OFFICERS OF THE SOCIETY.

PRESIDENTS.

1877-79 PROF. RALPH TATE, F.G.S., F.L.S.
1879-81 CHIEF JUSTICE [SIR] S. J. WAY.
1881-82 [SIR] CHARLES TODD, C.M.G., F.R.A.S.
1882-83 H. T. WHITTELL, M.A., M.D., F.R.M.S.
1883-84 PROF. H. LAMB, M.A., F.R.S.
1884-85 H. E. MAIS, M.I.C.E.
1885-88 PROF. E. H. RENNIE, M.A., D.Sc., F.C.S.
1888-89 [SIR] EDWARD C. STIRLING, C.M.G., M.A., M.D. (Cantab.), F.R.C.S., F.R.S.
1889-91 REV. THOMAS BLACKBURN, B.A.
1891-94 PROF. RALPH TATE, F.G.S., F.L.S.
1894-96 PROF. WALTER HOWCHIN, F.G.S.
1896-99 W. L. CLELAND, M.B.
1899-03 PROF. E. H. RENNIE, M.A., D.Sc., F.C.S.
1903-21 SIR JOSEPH C. VERCO, M.D., F.R.C.S.
1921-22 R. S. ROGERS, M.A., M.D.
1922-24 R. H. PULLEINE, M.B., Ch.M.
1924-25 SIR DOUGLAS MAWSON, D.Sc., B.E., F.R.S.
1925-26 PROF. T. G. B. OSBORN, D.Sc.
1926-27 PROF. F. WOOD JONES, M.B., B.S., M.R.C.S., L.R.C.P., D.Sc., F.R.S.
1927-28 PROF. JOHN B. CLELAND, M.D.
1928-30 L. KEITH WARD, B.A., B.E., D.Sc., F.G.S.A.
1930-31 C. A. E. FENNER, D.Sc.
1931-32 PROF. T. HARVEY JOHNSTON, M.A., D.Sc.
1932-33 PROF. J. A. PRESCOTT, D.Sc., A.I.C.
1933- J. M. BLACK, A.L.S.

SECRETARIES.

1877 W. C. M. FINNISS.
1877-81 WALTER RUTT, C.E.
1881-92 W. L. CLELAND, M.B.
1892-93 W. C. GRASBY.
1893-94 W. B. POOLE.
1894-95 { W. L. CLELAND, M.B. / W. B. POOLE.
1895-96 W. L. CLELAND, M.B.
1896-09 G. G. MAYO, C.E.
1909-12 R. H. PULLEINE, M.B., Ch.M.
1912-24 WALTER RUTT, C.E.
1924-25 CHAS. FENNER, D.Sc.
1925-30 R. H. PULLEINE, M.B., Ch.M.
1930- RALPH W. SEGNIT, M.A., B.Sc.

TREASURERS.

1877 J. S. LLOYD.
1877-83 THOMAS H. SMEATON.
1883-92 WALTER RUTT, C.E.
1892-94 W. L. CLELAND, M.B.
1894-09 WALTER RUTT, C.E.
1909-20 W. B. POOLE.
1920-32 B. S. ROACH
1932-33 CHAS. FENNER, D.Sc.
1933- W. CHRISTIE, M.B., B.S.

EDITORS.

1877-83 PROF. RALPH TATE, F.G.S., F.L.S.
1883-88 PROF. WALTER HOWCHIN, F.G.S.
1888-93 PROF. RALPH TATE, F.G.S., F.L.S.
1893-94 { PROF. WALTER HOWCHIN, F.G.S. / PROF. RALPH TATE, F.G.S., F.L.S.
1894-95 PROF. RALPH TATE, F.G.S., F.L.S.
1895-96 PROF. WALTER HOWCHIN, F.G.S.
1896-00 PROF. RALPH TATE, F.G.S., F.L.S.
1901-33 PROF. WALTER HOWCHIN, F.G.S.
1934- CHAS. FENNER, D.Sc.

REPRESENTATIVE GOVERNORS.

1877-83 [SIR] CHARLES TODD, C.M.G., F.R.A.S.
1883-87 H. T. WHITTELL, M.A., M.D., F.R.M.S.
1887-01 PROF. RALPH TATE, F.G.S., F.L.S.
1901-22 PROF. WALTER HOWCHIN, F.G.S.
1922-27 PROF. F. WOOD JONES, M.B., etc.
1927-29 PROF. T. H. JOHNSTON, M.A., D.Sc.
1929-31 CHAS. FENNER, D.Sc.
1932 T. D. CAMPBELL, D.D.Sc.

APPENDIX.

Summary

APPENDIX.

A LIST OF ORIGINAL PAPERS AND OTHER WORKS PUBLISHED BY WALTER HOWCHIN FROM 1874 TO 1933.

[*The Heading over each Section shows the Place of Publication.*]

I.

PRIMITIVE METHODIST QUARTERLY REVIEW AND CHRISTIAN AMBASSADOR.
PRIMITIVE METHODIST PUBLISHING HOUSE, SUTTON STREET, LONDON.

1874. "Scientific Dredging in the Deep Seas. Part I.," vol. xii., No. 47, Aug., 1874, pp. 221-233. [The *Lightning* and The *Porcupine* Expeditions.]

1874. "Scientific Dredging in the Deep Seas. Part II.," vol. xii., No. 48, Nov., 1874, pp. 353-361. [The *Challenger* Expedition.]

1875. "Scientific Dredging in the Deep Seas. Part III.," vol. xviii., No. 49, Feb., 1875, pp. 36-52. [The *Challenger* Expedition, continued.]

1876. "Geikie's Life of Murchison," vol. xiv., No. 53, Feb., 1876, pp. 29-45.

1876. "Sir Roderick I. Murchison and His Contemporaries," vol. xiv., No. 54, May, 1876, pp. 97-112.

1876. "The Present Aspects of Geological Science," vol. xiv., No. 56, Nov., 1876, pp. 320-330.

1889. "Darwinism and Design in Nature, Part I.," vol. xxxi. (N.S., vol. xi.), April, 1889, pp. 225-231.

1889. "Darwinism and Design in Nature, Part II.," vol. xxxi. (N.S., vol. xi), July, 1889, pp. 498-511.

II.

IN WILSON'S HANDBOOK TO MORPETH.

1876. "The Geology of Morpeth and Neighbourhood." Morpeth, 1876.

III.

PALAEONTOGRAPHICAL SOCIETY'S PUBLICATIONS.

1876. "Monograph of Carboniferous and Permian Foraminifera," by H. B. Brady, London, 1876.

References to Howchin's personal contributions will be found on the following pages:—

Localities reported on, pp. 29, 30 bis, 31 bis, 39, 41 tres.

References to particular genera and species, pp. 107, 119, 120, 121.

List of occurrences at particular localities:—

Table I. Nos. 2, 15, 16, 17, 18, p. 153.
Table II. Nos. 87, 103, 107, 116, pp. 154. 156.

Numerous figured specimens and micro-sections.

IV.

Natural History Transactions of Northumberland, Durham, and Newcastle-on-Tyne.

1880. "Notes on a Find of Prehistoric Implements in Allendale, with Notes of Similar Finds in the Surrounding Districts," vol. vii., 1880, pp. 210-222, Newcastle-on-Tyne.

V.

Journal of the Royal Microscopical Society, London.

1888. Additions to the Knowledge of the Carboniferous Foraminifera," 1888, pp. 1-13, pls. viii.-ix. [British Localities.]

VI.

The Hassell Press, Adelaide.

1899. "The Influence of the Physical Sciences on Religious Thought." "A Paper read before the Methodist Preachers' Association, Adelaide, on March 24, 1899, and published by request of the meeting."

VII.

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Fig. 1. Ancient Alluvial Plateau between Hutt and Hill Rivers. East Escarpment.

Fig. 2. Plateau of Consolidated Alluvium, as in Fig. 1. General View.

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Fig 1. Ancient River Plateau, west of Stockport. Eastern Escarpment.

Fig. 2. High-level River Terrace, east of Stockport. Distant view.

Fig. 3. Alluvial Capping on top of hill. Same as Fig. 2, Near view

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Fig. 1. Escarpment of Ancient River Terrace near Anstey's Hill, Hope Valley.

Fig. 2. Old Consolidated Alluvium unconformably on Decomposed Slates. Blackwood.

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Fig. 1. Ancient Alluvial Sand-rock. Railway cutting near Morphett Vale.

Fig. 2. Ancient Gravels resting unconformably on Miocene. Railway, Hackham.

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Fig. 2.

Fig. 1.

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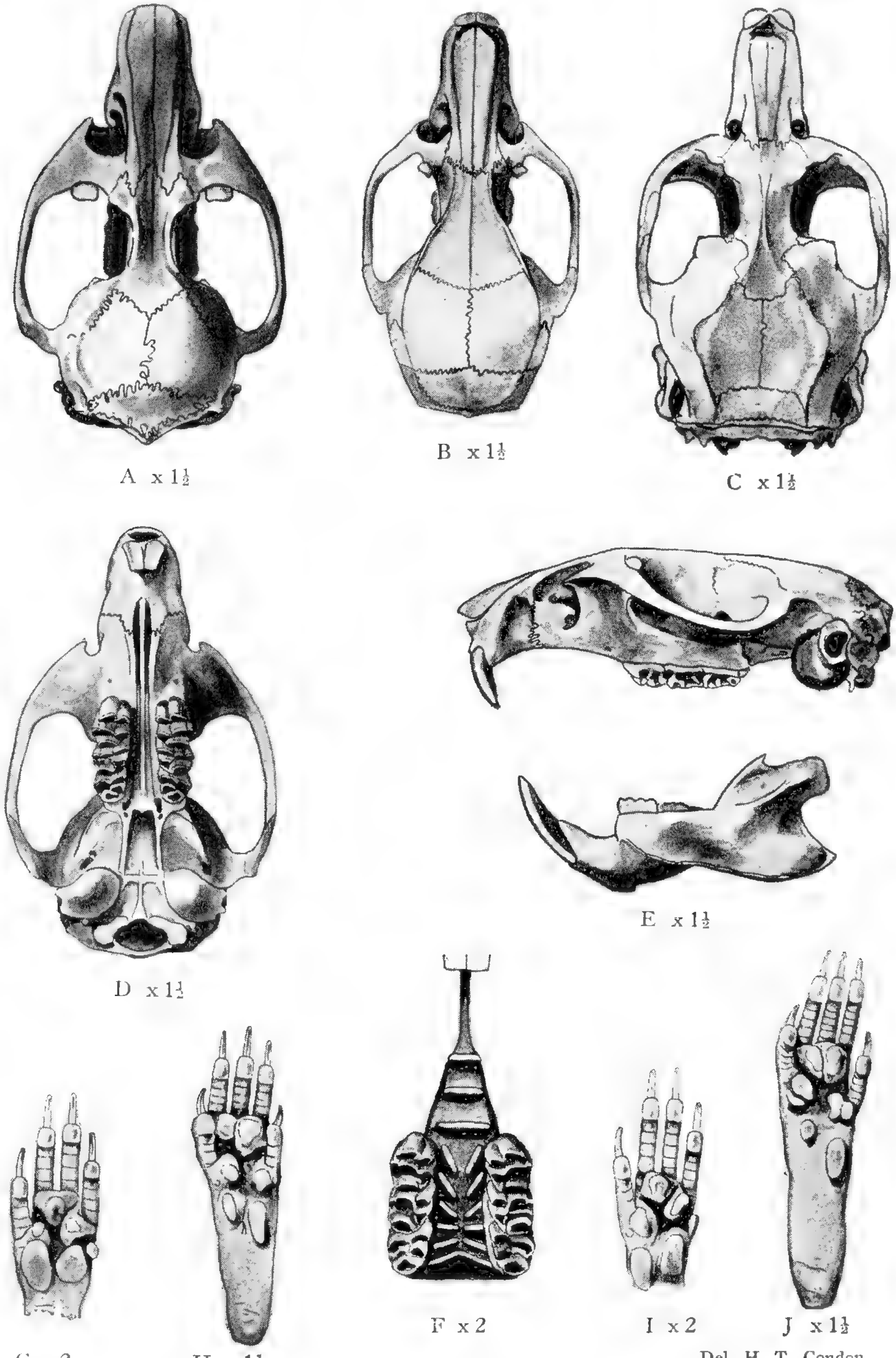

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Cradle Valley, Northwest Tasmania. Photo by H. H. Finlayson.

A view from the north, showing features of the country in which *Mastacomys* [illegible]

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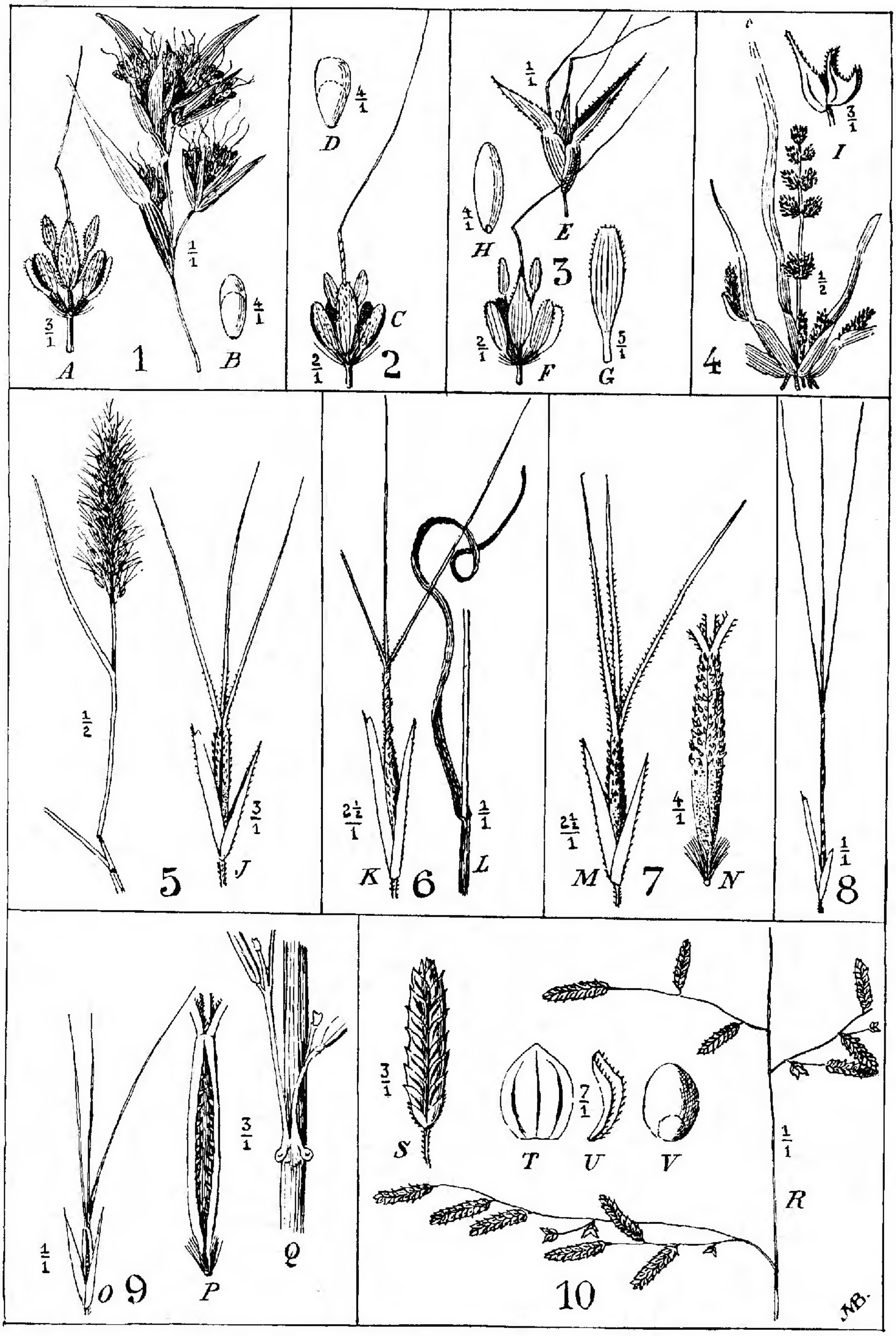

1. *Iseilema actinostachys.* 2. *I. membranacea.* 3. *I. vaginiflora.* 4. *Elytrophorus spicatus.* 5. *Aristida anthoxanthoides.* 6. *A. latifolia* var *minor.* 7. *A. echinata.* 8. *A. Browniana.* 9. *A. biglandulosa.* 10. *Eragrostis elongata.*

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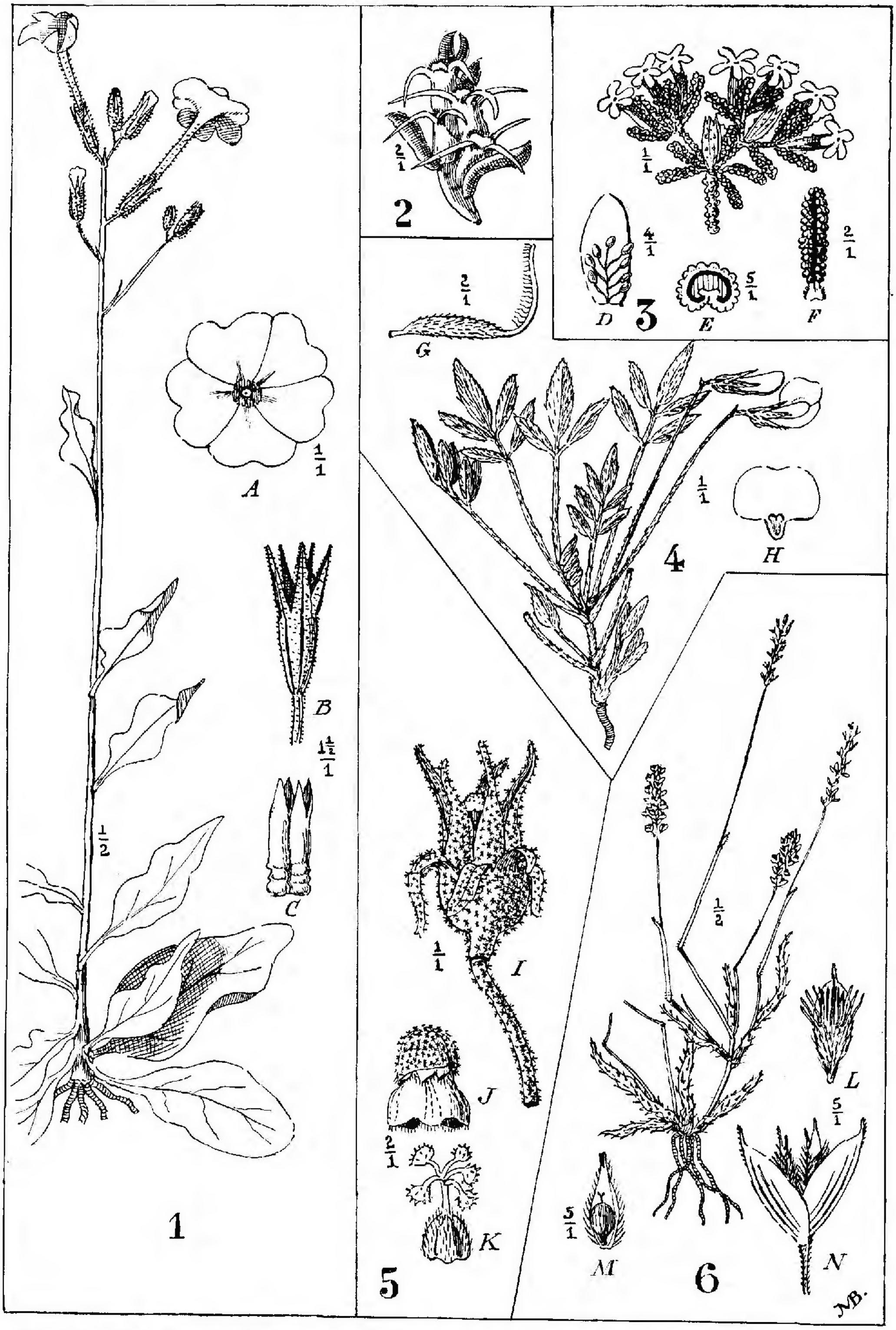

1. *Nicotiana ingulba.* 2. *Bassia articulata.* 3. *Frankenia granulata.* 4. *Swainsona uniflora.* 5. *Hibiscus crassicalyx.* 6. *Eriachne Isingiana.*

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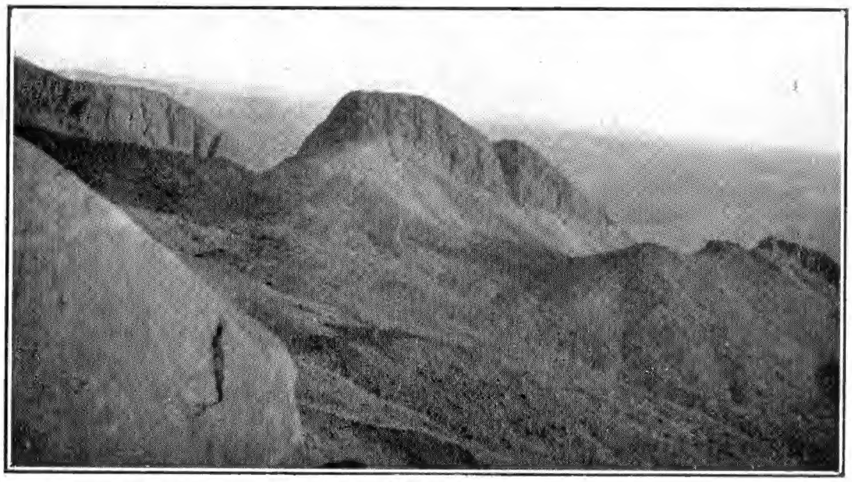

Fig. 1.

Fig. 2.

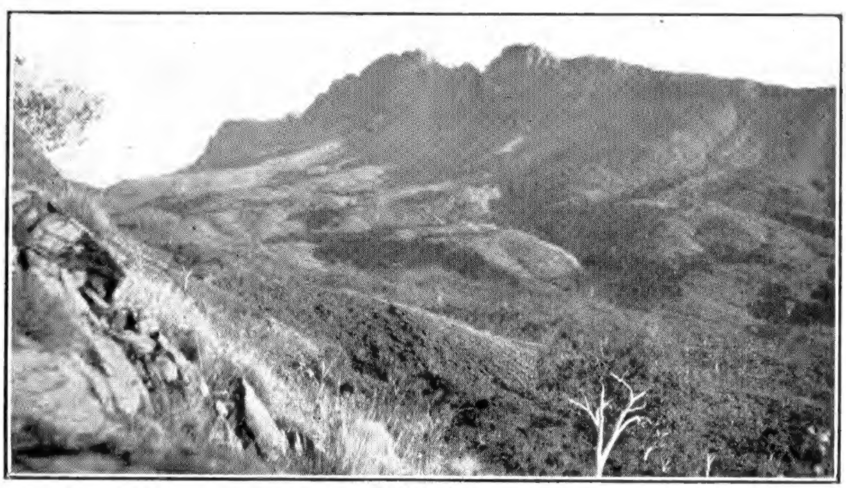

Fig. 3.

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