Abstract of Proceedings of the Royal Society of Queensland.

ABSTRACT OF PROCEEDINGS, MARCH 29TH, 1915.

Dr. J. Shirley, President, in the chair.

The Patron, His Excellency Sir Hamilton Goold-Adams, and Lady Goold-Adams and Mr. R. C. Morgan, A.D.C., were present.

Mr. T. R. Pearce was elected a member

Dr. F. Butler-Wood and Mr. J. Colvin were proposed for membership.

The Annual Report of the Council was adopted on the motion of Mr. J. B. Henderson, seconded by Dr. T. Harvey Johnston.

The Financial Statement was adopted on the motion of Mr. H. C. Richards, seconded by Dr. A. Jefferis Turner.

The President presented his retiring address entitled "A Review of Recent Australian Conchology," and delivered a popular discourse on the subject, illustrated by lantern slides.

His Excellency expressed his appreciation of the lecture, his thanks to the Society for its welcome and his acceptance of the office of Patron. He also expressed his interest in certain scientific matters, and indicated astronomy and anthropology as being worthy of the attention of the Royal Society.

The following office-bearers for the year 1915 were elected :—

Patron—His Excellency Sir Hamilton Goold-Adams, G.C.M.G., C.B., etc.

President—T. Harvey Johnston, M.A., D.Sc.

Vice-President—R. Hamlyn-Harris, D.Sc.

Hon. Secretary and Editor—A. B. Walkom, B.Sc.

Hon. Treasurer—E. H. Gurney.

Hon. Librarian—C. D. Gillies, B.Sc.

Council—W. R. Colledge, B. Dunstan, F.G.S., H. A. Longman, H. C. Richards, M.Sc., and J. Shirley, D.Sc.

Hon. Auditor—G. Watkins.

THE ROYAL SOCIETY OF QUEENSLAND

FINANCIAL STATEMENT for the Year 1915.

Dr. **Cr.**

Receipts.

	£	s.	d.
To Balance from 1913	18	11	10
,, Admission Fees and Subscriptions	80	6	6
,, Sale of Proceedings	2	8	0
,, Sundry Small Receipts	0	1	8
	£101	8	0

Expenditure.

	£	s.	d.	£	s.	d.
By Printing (Pole & Co.)—						
1913 Proceedings	15	0	0			
General	15	16	0			
				30	16	0
,, Postage						
Monthly Notices	3	4	0			
Librarian's Postage and Postage on 1913 Proceedings	5	10	6			
Geological Section's	0	10	0			
Nat. History Section's	0	10	0			
Editor's	0	10	0			
				10	4	6
,, Insurance				1	2	6
,, General Postage and Petty Cash ..				5	15	5
,, Cartage				0	9	3
,, Caretaker and Refreshments				2	5	0
,, Cab Fares (Funeral)				0	12	6
,, Bank Charge				0	10	0
,, Balance as per Bank Book				49	12	10
				£101	8	0

Examined and found correct.

GEO. WATKINS, Hon. Auditor.

BRISBANE, February 15th, 1915.

J. C. BRÜNNICH,
Hon. Treasurer.

Abstract of Proceedings, April 26th, 1915.

The Ordinary monthly meeting was held in the Geology Lecture Theatre in the University at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

Dr. Johnston thanked members for his election to the office of president, and took the opportunity of recording the members' appreciation of the work done by the retiring Honorary Secretary (Mr. F. Bennett) during his years of office.

The minutes of the special meeting of November 30th, 1914, were read and confirmed.

Mr. J. R. Cullen, of Montville, and Miss Irene V. Butler-Wood, B.D.S., were proposed as ordinary members, and Miss Edna Peberdy as an associate member of the Society.

Dr. F. Butler-Wood and Mr. J. Colvin were elected members.

The Library exchanges and donations for the month were laid on the table.

The following papers were read :

(1.) Studies in Australian Lepidoptera, by A. Jefferis Turner, M.D., F.E.S.

Fifty-seven genera and 82 species are dealt with, of which 10 genera and 49 species are new. They are mainly from Queensland localities, a few being from other Australian States.

(2.) The Nature and Origin of Manganiferous and Ferruginous Incrustations and Deposits, by W. D. Francis.

The subject is treated under the headings of incrustations, bog-iron ore and bog-manganese, and the disintegration of rocks. Incrustations are divided into fluviatile, subaerial, internal, marine and corrosive (chiefly iron rust). The author is opposed to the theory that incrustations of various types, accumulations of bog-iron ore and bog-manganese, and the disintegration of rocks are brought about by chemical action, and holds that these phenomena are occasioned almost completely, if not wholly, by organic agents. Incrustations such as manganiferous and ferruginous coatings, dendritic markings, etc., are ascribed to the decay and alteration of encrusting algæ and lichens, or of colonies of bacteria. To the latter are also ascribed accumulations of bog-iron ore and bog-manganese. The disintegration of rocks is held to be brought about by the attack of bacteria on their carbonaceous, ferruginous and other constituents and the consequent breaking down and loosening of the originally compact and resistant rock substance.

In the discussion on the paper it was generally conceded that the author had made certain interesting observations but his deductions were almost entirely disagreed with. The difficulty of carrying out efficient experiments with bacteria was pointed out and the wish was expressed that more should be known about the conditions under which the experiments had been carried out before any reliable conclusions could be drawn from them. Messrs. Gurney, Richards, Smith and Walkom and the President took part in the discussion.

NOTES AND EXHIBITS.

Dr. T. H. Johnston exhibited some interesting polypes (*? Corymorpha*) which were living as messmates on a crab; also some simple corals (*? Cylicia*). All of these specimens were collected by dredging recently in Bribie Passage. He also exhibited a worm, *Gordius sp.*, which was found by Mr. H. A. Longman in freshwater at Montville. In its young stage this animal lives as a parasite on certain insects.

Mr. C. T. White exhibited specimens of (i) *Nostoc commune*, a widely-spread species of alga recently recorded from Queensland. The specimens were found growing in damp soil on the Brisbane River. (ii) *Sporochnus pedunculatus* collected recently in Moreton Bay, a species of alga new to Queensland waters. Also a fungus, *Morchella rotundata, var. fulva*, an European species recently found by him growing in quantity at Fig Tree Pocket, Brisbane River.

Mr. H. A. Longman exhibited a live specimen of *Physignathus lesueurii* from Montville and a giant cricket.

Abstract of Proceedings, May 31st, 1915

The Ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President extended the Society's congratulations to Mr. W. H. Bryan, B.Sc., as being the first member of the Society to enlist for active service. He also expressed the sincere sympathy of members with Miss Bage in the loss of her brother in action at the Dardanelles, and with Mrs. De Vis in the loss of her husband, who was formerly one of our most prominent members. Dr. Hamlyn-Harris and Mr. H. A. Longman spoke in appreciation of the late Mr. De Vis and his work.

The minutes of the previous meeting were read and confirmed.

Mr. Dene B. Fry was proposed as an Ordinary Member, and Miss Margaret Mackenzie as an Associate Member of the Society.

Mr. J. R. Cullen and Miss Irene V. Butler-Wood were elected Ordinary Members, and Miss Edna Peberdy an Associate Member.

The following paper was read :

Herpetological Notes, by Dene B. Fry (communicated by Mr. H. A. Longman).

The paper comprised four parts, viz. :

(i) Description and Notes on three Lizards. The species *Œdura monilis*, De Vis, is redescribed and notes given on *Calotes cristatellus*, Kuhl, and *Gonyocephalus spinipes*, A. Dum.

(ii) On a new *Chelodina* with a key to the genus. A new species is described as *C. intergularis*.

(iii) Two new species of *Pseudelaps* and a key to the genus. *P. christieanus*, sp. nov., is described from Port Darwin, and *P. minutus* from three localities in New South Wales.

(iv) A new Queensland Frog. *Austrochaperina brevipes*, sp. nov., is described from the Bloomfield River, near Cooktown, Queensland.

NOTES AND EXHIBITS.

Mr. H. A. Longman exhibited a live specimen of *Phyllurus platurus*

Dr. R. Hamlyn-Harris exhibited (1) some native knitting needles and opossum-fur twine from Groote Eylandt. It was pointed out that the natives there had been singularly isolated, and beyond possible influence from Malay had not been affected by contact with civilization; hence the significance of the specimens. The twine consists of series of lengths of fur of about three-quarters of an inch, and these are united by being junctioned into clumps, presenting an almost moniliform appearance. (2) Two unpointed and rather roughly manufactured Death-bones were shown from the Mitchell River, Queensland. These specimens, which had actually been responsible for the death of two individuals, clearly demonstrated that in the olden days the natives used implements unlike the ordinary type, which may be compared to the elongated bone sewing-needle (example exhibited). (3) Poison carriers from the Roper River. These are made from the wing bones of the Pelican and are of special interest, and they point to the use of such things as arsenic as a modern idea. Whether here, as in Melanesia, the natural properties of poisons were disputed and their noxious results attributed to magic charms is an interesting question by no means easily solved. (4) A magical rain stick.

Mr. A. B. Walkom, by permission of the Director of the Queensland Museum, exhibited a specimen of *Annularia* associated with *Glossopteris* from Permo-Carboniferous rocks near Dunedoo, New South Wales. The specimen is of a type somewhat similar to *A. stellata* (Schloth), and is quite distinct from the only species of Annularia (*A. australis*) of which record can be found in rocks of this age in Australia.

Dr. T. H. Johnston exhibited a series of specimens of Ceratodus.

Abstract of Proceedings, June 28th, 1915.

A Special Monthly Meeting was held in the Geology Lecture Theatre in the University at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President referred to the loss sustained by the Society in the death of Mr. F. M. Bailey. The late Mr. Bailey had been a member of the Society since its inception, and in the earlier years took a very active part, having been President one year, Vice-President one year, and a member of the Council for fifteen years. He had also made twenty-one contributions to our Proceedings, in addition to many outside publications. Messrs. Longman and Colledge also spoke in appreciation of Mr. Bailey and his work.

The President also extended a welcome to Mr. Bridwell, Entomologist to the Hawaiian Government.

The minutes of the preceding meeting were read and confirmed.

Mr. H. A. Longman proposed "That the Society suspend the annual subscriptions of ordinary members on active service." Dr. Hamlyn-Harris seconded the motion, which was carried unanimously.

The exchanges and donations for the month were laid on the table.

Mr. Dene B. Fry was elected an Ordinary Member, and Miss Margaret Mackenzie an Associate Member of the Society.

The following paper was read :—

Herpetological Notes : Descriptions of Some Australian and Papuan Frogs ; by Dene B. Fry.

The paper was communicated by Mr. H. A. Longman.

Mr. Bridwell and the President offered remarks on the paper.

Mr. Bridwell, at the invitation of the President, gave an account of some of his experiences while engaged in scientific work in W. Africa.

Notes and Exhibits :—

Dr. T. H. Johnston exhibited specimens of *Acetabularia sp.* dredged by him in Pumice Stone Passage between Bribie

Island and the mainland. They were found at a few fathoms depth on a soft, muddy bottom, along with *Zostera marina* and *Halophyllum ovatum*.

Dr. R. Hamlyn-Harris exhibited a number of stone, iron and other implements of the Queensland Aborigines. He stated that the interest of the specimens lay in the fact that whereas some were genuine stone implements of the palæolithic stage of culture, others, having been manufactured quite recently, represented a temporary transition stage rapidly evolved through contact with civilization. This hastened disappearance of accurate and genuine workmanship on the part of these primitive people, whereby their trade becomes a lost art, emphasises with considerable force the necessity of saving the few remaining records before it is too late. Amongst the exhibits some very indifferently-worked knives and axes, shown in contrast with the genuine article, are evidences of the crudeness of the modern bungler. Since the introduction of such things as flakes of glass bottles and pieces of iron gives an already partially-manufactured product easily adapted to modern use, the native, however slightly civilised he may be, soon prefers to relinquish the arduous methods of old-time manufacture for the more easily acquired modern appliances placed in his hands.

Mr. H. A. Longman exhibited a specimen, seven feet in length, of *Acrochordus javanicus*, Hornst., obtained by Mr. Esmond Parkinson in the Leichhardt River, Gulf of Carpentaria, and forwarded to the Queensland Museum. This snake has not previously been recorded for Australia, but examples are occasionally found in or near rivers in the Malay Peninsula, Java, Siam and Papua. The species is non-venomous, and belongs to the Aglypha series.

Abstract of Proceedings, July 26th, 1915.

The ordinary monthly meeting was held in the Geology Lecture Theatre, in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President extended the congratulations of the Society to Mr. J. F. Bailey on his appointment to the position of Colonial Botanist.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

The following paper was read :—

"Notes on a few interesting plants from Moreton Bay," by C. T. White.

The paper consists mainly of records of occurrences of plants which have not previously been recorded from the Moreton Bay District.

Mr. Longman and the President remarked on the paper and congratulated Mr. White on his first contribution to the Proceedings.

Mr. J. C. Bridwell delivered a lecture entitled "The Use of Parasites in Economic Entomology." The lecture was illustrated by many diagrams and lantern slides.

NOTES AND EXHIBITS.

Mr. H. A. Longman exhibited a portion of the fore part of a fossil cranium with a fragment of tooth, received from North Western Queensland, which apparently represented an animal quite new to Australia. Although too fragmentary to be definitely allocated, some slight resemblance might be traced to the Dicynodonts of South Africa.

ABSTRACT OF PROCEEDINGS, AUGUST 30TH, 1915.

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The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

The following paper was read :—

"A List of the Recorded Freshwater Protozoa of Queensland, with a number of new records," by C. D. Gillies, B.Sc.

The paper contains an addition of 14 species to the recorded freshwater Protozoa of Queensland, together with a list of previously recorded forms.

NOTES AND EXHIBITS.

Dr. Shirley exhibited shells from North West Is., collected by Miss Peberdy. They included; *Atactodea striata*, Gmel.; *Trochus calcaratus*, Souv.; *Chrysostoma paradoxa*, Born.; *Quoyia decollata* Q. & G.; *Cerithium columna*, Sby.; *C. hanleyi*, Sby.; *C. rubum*, Martyn; *C. granosum*, Kien; *Clava aspera*, L.; *C. vertaga*, L.; *Natica chinensis*, Lam.; *Cypræa isabella*, L.; *C. annulus*, L.; *C. caurica*, L.; *C. errones*, L.; *Conus spectrum*, L.; *Arcularia jonasi*, Dunk (=nana, A. Ad.).

Except *Cerithium hanleyi*, most of these shells are of very extensive range. *Quoyia decollata* has been reported from Ascension I., and *Clava aspera* from Madagascar; the rest range widely over the E. Indian Islands or Western Polynesia, or both.

Mr. C. T. White exhibited specimens of *Erigeron linifolius*, Willd.; *E. canadensis*, Linn, and *Aster subulatus*, Michx, from the Queensland Herbarium, by permission of the Govt. Botanist. The latter species, for some time recorded as naturalised in Victoria and N.S.W., has previously gone in Queensland as a glabrous form of *E. canadensis*, but the normal form of that species has now appeared in several places in Queensland, and the two when seen growing together are very distinct.

Mr. H. A. Longman exhibited the following Queensland Museum specimens: (1) A fragment of the left maxilla with three abraded molars of a *Diprotodon* from the Flinders River, near Hughenden, donated by Mr. R. Pool, the locality record being of considerable interest; (2) dermal ossifications and a disarticulated cranium of *Trachysaurus rugosus*, the parietal region showing interiorly an infundibular pit for the accommodation of the epiphysial diverticulum of the pineal body; (3) a living *Typhlops* *wiedii*; this "blind snake" shows unusual transparency for a land vertebrate, and when held before a strong light its viscera may be discerned and the pulsations of the heart noted.

Dr. Hamlyn-Harris exhibited a Fijian chief's necklet made of a sperm whale's tooth, highly polished, with a cord of plaited and twisted vegetable fibre, much prized and formerly a sort of native currency. Also a fine set of shell implements collected recently by him from several native camps on Dunk Island, the knives and spoke-shaves being made from a species of *Perna*. A very interesting implement was a triangular (shark tooth shaped) scarifying implement, evidently used by the natives for the purpose of making tribal and other decorative marks. The set of implements demonstrated the manufacture of shell fish-hooks. Discs of about an inch or so square are cut from the black-lip shell, *Margaritifera margaritifera*; a centre hole is pierced by means of a quartz drill until the aperture is sufficiently large to admit of the use of the small coral files which further enlarge the hole. The discs are then divided into two and worked down until the proper crescent-shaped fish-hook is sufficiently pointed to render it of service. Some weathered pieces of a species of *Chama* were shown, these being of a similar shape to the fish hooks, and thought by some to have given the aboriginal the first idea of shape. Another interesting exhibit was an aboriginal plane made of a land shell (*Xanthomelum pachystyloides*), bearing the native name "KURRA DJU." This implement is used for planing the fruit of the Moreton Bay Chestnut (*Castanospermum australe*)—native name "TINDABURRA"—the operator being able to regulate the thickness of the shaving to a nicety.

ABSTRACT OF PROCEEDINGS, SEPTEMBER 27th, 1915.

The ordinary monthly meeting was held in the Geology Lecture Theatre, in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President expressed the sympathy of the Society with the relatives of the late Mr. C. W. Costin, who had been a member of the Society from 1906 to 1914.

The President, on behalf of the members, congratulated Mr. H. C. Richards on having been awarded the degree of Doctor of Science by the University of Melbourne.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

Mr. R. J. Tillyard, M.A., B.Sc., F.E.S., Macleay Fellow of the Linnean Society of N.S.W. in Zoology, delivered a lecture on the "Life History of the Dragon Fly." The lecture was illustrated by a series of specimens and numerous lantern slides.

Messrs. Tryon, Illidge, Colledge, Dr. Shirley and the President spoke in appreciation of the lecture.

Abstract of Proceedings, October 25th, 1915.

The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meeting were read and confirmed.

The donations and exchanges for the month were laid on the table.

Mr. J. Bain was proposed as a member of the Society.

The President gave a short account of a further communication from Mr. Francis, of Kin-Kin, regarding fluviatile and sub-aerial incrustations, which Mr. Francis believes to be of organic origin.

Dr. R. Hamlyn-Harris spoke in the interests of sociological anthropology, and by a number of illustrations, specimens and lantern views, showed how important this study was, and how the scope and significance of the subject, especially in its relationship to the vanishing race in Queensland, had not yet been realised.

He emphasised particularly some of the points so ably brought forward by Sir J. G. Frazer, whose comprehensive study of man as a whole, and whose methods of tabulating a multitude of facts, and presenting a critical analysis thereof, have enabled us to take a broad general view of the whole subject, and also to realise the necessity for further work on special details. He pointed out, however, that the time for "dilly-dallying" had passed, and that unless we set to work earnestly and sincerely to save such records as remain, we should not be without responsibility, and the stigma of disgrace would not be undeserved. He therefore urged the Royal Society of Queensland to take the matter more seriously, and to give it the attention it deserved. Amongst the exhibits shown were:—(1) A native pillow, made entirely of emu feathers. This is the first instance of anything of the kind having reached us. The habit of sleeping with only the flat ground beneath the head being universal throughout Queensland. (2) A series of eel-bone charms from the Atherton District, made from the pectoral girdle and branchiostegal rays of the eel, mounted in gum cement. It would appear that these were in use by young boys when being initiated into manhood. They are worn hanging on the chest, and the opposing tribe is supposed to throw spears at them during the ceremonies. The native name is "WAK-KEE." (3) A charm which seems to be connected with revenge. The flat stick, the ends of which are ovate-spatulate, has stretched along its surface a piece of human skin which is kept in place by being tightly wound round with a species of pliable cane, but beyond the fact that the specimen was taken forty years ago in the Marlborough District by Mr. T. Illidge, no information is available. These and many other exhibits showed how extremely necessary a proper understanding of the native is. The idea was beginning to take root, that as soon as possible a scientific expedition should be equipped and sent to the more remote parts of the State, ere the sands had entirely run out.

Dr. Shirley, Mr. T. Illidge, Dr. Butler-Wood, and the President contributed to the discussion.

Mr. J. F. Bailey exhibited a cassowary's egg.

ABSTRACT OF PROCEEDINGS, NOVEMBER 15TH, 1915.

An extraordinary meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The President announced that, owing to the increase in the number of members carrying out research, the Society had been unable to print all the papers offering this year. The Government had been approached and had very generously come to our assistance by offering to print the paper on "The Volcanic Rocks of South Eastern Queensland," by Dr. H. C. Richards. He took the opportunity of sincerely thanking the Government on behalf of the Society.

The President also congratulated Mr. F. Bennett, the late Honorary Secretary, on having qualified for the degree of B.Sc. of the Queensland University.

Dr. Richards read his paper on "The Volcanic Rocks of South Eastern Queensland," illustrating it with a number of lantern slides and projections of rock slides.

Remarks were made by Messrs. R. A. Wearne, E. H. Gurney, H. A. Longman and A. B. Walkom.

Dr. Hamlyn Harris exhibited a small aboriginal "camp" collection from near Bundaberg.

Mr. C. T. White exhibited part of a stem and long aerial root of *Tinospora similacina*, Benth., a large menispermaceous climber from the Rosewood scrub, Southern Queensland. Many species of the genus *Tinospora*, when the stem is cut, send down from the severed portion a slender shoot which lengthens till it reaches the ground, often from great heights. In the "Queensland Flora," *T. smilacina* is recorded only from Cape York and Thursday Is., but numerous specimens have since been received and the plant shown to have a wide range in Queensland. It has also been recorded from Northern N.S.W.

Abstract of Proceedings, November 29th, 1915.

The ordinary monthly meeting was held in the Geology Lecture Theatre in the University, at 8 p.m.

Dr. T. H. Johnston, President, in the chair.

The minutes of the previous meetings were taken as read.

His Excellency the Governor delivered an address entitled "Sidelights on South African History within the past thirty years."

The lecture dealt with many incidents which occurred during His Excellency's administration in South Africa.

Dr. R. Hamlyn Harris moved a vote of thanks to His Excellency, which was seconded by Mr. J. B. Henderson, and carried by acclamation.

Abstract of Proceedings of Geology Section.

MEETING, APRIL 9TH, 1915.

Mr. Dunstan in the chair.

Twelve Members present.

Office-bearers for 1915, were elected as follows :—

President, B. Dunstan, F.G.S. ; Vice-president, H. C. Richards, M.Sc. ; Hon. Secretary, W. E. Cameron, B.A.

A discussion, which was opened by Dr. Shirley, took place on the Oxley Beds.

MEETING, MAY 17TH, 1915.

Mr. Dunstan in the chair.

Eight Members present.

The subject for discussion was "The Permo-Carboniferous Beds of Eastern Australia" ; the discussion was opened by Mr. A. B. Walkom.

MEETING, JULY 30TH, 1915.

Mr. Dunstan in the chair.

Six Members and one visitor present.

Mr. Reid gave an account of the *Glossopteris* bearing beds of Bett's Creek, of Permo-Carboniferous age. A general discussion on these beds followed.

Abstract of Proceedings of Biology Section.

MEETING, APRIL 20TH, 1915.

Seven Members present.

Paper given by Mr. Watkins on Origin and Development of the Dahlia. He drew attention to the importance of this flower from the point of view of hybridisation and evolution.

MEETING, MAY 11th, 1915.

Six Members and two visitors present.

Dr. Hamlyn-Harris gave an account of "Magic and Superstition," as exhibited by the Australian aboriginal. Several specimens of death-bone and charms of various kinds were shown.

Mr. Watkins added a few remarks.

MEETING, AUGUST 18th, 1915.

Five members present.

Mr. C. T. White read a paper on "Queensland Ferns," and suggested that much of the work done by Domin in this connection might be revised.

Dr. Shirley and Mr. Longman took part in the discussion, Dr. Shirley pointing out that though much careful work had been done by Domin his localities were few.

Microscope slides of ferns were exhibited.

MEETING, SEPTEMBER 14th, 1915.

Five members present.

Dr. Shirley gave a summary of Andrews' paper on "Myrtaceæ." He pointed out an interesting fact in evolution shown by the reversion to type exhibited by the young leaves of the Eucalypt to that of the parent Myrtle.

Messrs. White and Watkins took part in the discussion on the paper.

MEETING, OCTOBER 20th, 1915.

Five members present.

Paper given by Mr. Colledge on the "Occurrence of Polyzoa in Brisbane water." Three species were described, and specimens, both living and mounted, were exhibited under the microscope.

Dr. Shirley and Mr. White spoke in appreciation of the paper.

List of Societies and Institutions with which the Royal Society of Queensland exchanges Publications.

AFRICA.

SOUTH AFRICA.

Geological Commission, Cape of Good Hope.

Natal Museum.

South African Association for the Advancement of Science.

South African Museum, Capetown.

NORTH AMERICA.

CANADA.

Canadian Institute.

Department of Mines.

Hamilton Association.

Literary and Historical Society, Quebec.

Nova Scotia Institute of Natural Science.

Royal Astronomical Society of Canada.

Royal Society of Canada.

MEXICO.

Instituto Geologico de Mexico.

Meteorologico Observatorio.

Sociedad Cientifica, Mexico.

UNITED STATES.

Academy of Natural Sciences, Philadelphia.

Academy of Science, Rochester, N.Y.

American Academy of Arts and Sciences, Boston.

American Geographical Society, N.Y.

American Mathematical Society, N.Y.

American Museum of Natural History, N.Y.

American Philosophical Society, Philadelphia.

Boston Society of Natural History.

UNITED STATES—*Continued.*

Buffalo Society of Natural History.

Californian Academy of Science.

Carnegie Institute.

Colorado State College.

Dept. of Agriculture, Washington, D.C.

Dept. of Commerce and Labour, Washington, D.C.

Field Museum of Natural History, Chicago.

Florida Geological Survey.

Geographical Society of Philadelphia.

Geological and Natural History Society of Minnesota.

Geological Survey of California.

Geological Survey of U.S.A., Washington, D.C.

Illinois State Laboratory.

Indiana Academy of Science.

Kansas Academy of Science.

Lloyd Library, Cincinatti.

Massachusetts General Hospital.

Michigan Academy of Science.

Minnesota Academy of Natural Science.

Missouri Botanic Gardens, St. Louis.

National Academy of Sciences.

New York Academy of Sciences.

New York Zoological Society.

Smithsonian Institution, Washington, D.C.

University of California, Berkeley.

University of Kansas.

University of Minnesota.

University of Montana.

University of New York.

Wilson Ornithological Club.

Wisconsin Academy of Sciences, Arts and Letters.

SOUTH AMERICA.

BRAZIL.

Instituto Oswaldo Cruz.

URUGUAY.

Instituto de Pesca, Monte Video.
Museo Nacionale, Monte Video.

ASIA.

CEYLON.

Colombo Museum.

INDIA.

Agriculture Institute, Pusa, Bengal.
Asiatic Society of Bengal.
Board of Scientific Advice for India.
Director General, Indian Medical Service ("Paludism.")
Geological Survey of India.
Superintendent of Govt. Printing, Calcutta.

JAVA.

Chef van het Mijnwesen.
(see also under Holland.)

PHILLIPINE ISLANDS.

Bureau of Science, Manila.
Manila Medical Society.

AUSTRALASIA.

NEW SOUTH WALES.

Australasian Association for the Advancement of Science.
Australian Museum, Sydney.
Botanic Gardens, Sydney.
Department of Agriculture.
Geological Survey of N.S.W.
Linnean Society of N.S.W.
Naturalists' Society of N.S.W.
Observatory, Sydney.
Public Library, Sydney.
Royal Anthropological Society.
Royal Society of N.S.W.
Technological Museum, Sydney.
The University of Sydney.

NEW ZEALAND.

Auckland Institute.
Dominion Museum, Wellington.
Geological Survey.
New Zealand Institute.

QUEENSLAND.

Colonial Botanist, Brisbane.
Field Naturalists' Club.
Geological Survey of Queensland.
Public Library, Brisbane.
The Queensland Museum, Brisbane.
The University of Queensland, Brisbane.

SOUTH AUSTRALIA.

Geological Survey.
National Museum, Adelaide.
Public Library, Adelaide.
Observatory, Adelaide.
Royal Geographical Society.
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PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND

FOR 1915

VOL. XXVII.—PART I.

Edited by
A. B. WALKOM, B.Sc

The Authors of Papers are alone responsible for the statements made and the opinions expressed therein.

PRINTED FOR THE SOCIETY
BY
H. POLE & CO., PRINTERS, ELIZABETH STREET, BRISBANE.

1915.

Price: Five Shillings.

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VOLUME XXVII.—PART 1.

A REVIEW OF RECENT AUSTRALIAN CONCHOLOGY.

(PRESIDENTIAL ADDRESS.)

By JOHN SHIRLEY, D.Sc., F.M.S.,
Principal, Teachers' Training College, Brisbane.

(*Delivered before the Royal Society of Queensland, March 29th*, 1915.)

THE conchologists of the world owe a debt of gratitude to America for the production of a standard work on the Mollusca. The publication of Tryon's Manual of the Mollusca has placed our knowledge of the Gasteropoda, Amphineura and Scaphopoda on a sound basis. The specialist, who devotes himself to the determination of species in these classes, has this work continually at his elbow, and though he may find fault with a few minor details, it is to him what the dictionary is to the beginner in a new language. Recent species makers with Tryon's Manual for reference are apt to talk from a height about "Tryon who hastily united species, which, though then indefinite in literature were distinct in nature," or of the slovenly work of early authors, as for instance the "carelessness and incapacity of Lovell Reeve," or to complain that "having left his species in the wrong genus, unfigured, unlocalised, known and knowable only to those who saw the type, Arthur Adams fortunately crowned his work by the adoption of a preoccupied name" Of the known marine mollusca of Queensland, it must not be forgotten that we owe the recognition and description of one-sixth of its species to Reeve, and one-twelfth to A. Adams, either alone or in conjunction with H. Adams, Reeve or Angas. This criticism of the private worker by men who have the resources of a State at their back is unfair and ungenerous; and leads one to recall with amusement the not yet forgotten early blunders of the critics themselves.

The Second Series of the Manual of Conchology has reached its twenty-second volume and its completion will place the classification of the land-shells — Subclass Pulmonata—on a similarly sound footing. The late Geo. W. Tryon, Junr., in a preface dated January 1st, 1885, makes the following declaration as to his basis of classification:—"The classification of the 'Pulmonata' will be essentially that exhibited in the third volume of my 'Structural and Systematic Conchology'; modified, nevertheless, as to minor details and chiefly by the introduction of additional groups. In the arrangement and synonymy of the species, the late Dr. Louis Pfeiffer's 'Nomenclator Heliceorum Viventium,' 1878, will be my principal guide, and I will endeavour so to intercalate the more recently described species as to preserve the essential features of that monumental work. I shall not follow him blindly, however. I shall consider the opinions of the special students of each local fauna as entitled to great weight, and I shall constantly subject questions of synonymy to the test of comparison of specimens in the admirable collections of terrestrial shells in the Museum of the Academy of Natural Sciences of Philadelphia."

Mr Tryon lived to complete four volumes, the first dealing with the Testacellidæ, etc., the second with the Zonitidæ, and the third and fourth with various orders of the Helicidæ, when death put an end to his labours.

Fortunately in February, 1888, a fit successor to continue this important work, was found in Mr. Henry A. Pilsbry, Conservator of the Conchological Section of the Academy of Natural Sciences of Philadelphia. Mr. Pilsbry completed the Helicidæ in Volume IX., and took this opportunity to make an index and a revision of all orders and sub-classes described by his predecessor. Twenty-two volumes dealing with inoperculate land shells have been published to date. The following table gives a brief summary of their contents and shows where the indexes are to be found :—

Descriptions Volume.	Family.	Index Volume.
I	Testacellidæ to Arionidæ	I
II	Zonitidæ, Endodontidæ (*Laoma, Flammulina, Endodonta, Pyramidula*) ..	IX
III-IX	Helicidæ, Acavidæ (*Strophocheilus, Gonyostomus*)	IX
X-XIV	Bulimulidæ, Cerionidæ	XIV
XV-XVI	Urocoptidæ, Megaspiridæ	XVI
XVI-XX	Achatinidæ, Oleacinidæ, and Ferrusacidæ	XX
XXI	Partulidæ	XXI
XXI-XXII	Achatinellidæ	XXII

This system of classification is now generally accepted and was used by Mr. Charles Hedley and Mr. W. F. Petterd in their valuable "Revised Census of the Terrestrial Mollusca of Tasmania." It will be necessary to bring the collections of land shells in our museums into agreement with Pilsbry's classification if they are to be of any service to students and collectors.

It is understood that the Manual is not to be extended to include the Pelecypoda. This is a distinct loss to science and to the species makers, whose timidity in dealing with bivalves contrasts with the readiness with which they attack material where the main divisions have been dealt with by Tryon or Pilsbry.

The loss of the trawler Endeavour will also be a loss to scientific study in Australia. Material collected by the trawler was distributed to various workers of eminence in the field of science, the Mollusca being reported upon by Mr. Charles Hedley, Assistant Curator and Conchologist, Australian Museum, Sydney. Mr. Hedley took part in one cruise from Melbourne to Nuyt's Archipelago, W. Australia, when he obtained specimens of some three hundred and fifty species, the greatest haul being made in the neighbourhood of Cape Wiles, South Australia. In his report on the Mollusca obtained by the F.I.S. "Endeavour," chiefly off Cape Wiles, South Australia, the writer gives a list of Adelaidean species, and describes a number of new shells. The most important feature of the paper is a separation under Carpenter's title—Amphithalamus—of a section of the swollen genus *Rissoa*. The Australian species and their synonyms are given for the benefit of systematists generally. In Part II. of the same series, Sydney, 2nd February, 1914, a number of large shells taken in the Australian Bight are described, some being new species, and various changes in classification are indicated.

One of the most important of recent additions to Australian Conchology is Mr. Hedley's "Notes in Museums Abroad" forming Part XI. of "Studies of Australian Mollusca." In conjunction with Mr. E. A. Smith, the Conchologist of the Natural History Museum, South Kensington, the writer examined many critical and doubtful species, each of which is discussed at length, and notes on their localities, synonyms, etc., are given. Much of this information was supplied by the learned British conchologist, his opportunities in charge of the South Kensington collection having made him one of the arbiters in molluscan determination.

Mr. Hedley also visited Newcastle, England, to study G. F. Angas's Australian land-shells, and Geneva, where Lamarck's priceless collection is housed in the city museum. Of this collection the well known conchologists Kiener and Chenu were in turn curators. The result of Mr. Hedley's critical studies is the relegation to the position of synonyms of many names that have swollen Australian lists, and recommendations that some twenty-four species be struck off as incorrect recognitions, or because they have never been figured, or from the habitat proving to be outside Australian waters, etc., Objection has already been given*

* Shirley, Proc. Roy. Soc. Q., 1914, XXVI., 48.

to the elimination of *Arca pistachia*, Lamk., from Queensland shells, and a further objection may be made to striking *Thalotia tricingulata*, A. Ad., off our lists. This shell is found plentifully at Murray Island, and extends at least as far south as Gladstone. It agrees far too closely with *Monodonta diminuta** Hedley, which is likely to prove a synonym.

Mr. Hedley's "Studies of Australian Mollusca," Part XII., contains much important matter for the collector and systematist. There is a rearrangement of the former overweighted genus *Voluta* giving generic rank to a number of its subdivisions, and rearranging under these all known Australian species. The beautiful shell, *Scaphella reticulata*, Rve., disappears from the Queensland list, Mr. Tom Iredale proving that this name had already been used, and renaming it *S. hedleyi*. A very appreciative article on the French conchologist Montrouzier is introduced in connection with a generic name given in his honour by Souverbie which lapses, having been previously appropriated in entomology.

In the examination of protean forms of *Acmæa* and *Helcioniscus* pertinacity and keen research are exhibited, and many tangled skeins are straightened for the assistance of the student. To those who have similar work to do in other branches of biology, a study of the argument upon the many-named *Patella tramoserica*, Chemnitz, will be of service.

All descriptions are detailed enough to aid recognition, without being so minute as to be true of the type specimen only; and the plates, as is always the case in Mr. Hedley's papers, are models of their kind. A large proportion of the new species are additions to the Queensland fauna.

Mr. Tom Iredale, the authority on Chitons, paid a visit to Queensland during the meeting of the Australasian Association in Brisbane, 1909. He collected round Caloundra, at the northern end of Moreton Bay, where he obtained fifteen species, of which ten had not previously

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* Hedley, Rec. Aust. Mus., VIII, I., p. 137, Pl. XLI, f. 12.

been recorded for our State. In all, Mr. Iredale collected ninety-five species of Australian Polyplacophora. At his request, to assist him in his studies, specimens of Chitons in my collection were sent to him, in all forty-six species or marked varieties, of which the majority have been returned, while some are still under consideration. Kindly recognition of the assistance given was made through the Proceedings of the Malacological Society.*

In a paper in Proc. Zool. Soc.,† Mr. Iredale deals with a small collection of shells from the Montebello Islands, W.A. As the Dampierian province stretches from Cape York along the northern and western portions of Australia to Shark Bay, it is not surprising that a number of the species identified are found in the Gulf of Carpentaria, and much helpful work has been done in collating the synonyms of well known species.

The late Mr. A. J. Jukes-Browne, F.R.S., F.G.S., a writer both on fossil and on recent shells, was specially interested in Pelecypoda, and wrote a series of articles in the proceedings of the Malacological Journal of which Part II. appeared in Volume XI., Part II., June, 1914. To this conchologist were forwarded specimens of all collected species of the *Venus* family. Review of the shells forwarded proved more conclusively than ever the great want of a standard work on bivalves; it also revealed the overlapping of species, the distribution of shells under incorrect names, and the simultaneous use of several synonyms for one and the same shell. Mr. Jukes-Browne was specially interested in *Cytherea embrithes*, Melville and Standen, whose astonishing similarity to the Madeiran *Cytherea* (*Antigona*) *effossa*, Phil, was shown on receipt of a specimen from my correspondent. Through a relative the sad news has just come to hand of Mr. Jukes-Browne's death, after much suffering, which did not keep him from carrying on his beloved studies to the last. His collection has been left to Oxford University. His death, as his labours were beginning to evolve order out of the chaos of bivalve nomenclature and classification, will be a distinct loss to all students of this branch of natural history.

* Loc. cit., Vol. XI, Pt. 2, p. 131.
† 1914, Pt. 3, p. 665.

Mr. H. H. Bloomer, well known for his anatomical studies of shell-fish, especially the genus *Siliqua* and its allies, made a collection of marine shells during a visit to Queensland in 1912. He submitted a small collection of Moreton Bay bivalves to Mr. E. A. Smith. These were chiefly Mactridæ, and were dealt with by the conchologist of the British Museum in the Proceedings of the Malacological Society.* The paper, by its table of synonymy, sheds much long-needed light on species reported from Queensland ; it makes a new species, *M. queenslandica*, of a shell formerly distributed under various names, and common in Moreton Bay. It also determines a common, dirty-brown *Mactra*, to be picked up anywhere on the beach at Caloundra, as *M. tristis*, Desh. This paper still further accentuates the need for the continuation of Tryon's Manual to include the Pelecypoda.

As in other groups of animals the teeth of mollusks are of assistance in the grouping of genera and the classification of species. In the volume on " Molluscs and Brachiopods " of the Cambridge Natural History Series, the figures of radulæ or lingual ribbons, are all taken from original specimens in the collection of the Revd. Professor H. M. Gwatkin, D.D., M.A. At the request of the Professor a number of Queensland shells, each containing the animal and preserved in spirit, were forwarded to him, and he very kindly returned a large number of mounted radulæ, of which many were Australian. These, when viewed under the microscope, are among the most beautiful objects in nature.

In a presidential address of October 11th, 1914, entitled " Some Molluscan Radulæ " published in the " Journal of Conchology " the value of a study of this branch of anatomy is strikingly shown. Professor Gwatkin states : " The distribution of *Physa* is anomalous. Like the higher mammalia, it has not reached Australia and Polynesia—at least all the *Physas* I have seen from those parts have the radula of *Isidora* (including *Physopsis*). Nevertheless there is a true *Physa* (*Physa compacta*, Gld.) from the Hawaiian Islands Either we have overlooked *Physas*

* Loc. cit., Vol. XI., Pt. 2, pp. 137-151.

in Australia, or — what I am more inclined to think— this *Physa*, like some of the birds, may be of American origin." Yet Mr. E. A. Smith in a paper read before the Linnean Society of New South Wales, April 21st, 1881, gives the names of fifty-two species of Australian *Physas* and one of *Physopsis*.

Mr. H. B. Preston, F.L.S., is one of the best known writers on land-shells. He has published papers on the Pulmonata from all parts of the world, including recent ones on Chinese, Nigerian, British East African, South African, and Uruguayan shells. To Australian conchology his study of shells from the Montebello Islands, West Australia, is a valuable addition Several parcels of Queensland mollusca have been sent to Mr. Preston, among which were a few new species.

For a record of Victorian marine mollusca, and for the determination of many new species, we are indebted during recent years mainly to Mr. J. H. Gatliff, at first in conjunction with Mr. G. B. Pritchard, but for the last seven years in collaboration with Mr. C. J. Gabriel. Over one thousand marine species have been recorded from Victorian waters. An index of seven hundred and sixty-five species was given in the Proceedings of the Royal Society of Victoria, in 1905,* and between two and three hundred additions have since been announced. In illustration of new species, Mr. Gatliff and his colleagues have at times made use of photographs of large shells taken on a black background. These are particularly clear and definite, and, where the copies are struck off distinctly, are of more use to collectors and workers generally than a drawing. This will be readily acknowledged by any expert studying such an illustration as Plate XV., of Proc. Roy. Soc., Victoria, 1903.

South Australian conchologists have been assisted in their studies by the labours of Dr. J. C. Verco, who published a list of nine hundred and sixty Adelaidean species, in 1908, to supersede the out of date and out of print list published by Adcock in 1893. For over twenty years Dr. Verco has devoted himself to this branch of biology, and has now one

* Proc. Roy. Soc., Vic., 18 (N.S.), Pt. II., pp. 70-92.

of the finest private collections in Australia It may interest members of this Society to know that the late Mr. G. Gross's collection passed into Dr. Verco's hands, and arrangements have been made which will prevent this valuable collection of Australian shells from being broken up. Recently Dr. Verco has extended his studies to the great Australian Bight and Western Australia generally, and in the "Transactions of the Royal Society of South Australia" for 1912,* gives a list of one hundred and fifty shells mainly from Geraldton and the Abrolhos Islands.

The Polyplacophora of Dr. Verco's list were furnished by Dr. W. G. Torr, also of South Australia, who has made this difficult family his special study. Dr. Torr has collected in most of the Australian States, and alone, or in collaboration with Mr. W. L. May and others, has published critical notes and descriptions of new species which have been of marked assistance, especially to southern workers.

Tasmania has been noted for its many workers and collectors in the conchological field, of whom Petterd, Legrand, Simson, Beddome, Miss M. Lodder, the Revd. Tenison-Woods, may be mentioned. The "Census" of Tasmanian Shells of the latter, published in 1878† was revised in the Proceedings of the Linnean Society of New South Wales, 1901,‡ by Professor Ralph Tate and Mr. W. L. May; since which date Mr. May has communicated many papers on the molluscan fauna of the island, mainly by means of the publications of its Royal Society. Other of Mr. May's papers, in conjunction with Dr. Torr or with Mr. C. Hedley, appear in the same series or in the "Records of the Australian Museum." Mr. May has done much to clear the way for those who follow him in the study of Tasmanian shells, by ridding the list of false entries, by his extensive lists of synonyms, by his study of critical species, and by constant reference to typical specimens, especially to those in the collections of the Tasmanian Museum.

The geological distribution of marine shellfish is receiving increased attention since the bulk of existing species have been determined and recorded.

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* Loc. cit., Vol. XXXVI, pp. 202-205.

† Proc. Roy. Soc., Tas., pp. 26-57 1877.

‡ P.L.S., N.S.W., 1901, Pt. 3, July 31st, pp. 344-471, Pl. XXXIII-XXXVII.

Our coasts have been divided into four sub-regions—(1) The Solanderian, from Cape York to Moreton Bay; (2) The Dampierian, from Cape York to Shark Bay; (3) The Adelaidean, from Shark Bay to the Australian Bight along the south coast of Australia, to Wilson's Promontory, and including the west side of Tasmania; (4) The Peronian, taking in the east side of Tasmania, Victoria and New South Wales, to Moreton Bay. The first and second of these are subdivisions of the great Indo-Pacific Province, and the third and fourth of the Australian Province. Shells have been assigned to each of the four subprovinces, not always in a tentative way, but from the point of view of the courtiers of King Canute, the creatures being expected to obey the arrangement made for them, however artificial or temporary.

Some few years ago specimens of a striking species of *Littorina* were sent down from Yeppoon, and were submitted to a specialist for determination. He decided that they belonged to an American species from the North Atlantic, and that they could not have come from Keppel Bay. Recently Dr. Hamlyn-Harris visited Dunk Island and picked up a single specimen of the same *Littorina* on the island beach. While such mistakes are possible, it is well to make our schemes of distribution elastic, until the gaps in our information have been filled in.

My main purpose in placing this information before the Royal Society of Queensland is to show how little is being done for Queensland conchology within the State, and to point out to possible workers what a wide field and what splendid opportunities lie waiting for them. With the opening of the Queensland University new workers in biology are being added to our present meagre list, and the known species of marine mollusca, numbering close on two thousand five hundred at present, should in the next few decades be raised to three or four thousand. Of known species little has been recorded about the animals themselves, and large stores of material await the coming of the anatomist, the physiologist and the student of life histories.

STUDIES IN AUSTRALIAN LEPIDOPTERA.

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

(*Read before the Royal Society of Queensland, 26th April, 1915.*)

Family ARCTIADÆ.

Subfamily Nolinæ.

Pisara hyalospila.

ὑαλοσπιλος, with transparent spot.

Pisara hyalospila, Hmps. Cat. Lep. Phal., Suppl. i., p. 389.

♂ ♀ 18-20 mm. Head white. Palpi 3; pale brownish. Antennæ grey; basal joint white; ciliations in ♂ 2. Thorax brown mixed with whitish. Abdomen whitish; a strong basal dorsal crest pale brown. Legs whitish with some fuscous irroration; anterior femora and tibiæ fuscous; anterior and middle tarsi fuscous with white annulations. Forewings suboblong, costa rather strongly arched, apex rounded, termen obliquely rounded; in ♂ with a square hyaline fovea at $\frac{1}{3}$ with transversely striated base and visible on both upper and lower surfaces; white; basal third fuscous brown with a darker outwardly curved transverse line from $\frac{1}{3}$ costa to $\frac{1}{4}$ dorsum; fovea preceded and followed by a raised tuft of scales; a fine interrupted dark fuscous line from $\frac{3}{5}$ costa to mid-dorsum, curved outwards in disc; a thick dark fuscous line from costa before apex to tornus, straight but with a posterior dentation above tornus; a fuscous terminal line; cilia white with some fuscous irroration. Hindwings with termen rounded grey-whitish, towards base whitish; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in June and October. Q Brisbane. Three specimens.

Celama thyridota.

θυριδοτος, windowed.

Celama thyridota, Hmps. Cat. Lep. Phal., Suppl. i., p. 390.

14-16 mm. Head white. Palpi $2\frac{1}{2}$; white external surface suffused with pale fuscous. Antennæ white; in ♂ finely pectinated. Thorax white with some pale fuscous suffusion. Abdomen grey-whitish, apices of segments white. Legs white, with some fuscous irroration; tarsi fuscous annulated with white. Forewings triangular, costa nearly straight to beyond middle, then rather abruptly bowed, apex rounded, termen obliquely rounded; in ♂ with a large oval hyaline fovea in costal and posterior part of cell, and a second narrower similar fovea between bases of veins 6 and 7; white with some fuscous and brownish irroration; three raised tufts on costa, fuscous-brownish; first near base; second at $\frac{1}{4}$, its apex rounded, expanded, dark-fuscous, preceding first fovea; third shorter, its rounded apex lying between the two foveæ; a dark-fuscous dot beneath second tuft; a fine dark fuscous transverse line at $\frac{3}{4}$, with slight outward projections in middle and above dorsum; an irregularly dentate pale fuscous subterminal line, with subcostal and median projections; an interrupted pale fuscous terminal line; cilia white with greyish specks. Hindwings with termen rounded; grey-whitish; cilia grey-whitish.

Exactly like *C. bifascialis*, Wlk., which is found in the same localities, except for the ♂ foveæ. The only difference I can detect in the ♀ is in the shape of the forewings, but this may not be trustworthy.

Type in Coll. Turner.

N.Q., Townsville, in May (♂ type); Q., Brisbane (1 ♀).

Nola lechriopa.

λεχιωπος, oblique-looking.

Nola lechriopa, Hmps. Cat. Lep. Phal., Suppl. i., p. 418; Pl. 24, f. 10.

♂ ♀ 16-18 mm. Head white, irrorated with grey. Palpi 3; grey. Antennæ grey-whitish; in ♂ with moderately long ciliations (2). Thorax grey, with slight fuscous irroration. Abdomen pale grey. Legs whitish, with fuscous irroration; anterior pair fuscous; all tarsi fuscous with whitish annulations. Forewings elongate-triangular, costa moderately arched, more strongly towards apex, apex rounded, termen obliquely rounded; grey, with slight fuscous and whitish irroration: three small tufts of raised scales beneath costa, near base, at $\frac{2}{5}$, and middle, fuscous; a slender fuscous line, internally oblique, from second tuft, bent outwards and dentate near dorsum, ending on $\frac{1}{3}$ dorsum; a dark fuscous finely dentate line from $\frac{2}{3}$ costa, at first outwards, then strongly sinuate and very obliquely inwards, bent outwards again beneath middle of disc and ending on dorsum at $\frac{2}{3}$, its posterior edge suffusedly grey-whitish; a faintly darker dentate subterminal line; also edged posteriorly with grey-whitish; some obscure dark terminal dots; cilia grey, with whitish specks. Hindwings rather elongate, termen gently rounded; pale grey; cilia pale grey.

Type in Coll. Turner.

Q., Brisbane, in July and September; Stradbroke Island, in September; four specimens.

Nola zaplethes.

ζαπληθης, of full size.

Nola zaplethes, Hmps. Cat. Lep. Phal, Suppl. i., p. 418. Pl. 24; f. 9.

♀ 28 mm. Head white; face irrorated with pale brownish-fuscous. Palpi 2; pale brownish-fuscous, basal joint dark fuscous. Antennæ grey-whitish. Thorax whitish, tegulæ pale brownish-fuscous. Abdomen whitish. Legs whitish; tarsi fuscous, with whitish annulations; anterior coxæ fuscous. Forewings suboblong, costa strongly arched at base, then straight (apex broken), termen obliquely rounded; whitish; a broad pale fuscous streak from base along costa to $\frac{1}{6}$; a dark fuscous ring on costa at $\frac{2}{5}$; a pale fuscous suffusion on costal half of disc containing crests of raised scales at $\frac{1}{3}$ and middle; a curved dark fuscous line from $\frac{3}{4}$ costa towards midtermen, then bent parallel to termen not reaching tornus ; cilia whitish. Hindwings with termen rounded ; grey-whitish ; cilia grey-whitish.

Type (damaged) in Coll. Turner.

Q., Mount Tambourine, in November ; one specimen. The locality given by Hampson is incorrect.

Nola phlœophila.

φλοιοφιλος, bark-loving.

Nola phlœophila, Hmps. Cat. Lep. Phal., Suppl. i., p. 419. Pl. 24 ; f. 11.

♂ ♀ 22-24 mm. Head white, with a few dark fuscous scales. Palpi 3 ; whitish, towards base dark-fuscous, in ♀ mostly dark-fuscous. Antennæ grey-whitish, towards base white ; ciliations in ♂ 2. Abdomen pale fuscous ochreous-tinged ; tuft whitish-ochreous. Legs fuscous ; posterior pair ochreous-whitish. Forewings suboval, costa strongly and uniformly arched, apex round-pointed, termen obliquely rounded ; whitish with fuscous irroration ; markings dark-fuscous ; a short broad streak from base of costa ending in a raised tuft ; a fine line from $\frac{1}{4}$ costa obliquely outwards to a raised tuft, there sharply angled, again angled outwards, then curved to $\frac{1}{4}$ dorsum ; a third tuft beneath mid-costa connected by a subcostal streak with second tuft ; a second line from midcosta very obliquely outwards, then curved and continued by interrupted dots to mid-dorsum ; some fine streaks on veins in subterminal area, with some whitish streaks succeeding them, and in ♀ a series of short streaks running into termen ; cilia grey barred with whitish, apices whitish. Hindwings with termen rounded ; grey ; cilia pale grey.

Type in Coll. Turner.

Q., Brisbane, in July and August ; three specimens on tree trunks.

Nola belotypa.

βελοτυπος, marked with a dart.

Nola belotypa, Hmps., Cat. Lep. Phal. Suppl. i., p. 421, Pl. 24, f. 15.

♂ ♀ 21-22 mm. Head white ; in ♀ grey. Palpi 5 ; grey, internal surface whitish. Antennæ pale grey, towards base whitish ; ciliations in ♂ 2. Thorax grey, anteriorly in ♂ white. Abdomen grey-whitish. Legs fuscous ; posterior pair whitish. Forewings elongate-triangular, costa gently arched, apex round-pointed, termen obliquely rounded ; whitish suffused with pale brownish-fuscous ; markings dark-fuscous ; a subcostal streak from base of costa to middle, gradually attenuating, with a raised tuft at $\frac{1}{3}$ of disc and at termination ; a very oblique sharply and finely dentate line from $\frac{3}{4}$ costa to mid-dorsum, succeeded by a whitish shade ; cilia grey irrorated with whitish. Hindwings with termen rounded ; pale grey, cilia pale grey.

Type in Coll. Turner.

N.S.W., Ebor in January ; Mount Victoria, near Katoomba, in February ; two specimens. The locality given by Hampson is incorrect.

Subfamily Lithosianæ.

Graphosia stenopepla.

στενοπεπλος, narrow-robed.

Graphosia stenopepla, Hmps., Cat. Lep. Phal. Suppl. i, p. 444, Pl. 25, f. 12.

♂ ♀ 24-26 mm. Head, palpi, and thorax pale ochreous. Antennæ pale-ochreous ; in ♂ with short ciliations ($\frac{1}{3}$), and longer bristles (1). Abdomen and legs whitish-ochreous. Forewings narrow-elongate ; costa gently arched towards apex, apex rounded-rectangular, termen obliquely rounded ; whitish-ochreous irrorated with fuscous, more so towards termen ; a fuscous fascia from $\frac{2}{3}$ costa to mid-dorsum, interrupted beneath costa, its anterior edge straight, posterior edge sharply dentate, in ♀ obsolescent ; cilia whitish-ochreous. Hindwings elongate-ovate, termen rounded ; whitish-ochreous ; cilia whitish-ochreous.

Type in Coll. Turner.

N.Q., Atherton ; Q., Mount Tambourine, in November. Two specimens. The locality given by Hampson is incorrect.

Scoliacma xuthopis.

ξουθωπις, tawny.

Scoliacma xuthopis, Hmps., Cat. Lep. Phal. Suppl. i, p. 461, Pl. 25, f. 22.

♀ 24 mm. Head, palpi, antennæ, and thorax brownish-ochreous. Abdomen grey, tuft brownish-ochreous. Legs brownish-ochreous. Forewings elongate, posteriorly dilated, costa evenly arched, apex rounded, termen obliquely rounded; brcwnish-ochreous; a faint interrupted fuscous line from $\frac{2}{3}$ dorsum towards $\frac{3}{4}$ costa; cilia brownish-ochreous. Hindwings with termen sinuate beneath apex, then rounded; pale ochreous; cilia pale ochreous.

Type in Coll. Turner.

W.A., Albany, in January. One specimen.

Lepista pulverea.

Pulvereus, dusty.

Lepista pulverea, Hmps., Cat. Lep. Phal. Suppl. i., p. 462.

♀ 23-24 mm. Head, palpi, and thorax brownish. Antennæ brownish; in ♀ with short ciliations ($\frac{1}{3}$) and longer bristles (1). Abdomen brownish-grey. Legs pale brownish. Forewings narrow-elongate, costa evenly arched, apex rounded, termen obliquely rounded; whitish-ochreous unevenly irrorated with pale-fuscous, which sometimes forms a streak along fold, and a median streak beyond middle; cilia whitish-ochreous. Hindwings broadly ovate, termen rounded; pale ochreous; cilia pale ochreous.

Type in Coll. Turner.

Q., Burpengary, near Brisbane, in April; Stradbroke Island, in April; Coolangatta, in March; three specimens.

Poliosia zetesima, *n. sp.*

ξητησιμος, to be searched out.

Poliosia zatesima (misprint), Hmps., Cat. Lep. Phal. Suppl. i., p. 463, Pl. 25, f. 26.

♂ 12 mm. Head ochreous-grey-whitish; face grey. Palpi minute; grey. Antennæ ochreous-grey-whitish; in

♂ with moderate ciliations (1) and longer bristles ($1\frac{1}{2}$). Thorax ochreous-grey-whitish. Abdomen ochreous-whitish. Legs grey; posterior pair ochreous-whitish. Forewings narrow, costa moderately and evenly arched, apex rounded, termen obliquely rounded; ochreous-grey-whitish without markings; cilia whitish. Hindwings with termen rounded; ochreous-whitish; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns, in October; Evelyn Scrub, near Herberton, in December or January; three specimens.

HALONE CORYPHÆA, *n. sp.*

κορυφαιος, chief.

This is the species described by Mr. Meyrick (P.L.S. N.S.W., 1886, p. 729) as *Mosoda consolatrix*, Ros. This is, however, an erroneous identification, as that name is a synonym of *Halone sobria*, Wlk. In the British Museum the two species have been confused, and most of the localities given by Sir Geo. Hampson (Cat. Lep. Phal. i., p. 279) for *sobria* are erroneous. The present species has a wide distribution.

Q., Warwick. N.S.W., Tenterfield, Glen Innes, Ebor, Bathurst, Mount Kosciusko (4,700ft.). V., Beechworth.

HALONE EBÆA.

ἠβαιος, little.

Halone ebœa, Hmps., Cat. Lep. Phal. Suppl. i., p. 589, Pl. 31, f. 16.

♂ 10 mm. Head whitish. Palpi rather long (2), very slender; whitish, apex fuscous. Antennæ whitish; in ♂ minutely ciliated. Thorax whitish. Abdomen fuscous, tuft whitish. Legs whitish. Forewings oval, costa strongly and evenly arched, apex rounded, termen obliquely rounded; whitish with a few fuscous scales; markings fuscous, indistinct; a dot on midcosta, a second in mid-disc, a third in fold, and a fourth on mid-dorsum, representing an angulated median line; a fine interrupted line from $\frac{3}{4}$ costa to $\frac{5}{6}$ dorsum, angulated outwards in disc; a dot on termen beneath apex, and a second above tornus;

cilia whitish. Hindwings with termen rounded, slightly sinuate beneath apex; pale grey; cilia pale grey.

Type in Coll. Turner. A minute and insignificant species.

N.Q., Kuranda, near Cairns, in February, March and May; Innisfail in November; seven specimens.

Macaduma picroptila.

πικροπτιλος, with sharp-pointed wings.

Macaduma picroptila, Hmps., Cat. Lep. Phal. Suppl. i., p. 580.

♂ 20 mm. Head, palpi, and thorax brown. Antennæ brown, in ♂ moderately ciliated (⅔), with longer bristles (1½). Abdomen grey; basal segment and apical tuft brown. Legs whitish-brown. Forewings irregularly quadrate, costa sinuate, strongly bowed at ¾, apex acute, produced, termen concave; 7, 8 and 9 stalked; brown, without defined markings; a fuscous dot on midcosta and another slightly beyond; traces of a transverse line from second dot; cilia ochreous-brown. Hindwings with termen rounded, slightly sinuate beneath apex; grey; short brown streaks from base along median and internal veins; cilia grey.

Type in Coll. Turner.

Q., Burpengary, near Brisbane, in April; one specimen.

Caprimima pelochroa.

πηλοχρωος, clay-coloured.

Caprimima pelochroa, Hmps., Cat. Lep. Phal. Suppl. i., p. 611, Pl. 32, f. 16.

♂ ♀ 15-18 mm. Head, palpi, and thorax brownish-fuscous. Antennæ brownish-fuscous; ciliations in ♂ 1½. Abdomen brownish-fuscous. Legs brownish-fuscous; posterior pair whitish. Forewings triangular, costa rather strongly and evenly arched, apex rounded, termen obliquely rounded; brownish-fuscous; a fine strongly-dentate fuscous line from ⅓ costa to ⅓ dorsum, in ♂ sometimes blackish on costa; a second similar but more finely dentate and often indistinct line from $\frac{2}{3}$ costa to $\frac{2}{3}$ dorsum, bent outwards in disc ; a similar indistinct subterminal line ; cilia brownish-fuscous. Hindwings with termen rounded, slightly sinuate beneath apex ; brownish-fuscous ; cilia brownish-fuscous.

Type in Coll. Turner.

Q., Brisbane, in May and July ; Killarney, in October ; three specimens. The locality given by Hampson is incorrect.

TRICHOCEROSIA ZEBRINA.

Trichocerosia zebrina, Hmps., Cat. Lep. Phal. Suppl. i., p 739, Pl. 38, f. 26.

♂ ♀ 20-25 mm. Head blackish, face orange. Palpi blackish. Antennæ blackish ; in ♂ bipectinate to apex, pectinations 6 ; in ♀ serrate ; in both sexes hairy on upper surface of shaft. Thorax blackish, tegulæ orange. Abdomen blackish, apical segments ochreous ; towards base beneath ochreous with two pairs of lateral orange spots. Legs blackish ; middle joints of posterior tarsi ochreous. Forewings narrowly elongate-ovate, costa moderately arched, apex rounded, termen obliquely rounded ; blackish ; a transverse orange streak from dorsum near base, not reaching costa ; an orange spot above dorsum at $\frac{1}{4}$; a second orange streak from mid-dorsum, in ♀ almost reaching midcosta, in ♂ shorter ; an ochreous spot just above tornus, with another above in disc, in ♂ these two spots are absent ; cilia blackish. Hindwings elongate-ovate ; blackish ; an orange sub-basal spot ; a larger median spot elongated transversely ; cilia blackish.

A brilliant little species very tropical in appearance. It differs from the type in having vein 9 present arising with 8 by a common stalk from 7.

Type in Coll. Lyell.

N.S.W., Lilyvale, Wingham, and Stanwell Park, near Bulli, in March ; four specimens.

Gen. IONTHAS.

ἰονθας, with fine hairs.

Ionthas, Hmps., Cat. Lep. Phal. Suppl. i., p. 777.

Head, thorax, and abdomen clothed with hairs above and beneath. Tongue absent. Palpi minute, porrect.

Antennæ of ♂ bipectinate to apex, pectinations long. Anterior coxæ hairy. Posterior tibiæ with all spurs present. Wings clothed with fine hairs. Forewings with 2 from $\frac{2}{3}$, 3, 4, 5 separately from near angle, 6 from near upper angle, 7, 9 stalked, 8 absent, 10 connate with 9, 11 from $\frac{2}{3}$. Hindwings with 3 and 4 connate, 5 approximated at base to 4, 6 and 7 stalked, 8 anastomosing with cell to $\frac{1}{6}$.

IONTHAS ATARACTA.

ἀταρακτος, unperturbed.

Ionthas ataracta, Hmps., Cat. Lep. Phal. Suppl. i., p. 777.

♂ 24 mm. Head pale ochreous-yellow. Palpi fuscous. Antennæ fuscous; pectinations in ♂ very long (10). Thorax fuscous; tegulæ pale ochreous-yellow. Abdomen ochreous. Legs fuscous. Forewings elongate-triangular, costa gently arched, apex rounded, termen rounded; oblique; pale fuscous; cilia fuscous-whitish. Hindwings broad, termen rounded; pale ochreous-yellow; a moderate fuscous terminal band, attenuated shortly beneath apex; cilia pale-fuscous.

Type in Coll. Turner.

Q., Warwick, in October; one specimen.

Subfam. Arctianæ.

RHODOGASTRIA TIMIOLIS, *n. sp.*

τιμιολις, worthy of honour.

♂ ♀ 60-64 mm. Head whitish, with a black dot on crown and another on forehead. Palpi short (1), not nearly reaching vertex; rosy, beneath whitish, apices of joints broadly blackish. Antennæ blackish, towards base rosy; in ♂ with minute almost inappreciable ciliations and short bristles ($\frac{1}{2}$). Thorax whitish with ten black dots, one each on tegulæ and patagia, and a double row of three on thorax. Abdomen rosy; basal segments in ♂ partly whitish-ochreous; a double lateral row of black dots; beneath whitish. Legs ochreous-whitish longitudinally streaked with rosy; tarsi rosy; a black dot on base of anterior coxæ. Forewings elongate-oval, costa strongly arched, apex round-pointed, termen slightly rounded, strongly oblique; whitish, semihyaline; a black dot on base of costa, a second on middle of base, and a third closely following second; a pale ochreous-fuscous broad transverse bar beyond middle on end of cell; a large similar apical patch; in ♂ whole of basal area to middle and on dorsum to tornus suffused with pale ochreous-fuscous; cilia whitish, in ♂ pale ochreous-fuscous. Hindwings with termen slightly rounded in ♀, more strongly in ♂; in ♀ whitish; in ♂ wholly suffused with pale ochreous-fuscous, with long hairs on basal area, and a darker bar on end of cell; cilia whitish.

Type in Coll. Turner.

N.Q., Kuranda, near Cairns (♀); Townsville in April; three specimens received from Mr. F. P. Dodd. I have also seen a ♀ from N.A., Melville Island. The ♀ from N.Q., Cape York, described by Mr. Meyrick as *astreas*, Drury, is in all probability the same species. The females of the two species are scarcely distinguishable, but the males are very different

Fam. NOCTUIDÆ.

Subfam. Agrotinæ.

Canthylidia eurhythma, *n. sp.*

εὔρυθμος, well-proportioned.

♀ 25-26 mm. Head ochreous-whitish; face pale ochreous-fuscous. Palpi ochreous-whitish. Antennæ pale ochreous-fuscous. Thorax ochreous-whitish. Abdomen whitish-ochreous, towards base ochreous. Legs ochreous-whitish. Forewings triangular, costa nearly straight, apex rounded, termen bowed, oblique; ochreous-whitish; markings dark-fuscous irrorated with pale-ochreous so as to appear greenish; a broad median band, edged internally by a dentate fuscous line, and including a round whitish median discal spot; a fine dentate line from $\frac{2}{3}$ costa, extending outwards beneath costa, then bent, and slightly sinuate to $\frac{2}{3}$ dorsum; a subterminal transverse shade; a terminal series of dark-fuscous dots between veins; cilia grey-whitish. Hindwings with termen rounded; ochreous-whitish; a broad fuscous terminal band; cilia whitish, with a grey sub-basal line.

Type in Coll. Turner.

Q., Gayndah; two specimens received from Dr. Hamilton Kenny.

ARIATHISA SPILOCROSSA, *n. sp.*

σπιλοκροσσος, with spotted border.

♂ 26 mm. Head and palpi dark-fuscous. Antennæ dark-fuscous: in ♂ shortly and evenly ciliated ($\frac{1}{2}$). Thorax dark-fuscous with a few whitish scales. Abdomen grey. Legs fuscous mixed with whitish; posterior pair paler; tarsi dark-fuscous annulated with whitish. Forewings elongate-triangular, costa straight, apex rounded, termen scarcely oblique, rounded beneath; dark-fuscous; markings and some scattered scales whitish; a short dentate line from costa near base not reaching dorsum; a dentate line from $\frac{1}{4}$ costa to $\frac{1}{3}$ dorsum; orbicular represented by a minute white dot; reniform by a blackish spot, its posterior lower angle produced into a sharp point, edged especially posteriorly by whitish; two sharply dentate lines from beneath reniform to before tornus; a series of dots along apical half of costa and whole of termen; cilia fuscous, apices whitish. Hindwing grey; cilia whitish, towards apex grey.

Type in W.A. Museum.

W.A., Busselton, in October; two specimens.

Fam. LYMANTRIADÆ.

Subfam. Lymantrianæ.

Gen. EUZORA, nov.

εὔζωρος, pure.

Palpi minute, porrect. Antennæ bipectinated in both sexes. Thorax and abdomen not crested. Posterior tibiæ without middle spurs. Forewings with 2 from $\frac{3}{5}$, 3 from before angle, 7, 8, 9 stalked, 7 arising before 9, 10 and 11 from cell, no areole. Hindwings with 5 approximated at base to 4, 6 and 7 connate, 8 approximated to cell before middle.

Type *Porthesia collucens*, Luc. This genus is the same as *Caragola*, Moore, Lep. Atk., p. 46 (1879), Hmps., Moths Ind. i., p. 489, but that name is preoccupied (Gray, Pisces, 1851).

Euzora collucens.

Porthesia collucens, Luc., P.L.S. N.S.W., 1889, p. 1090.
N.Q., Atherton. Q., Brisbane.

I formerly identified this species with *clara*, Wlk., Cat. Brit. Mus. xxxii., p. 343, but I note that Sir Geo. Hampson, Moths Ind. i., p. 490, states that in that species the palpi and legs are orange, which is not the case in my example.

Lymantria antennata.

Lymantria antennata, Wlk., Cat. Brit. Mus., iv., p. 881.
Lymantria aurora, Turn., Tr. R.S.S.A., 1902, p. 181 (præocc.)
Lymantria turneri, Swin., Tr. E.S., 1903, p. 484.

Aurora = *turneri* is merely a varietal form. A series of bred specimens shows great variation in the reddish suffusion of abdomen and hindwings.

Lymantria maculosa, Wlk. Cat. Brit. Mus. iv., p. 881, is a synonym of *L. grandis*, Wlk., from Ceylon, and the Australian locality may be taken as erroneous.

Lymantria nephrographa, *n. sp.*

νεφρογραφος, kidney-marked.

♂ 62-65 mm. Head white. Palpi blackish. Antennæ fuscous or blackish, pectinations brown. Thorax white. Abdomen white, apices of segments blackish. Legs whitish; tarsi fuscous. Forewings triangular, costa moderately arched, apex round-pointed, termen nearly straight, oblique; grey-whitish; markings blackish or sometimes partly reddish; a basal spot; a spot on costa near base, and another beneath it; a transverse row of four dots at $\frac{1}{6}$; an irregularly dentate line from $\frac{1}{3}$ costa to $\frac{1}{3}$ dorsum; a dot on costa before middle; a reniform median pale-centred discal spot; a dentate interrupted line from $\frac{2}{3}$ costa to $\frac{2}{3}$ dorsum, bent inwards beneath reniform; a similar subterminal line; a terminal series of dots; cilia whitish, on dots partly blackish. Hindwings subquadrate, obtusely angled on vein 4; fuscous, towards termen grey-whitish; a terminal series of blackish dots of which the two next tornus are transversely elongate; cilia as forewings.

Type in Coll. Turner.

Q., Mount Tambourine; Killarney, in November; two specimens.

LYMANTRIA PELOSPILA, *n. sp.*

πηλοσπιλος, clay-spotted.

♂ 38 mm. Head white. Palpi whitish, faintly brownish-tinged. Antennæ ochreous-whitish. Thorax white. Abdomen whitish, towards base ochreous-tinged. Legs whitish. Forewings broadly triangular, costa straight to beyond middle, then strongly arched, apex rounded, termen nearly straight, rounded beneath, slightly oblique; white; a brown subcostal spot near base, and a second beneath it; a straight row of brown dots from $\frac{1}{3}$ costa to $\frac{2}{5}$ dorsum; a suffused brownish fascia from $\frac{4}{5}$ costa bent outwards in disc, and then strongly inwards, then outwards again to $\frac{4}{5}$ dorsum; a suffused interrupted line from $\frac{2}{3}$ costa joining fascia; cilia white. Hindwings with termen strongly rounded; white; cilia white. Veins 6 and 7 of hindwings are short-stalked, which is unusual in this genus.

Type in Coll. Turner.

N.T., Port Darwin, in October; one specimen received from Mr. F. P. Dodd.

IMAUS MARGINEPUNCTATA.

B—Bak., Nov. Zool. 1904, p. 410.

N.Q., Atherton; Kuranda, near Cairns in November, December, and February. Also from New Guinea.

Subfam. Anthelinæ.

ANTHELA CHRYSOCROSSA, *n. sp.*

χρυσοκροσσος, with golden border.

♂ 38 mm. Head fuscous, back of crown ochreous. Palpi fuscous, beneath ochreous. Antennæ pale ochreous, pectinations fuscous. Thorax fuscous; patagia with a basal ochreous spot. Abdomen densely clothed with very long hairs towards apex; fuscous. Forewings triangular, costa straight nearly to apex, apex rounded, termen strongly rounded, slightly oblique; fuscous, partly suffused with orange-ochreous; markings orange-ochreous; a streak along costa from base to $\frac{2}{3}$; a small discal spot at $\frac{1}{4}$, and another somewhat larger at middle; a fine strongly dentate subterminal line; cilia pale ochreous, bases mixed with fuscous. Hindwings with termen strongly rounded; dark fuscous; an ochreous discal dot at $\frac{1}{3}$; an orange-ochreous narrow terminal band containing a few dark-fuscous scales, its anterior edge dentate; cilia orange-ochreous, apices paler. Underside of forewings ochreous; discal dots faintly outlined and followed by a slight fuscous suffusion; a short fuscous line from costa at $\frac{3}{4}$; an interrupted dentate dark-fuscous subterminal line; a suffused fuscous terminal line not reaching tornus; of hindwings like upperside but with larger discal spot.

Type in Coll. Turner.

N.A., Batchelor, near Stapleton; one specimen received from Mr. G. F. Hill.

Anthela ochroneura, *n. sp.*

ὠχρονευρος, pale-nerved.

♂ 38 mm. Head and thorax ochreous-whitish. Palpi brownish-ochreous. Antennæ ochreous-whitish, pectinations brown. Abdomen pale brownish-fuscous; tuft and underside ochreous-whitish. Legs ochreous-whitish; anterior and middle pairs fuscous on anterior surface. Forewings triangular, costa straight, arched towards apex, apex rounded, termen strongly rounded, rather outwardly oblique; pale brownish-fuscous with strongly marked ochreous-whitish lines along veins; comprising a wide subcostal streak bifurcating beyond middle, and reuniting before apex, giving off five streaks to costa, apex and termen; a median streak giving off four streaks to termen; and a subdorsal streak ending in tornus; dorsal edge ochreous-whitish; cilia whitish, bases barred with pale brownish-fuscous. Hindwings with termen strongly rounded; pale brownish-fuscous; veins outlined by slender whitish lines; cilia as forewings. Underside similar, but lines on forewing obsolescent.

Type in Coll. Turner.

N.A., Stapleton, in January; two specimens received from Mr. G. F. Hill.

Anthela rubicunda.

♂ *Darala rubicunda*, Swin., A.M.N.H. (7), ix., p. 419 (1902).

♂ *Anthela phœnicias*, Turn., Tr. R.S.S.A., 1902, p. 182.

♀ *Anthela aspilota*, Turn., Tr. R.S.S.A., 1902, p. 182.

In spite of the difference in colour, the ♂ being reddish-purple and the ♀ ochreous, I now believe these two sexes to be of the same species, which has a wide distribution.

N.Q., Cairns, Stannary Hills. Q., Brisbane, Stanthorpe. N.W.A., Roeburne.

Fam. THYRIDIDÆ.

Gen. Abrotesia, *nov.*

ἀβρωτησιος, unfit for eating.

Head rounded. Tongue obsolete. (Palpi unknown). Antennæ of ♂ shortly bipectinate. Thorax and abdomen moderately stout. Posterior tibiæ not hairy. Forewings with 7 and 8 stalked, 9 and 10 short-stalked. Hindwings with 5 from below middle of discocellulars, but remote from 4, 6 and 7 remote at origin.

Abrotesia griphodes, *n. sp.*

γριφωδης, reticulated.

♂ 20 mm. Head reddish-brown. (Palpi broken). Antennæ reddish-brown; in ♂ shortly bipectinate (1). Thorax dark-brown; tegulæ and posterior end reddish-brown. Abdomen dark-brown, apices of segments ochreous. Legs brownish-ochreous. Forewings triangular, costa straight, apex round-pointed, termen strongly bowed, oblique; brownish-ochreous coarsely reticulated with brown-fuscous; a broad dorsal streak; a transverse fascia at $\frac{1}{3}$, and another at $\frac{2}{3}$, with some fine transverse lines before and between fasciæ; coarse reticulations between second fascia and apex; cilia brown-fuscous. Hindwings with termen slightly rounded; similar to forewings, but with fasciæ narrower. Underside similar, but pale-ochreous.

Type in Coll. Turner.

N.A., Port Darwin, in January; one specimen received from Mr. F. P. Dodd.

Gen. CYDRASTIS, *nov.*

κυδραστις, illustrious.

Frons rounded. Tongue well-developed. Palpi long, porrect; terminal joint long, stout, obtuse. Antennæ of ♂ (unknown). Thorax and abdomen moderately stout. Posterior tibiæ hairy. Forewings with 7 and 8 stalked, 9 and 10 parallel and closely approximated. Hindwings with 5 approximated to 4 at origin, 7 from before angle of cell, closely approximated to 8 for a short distance.

Allied to *Aglaopus*, Turn, with which it agrees in neuration, but differs markedly in the palpi.

CYDRASTIS CARYCINA, *n. sp.*

καρυκινος, blood-red.

♀ 24 mm. Head yellowish mixed with red; face bright red. Palpi $2\frac{1}{2}$, second joint long, slightly rough-haired; terminal joint $\frac{1}{2}$ second, smooth; yellowish mixed with red. Thorax and abdomen red mixed with pale-yellow and a few fuscous scales. Legs ochreous; anterior coxæ and femora red anteriorly; anterior tibiæ and tarsi fuscous anteriorly. Forewings triangular, costa moderately arched, apex round-pointed, termen bowed, slightly oblique; bright red with numerous thickly-set pale-yellow spots; costal edge fuscous; a series of fuscous subcostal spots confluent with this; a double transverse row of fuscous spots before middle; some small fuscous spots irregularly scattered in posterior part of disc; cilia yellowish, towards tornus reddish, on dorsum fuscous. Hindwings with termen rounded; as forewings.

Type in Coll. Lyell.

N.Q., Evelyn Scrub, near Herberton; one specimen received from Mr. F. P. Dodd.

STRIGLINA GLAREOLA.

Siculodes ? glareola, Feld., Reise Nov. Pl. 134, f. 11.

Songara vittata, Moore, P.Z.S., 1883, p. 27, Pl. vi., f. 7.

Songara decussata, Moore, P.Z.S., 1883, p. 27, Pl. vi., f. 8.

Striglina sordida, Pag., Iris v., p. 47.

Siculodes platyntis, Meyr., Tr. E.S., 1894, p. 479.

Striglina duplicifimbria, Warr., A.M.N.H. (6), xviii., p. 272.

Striglina decussata, Hmps., Moths Ind. i., p. 354.

Striglina glareola, Hmps., P.Z.S., 1897, p. 613.

This species appears variable. My examples agree fairly well with the description of Sir Geo. Hampson. Moore's figures are poor, Felder's is quite unrecognisable, but I believe Sir Geo. Hampson has examined his type.

N.A., Melville and Bathurst Islands (W. D. Dodd). Also from Java, Borneo, Ceylon, and India.

Gen. Rhodoneura.

In my revision of this family (Ann. Q. Mus. x., p. 97), I overlooked an important character. This is a large expanded tuft of scales arising from the base of the costa beneath, and overlying the frenulum. It is present in both sexes, not only in this genus but also in the genera *Oxycophina*, *Hypolamprus*, *Obelura*, and *Addæa*, but is absent in *Striglina* and the other Australian genera of this family.

Rhodoneura splendida.

Pharambara splendida, Butl., A.M.N.H. (5), xx., p. 117 (1887), Hmps. Moths Ind., i., p. 363.

Pharambara parcipunctalis, Warr., A.M.N.H. (6), xvii., p. 210.

Rhodoneura rhaphiducha, Turn., Ann. Q. Mus. x., p. 106 (1910).

N.Q., Cairns, Herberton. Also from Solomons and India.

Rhodoneura submicans.

Dohertya submicans, Warr., Nov. Zool. xv., p. 330 (1908).

Rhodoneura crypsilitha, Turn., Ann. Q. Mus. x., p. 105 (1910).

Q., Brisbane. Also from New Guinea.

Rhodoneura giulia.

Rhodoneura giulia, Swin. A.M.N.H. (7), x., p. 50 (1902).

♀ 22 mm. Head, palpi, and antennæ pale brownish-ochreous. Thorax pale brownish-ochreous, posteriorly whitish. Abdomen brownish-grey, towards base pale brownish-ochreous; a fuscous band on dorsum on apex of fifth segment. Forelegs brownish-grey, apices of tibiæ and tarsal joints whitish; (other legs broken). Forewings triangular, costa straight to near apex, apex rounded, termen slightly sinuate beneath apex, then strongly bowed, oblique; pale brownish-ochreous, markings pale-fuscous; four rectangular costal spots, first near base, second at $\frac{1}{4}$, third before middle, fourth, rather larger, at $\frac{3}{4}$; an oblique streak from mid-dorsum to beneath $\frac{3}{5}$ costa; a subapical blotch connected with mid-termen; some short transverse strigulæ dispersed in disc; cilia whitish barred with fuscous on veins 2, 3, 4, and 7. Hindwings with termen doubly sinuate; colour and strigulæ as forewings; a transverse fuscous streak before middle; a second streak from tornus along termen for a short distance; cilia whitish. Underside similar but groundcolour paler, markings dark-fuscous and more clearly defined.

My example corresponds closely to Swinhoe's description, except that in this the ground colour is "orange-red."

N.Q., Evelyn Scrub, near Herberton, in January; one specimen received from Mr. F. P. Dodd. Also from New Guinea.

RHODONEURA MOLYBDITIS, *n. sp.*

μολυβδιτις, leaden.

♀ 18 mm. Head brownish-ochreous; face fuscous. Palpi pale fuscous, lower edge whitish. Antennæ whitish-ochreous. Thorax fuscous-brown; tegulæ brownish-ochreous. Abdomen whitish-ochreous partly suffused with fuscous. Legs whitish-ochreous; anterior pair fuscous with whitish annulations. Forewings obovate, costa straight to near apex, apex rounded, termen sinuate beneath apex, strongly bowed on vein 3, oblique; leaden-fuscous with obscure ochreous reticulations towards margins, on costa these are more conspicuous and whitish; cilia ochreous-whitish, barred with dark-fuscous at apex and broadly so opposite veins 3 and 4. Hindwings with termen sinuate beneath apex and bowed on vein 4; ochreous finely reticulated with fuscous; three fuscous fasciæ from dorsum at base, middle, and tornus, reaching about middle of disc; cilia ochreous with some obscure fuscous bars, apices whitish. Underside whitish-ochreous; forewings with angular spots more or less confluent, forming interrupted antemedian, postmedian, and subterminal lines, the last connected with mid-termen; hindwings marked as on upper side.

Type in Coll Turner.

N.A., Port Darwin; one specimen received from Mr. G. F. Hill.

Addæa aneranna, *n. sp.*

ἀνεραννος, unlovely.

♀ 17 mm. Head, palpi, and antennæ ochreous-whitish. Thorax and abdomen ochreous-grey-whitish. Legs ochreous-whitish; tarsi annulated with fuscous. Forewings triangular, costa straight, beyond middle slightly sinuate, apex acute and slightly produced, termen sinuate beneath apex, then strongly bowed, oblique; ochreous-whitish, markings pale brownish-fuscous; costa finely strigulated; an ill-defined basal patch; a postmedian fascia, well defined towards costa, towards dorsum lost in a strigulated dark shade which extends broadly along tornus and termen to beneath apex; cilia ochreous-whitish. Hindwings triangular, apex round-pointed, termen straight; as forewings but without basal patch and postmedian fascia. Underside similar but more distinct.

Type in Coll. Turner.

N.A., Port Darwin; one specimen received from Mr. F. P. Dodd.

Fam. PYRALIDÆ.

Subfam. Crambinæ.

Platytes idioptila, *n. sp.*

ιδιοπτιλος, with peculiar wing.

♂ 44 mm. Head whitish. Palpi 3; pale ochreous-brown, upper edge and internal surface whitish. Antennæ ochreous-whitish, beneath pale fuscous; in ♂ somewhat thickened and flattened. Thorax whitish, patagia reddish-brown. Abdomen whitish. Legs whitish; anterior pair ochreous-brown anteriorly. Forewings elongate, not dilated, costa moderately arched, apex rounded, tornus deeply incised at vein 3, the incision overhung by a hooklike projection containing vein 4; whitish, strongly suffused with reddish-brown and fuscous except dorsal area and costal edge; an interrupted fuscous line from beneath $\frac{5}{6}$ costa, outwardly oblique, then bent strongly inwards towards $\frac{2}{3}$ dorsum; cilia grey, apices whitish, on apex whitish, on hook fuscous, on incision whitish. Hindwings more than twice breadth of forewings, termen sinuate; whitish, thinly scaled; cilia whitish.

Type in Coll. Turner.

N.S.W., Brewarrina; one specimen received from Mr. W. W. Froggatt. Very little is yet known of the lepidoptera of the western interior, and the advent of this large and remarkable form shows that there is still much to be discovered.

Subfam. Schoenobianæ.

Gen. STYPHLOLEPIS.

Hmps., P.Z.S., 1895, p. 912.

I have but one example (♀) of *S. squamosalis*, the only described species, and in this veins 6 and 7 of the forewings are separate at origin, not stalked, as stated by Hampson. I mention this as the latter structure, which is peculiar, occurs in the ♂ of the following species. Probably the difference in neuration is sexual.

STYPHLOLEPIS AGENOR, *n. sp.*

ἀγηνωρ, splendid.

♂ 46-48 mm. Head whitish-grey. Palpi 3; whitish-grey, base beneath white. Antennæ of ♂ flattened, thickened towards base, and shortly laminate; ochreous-fuscous. Thorax and abdomen grey. Legs whitish. Forewings with costa straight for $\frac{3}{4}$, then moderately arched, apex acute, termen sinuate beneath apex and above costa, in middle rather strongly bowed, oblique; 6 and 7 stalked in ♂ separate in ♀, 7, 8, 9, 10 stalked; grey-whitish coarsely irrorated with dark grey; some ochreous suffusion near base; a faint oblique grey line at $\frac{5}{6}$; cilia fuscous with a white patch above tornus. Hindwings with termen gently rounded; orange-ochreous towards apex suffused with grey; a short fine grey line from $\frac{3}{4}$ costa parallel to termen; cilia whitish, on apex grey, with a fuscous basal line except on tornus and dorsum.

Type in Coll. Turner.

N.S.W., Brewarrina; two specimens received from Mr. W. W. Froggatt, who informs me that the larvæ bore the stems of *Capparis mitchelli*, feeding for about twelve months in the wood and finally killing the tree. This is an even finer discovery than the previous species described from the same locality.

Subfam. Pyralinæ.

CANGETTA AMMOCHROA, *n. sp.*

ἀμμοχροος, sand-coloured.

♂ 10 mm. Head pale-brown; face whitish. Palpi pale-brown; apex of second joint blackish; terminal joint white. Antennæ brown-whitish. Thorax pale-brown. Abdomen pale-brown, apices of segments whitish, but apex of ninth segment blackish. Legs whitish. Forewings triangular, costa straight, arched towards apex, apex rounded, termen rounded, scarcely oblique; pale-brown; a costal fuscous streak to $\frac{1}{3}$; two brown transverse lines, fuscous on costa; first at $\frac{1}{3}$, outwardly curved; second from $\frac{2}{3}$ costa to $\frac{3}{4}$ dorsum, nearly straight; four or five brown-fuscous dots on apical half of termen, edged by a narrow whitish shade; cilia white with a fuscous sub-basal line. Hindwings with termen gently rounded; as forewings but without first line; a line from $\frac{2}{3}$ costa forming a v-shaped curve in disc, and ending on dorsum near tornus.

Type in Coll. Turner.

N.A., Port Darwin, in January; one specimen received from Mr. F. P. Dodd.

Gen. TANAOBELA, *nov.*

τανaoβελος, with long weapons (palpi).

Frons with a short projecting tuft. Tongue present. Palpi extremely long (12), porrect; second joint extremely long, thickened with long loose scales above and beneath; terminal joint about $\frac{1}{3}$ second, spathulate, much thickened with loosely spreading scales at apex. Maxillary palpi long (1), triangularly dilated with scales. (Antennæ of ♂

unknown). Forewings with discocellulars very obliquely angled inwards, 2 from $\frac{2}{3}$, 3 from well before angle, 4 from angle, 5 from a little above angle, 6, 7, 8, 9 stalked, 6 and 7 arising by a common stalk which is very shortly coincident with that of 8, 9, 10 from well before upper angle, 11 from $\frac{2}{3}$, running into 12. Hindwings with 4 and 5 stalked, 6 and 7 connate, 7 anastomosing with 8 for a short distance.

This peculiar genus with its extraordinary palpi appears to be nearest *Lamacha*, Wlk. (Hmps. Tr. E.S., 1896, p. 526), though in this genus vein 7 of the hindwings and veins 6 and 11 of the forewings are free.

Tanaobela chrysochlora, *n. sp.*

χρυσοχλωρος, golden green.

♀ 20 mm. Head yellowish-green. Palpi pinkish-white densely irrorated with fuscous, inner surface whitish-ochreous. Antennæ pale ochreous-fuscous. Thorax yellowish-green. Abdomen pale-ochreous. Legs ochreous-whitish; anterior and middle tarsi annulated with dark-fuscous, posterior tarsi with pinkish. Forewings triangular, costa nearly straight, apex rounded-rectangular, termen straight, slightly oblique; yellowish-green without defined markings; a brownish streak on base of costa, and a minute dot beneath mid-costa; traces of a pale-fuscous dentate transverse line at $\frac{5}{6}$; some fuscous suffusion at tornus; cilia dark brownish-fuscous. Hindwings with termen strongly rounded; pale-pinkish; a narrow dark-fuscous sub-dorsal blotch, from the base of which arises a long tuft of pinkish hairs; cilia grey, on dorsum whitish.

Type (damaged) in Coll. Turner.

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

Titanoceros cataphanes.

Axiocrita cataphanes, Turn., P.R.S.Q., 1912, p. 136.

The genus *Axiocrita* must be dropped unless the ♂ shows reason for its retention. My type is a ♀; my error arose from overlooking the fact that in this group there is a single bristle in the frenulum in both sexes. The species is very similar to the ♀ of *T. cataxautha*, Meyr., but is certainly distinct. The much longer slender palpi, and the snow-white spot on base of anterior coxæ are in themselves sufficient distinctions.

Macalla zophera.

Macalla zophera, Turn., P.R.S.Q., 1903, p. 196.

Macalla mixtirosalis, Hmps., A.M.N.H. (7), xvii., p. 135 (1906).

Q., Duaringa, Brisbane.

Macalla pentabela, *n. sp.*

πενταβελος, with five arrows, or darts.

♂ 35 mm. Head greenish-fuscous. Palpi greenish-fuscous with some whitish scales. Antennæ fuscous; in ♂ dentate with fascicles of rather long cilia ($1\frac{1}{2}$); antennal processes dark-fuscous. Thorax reddish-whitish; patagia and tegulæ greenish. Abdomen whitish rather densely irrorated with fuscous. Legs dark-fuscous mixed with reddish and whitish scales; tarsi annulated with whitish. Forewings triangular, costa almost straight, a slight incision at $\frac{2}{3}$ preceded by a small glandular (?) thickening, apex round-pointed, termen bowed, slightly oblique; whitish suffused with greenish and irrorated with dark fuscous; a strong tuft of raised scales in disc at $\frac{1}{6}$, anteriorly whitish posteriorly dark-fuscous; a dark fuscous line from $\frac{1}{3}$ costa to dorsum before middle; a finely dentate slender fuscous line edged posteriorly with whitish, bent first outwards and then inwards to $\frac{3}{4}$ dorsum; median area whitish towards costa; a whitish subcostal tuft just beyond first line; a suffused dark-fuscous broad line from dorsal end of first line curved outwards along edge of cell, and emitting five slender streaks along veins 1, 2, 3, 4, and 5; terminal area whitish towards tornus; a terminal series of whitish dots on ends of veins; cilia reddish-whitish barred with fuscous. Hindwings with termen gently bowed; whitish, towards termen fuscous; a short dentate line from $\frac{2}{3}$ costa, terminal dots and cilia as forewings. Underside of forewings with dentate postmedian line well marked.

Type in Coll. Goldfinch.

N.S.W., Mount Kosciusko (5,000ft.), in January; one specimen taken by Mr. G. N. Goldfinch.

Macalla eupepla, *n. sp.*

εὔπεπλος, well-clothed.

♀ 36 mm. Head ochreous-green mixed with white. Palpi ochreous-green mixed with white and rosy; terminal joint rosy, apex whitish. Antennæ ochreous-green, at base mixed with white and rosy. Thorax ochreous-green mixed with whitish and rosy. Abdomen white mixed with fuscous and rosy, towards base and at apex suffused with ochreous-green. Legs fuscous, annulated with white and irrorated with rosy. Forewings triangular, costa straight, slightly arched towards apex, apex rounded, termen obliquely rounded; ochreous-green patchily irrorated with fuscous, white, and rosy scales; a triangular basal patch extending to $\frac{1}{3}$, its outer portion wholly ochreous-green; a transverse rosy line following this; a white spot on costa at $\frac{2}{3}$, extending as a dentate line a short way into disc, at its extremity two blackish dots; a white spot above dorsum at $\frac{2}{3}$ edged anteriorly and posteriorly with blackish; some short blackish streaks on veins beyond $\frac{2}{3}$; a rosy and white terminal shade, with a terminal series of ochreous-green spots; cilia whitish, bases barred with ochreous-green, apices with pale-rosy. Hindwings with termen rounded; whitish; towards termen shaded with fuscous; cilia as forewings.

Type in Coll. Turner.

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

Epipaschia cletolis.

Also in British Museum from New Guinea.

Orthaga picta.

Stricta picta, Warr., A.M.N.H. (6), xvi., p. 461.

N.Q., Kuranda near Cairns, in June; one ♂ specimen (Dodd).

Gen. Termioptycha.

Termioptycha, Meyr., Tr. E.S., 1889, p. 504; Hmps., Tr. E.S., 1896, p. 451.

Sialocyttara, Turn., P.R.S.Q., 1912, p. 134.

My description needs amendment in two particulars. The forewing of ♂ is not abbreviated, but the termen is broadly folded over beneath, and vein 10 anastomoses with 9 beyond 7 in both sexes.

TERMIOPTYCHA CYANOPA.

Termioptycha cyanopa, Meyr., Tr. E.S., 1889, p. 505.

Sialocyttara erasta, Turn., P.R.S.Q., 1912, p. 134.

N.Q., Cairns. Also from New Guinea.

Subfam. Pyraustinæ.

Gen. THOLERASTIS, *nov.*

θολεραστις, turbid, muddy.

Frons not projecting. Tongue present. Palpi long, ascending, recurved; terminal joint as long as second, slender, acuminate. Maxillary palpi moderately dilated. Forewings rather narrow, 5 absent, 8, 9, 10, 11 stalked. Hindwings with 5 absent, 8 anastomosing with cell and with 7. A derivative of *Nymphula*.

THOLERASTIS ELAPHRA, *n. sp.*

ἐλαφρος, light.

♀ 16 mm. Head, palpi, antennæ, and thorax fuscous. Abdomen and legs pale fuscous. Forewings narrowly triangular, costa straight for $\frac{2}{3}$, gently arched towards apex, apex rounded, termen obliquely rounded; fuscous-whitish suffused with fuscous; a fuscous spot beneath costa just beyond middle; a pale submarginal line; cilia fuscous-whitish with a fuscous basal line. Hindwings with termen rounded; whitish with some pale grey suffusion; cilia whitish with a grey basal line.

Type in Coll. Turner.

Q., Killarney, in November; one specimen.

CATACLYSTA PERICOMPSA, *n. sp.*

περικομψος, exquisite.

♂ ♀ 11-14 mm. Head, whitish. Palpi $1\frac{1}{2}$; fuscous, apices whitish. Antennæ fuscous-whitish; ciliations in ♂ $\frac{1}{4}$. Thorax fuscous; patagia mostly whitish. Abdomen fuscous or ochreous-brown, beneath whitish. Legs whitish; anterior coxæ and femora fuscous; anterior tibiæ and tarsi annulated with fuscous. Forewings elongate-triangular, costa gently arched, apex round-pointed, termen slightly rounded, oblique ; 10 from cell ; brownish-ochreous sometimes partly suffused with fuscous ; markings white edged with fuscous ; short broad subcostal and dorsal streaks from base ; two sickle-shaped fasciæ from dorsum at $\frac{1}{8}$ and $\frac{1}{3}$, outwardly curved, not quite reaching costa, narrowly connected beneath costa ; a subcostal spot just beyond second fascia ; a dorsal spot at $\frac{2}{3}$; a bar from $\frac{3}{4}$ costa to about middle of disc ; a subterminal fascia from costa ending above tornus, mostly suffused with fuscous ; cilia white with a dark-fuscous basal line, on apex and tornus fuscous. Hindwings with termen rounded ; 7 and 8 coincident ; colour as forewings ; basal streaks present or absent ; a transverse fascia at $\frac{1}{4}$ sometimes interrupted by a fuscous septum ; a fascia from $\frac{3}{4}$ costa describing a sharp curve before apex and continued to dorsum near tornus, its curve including anteriorly an elongate spot ; a black subterminal streak from beneath apex to before tornus, connected by bars with termen, and including five or six silvery dots ; cilia white with a fuscous basal line.

Type in Coll. Turner.

N.A., Port Darwin ; five specimens received from Mr. G. F. Hill.

MUSOTIMA STICTOCHROA, *n. sp.*

στικτοχροος, speckled.

♀ 14 mm. Head whitish, irrorated with dark-fuscous. Palpi whitish with dark-fuscous annulations. Antennæ dark-fuscous. Thorax dark-fuscous with some whitish scales. Abdomen dark-fuscous mixed with whitish-ochreous, apices of segments whitish. Legs fuscous ; tarsi partly whitish. Forewings triangular, costa twice sinuate, apex rounded ; termen deeply sinuate beneath apex, then strongly bowed, incised above tornus ; moderately oblique ; dark-fuscous with some whitish-ochreous irroration ; a fine whitish transverse line at $\frac{1}{3}$, angled outwardly in middle ; a large oblong white discal spot beyond middle ; a second fine whitish line from $\frac{4}{5}$ costa parallel to termen, then bent to below discal spot, and again bent at right angle to end in $\frac{2}{3}$ dorsum ; a white subapical dot giving rise to an obscure subterminal line of dots, ending in a white subtornal dot; cilia fuscous barred with white beneath apex, in sinuation, and in subtornal incision. Hindwings with termen deeply sinuate beneath apex, irregularly dentate towards tornus; colour as in forewings; a curved transverse whitish line at $\frac{1}{4}$; a white discal spot before middle; a whitish line from $\frac{2}{3}$ costa at first sinuate and approaching termen, dentate in middle, then bent inwards, and again bent to end in dorsum above tornus; cilia dark-fuscous, irregularly barred with white.

Type in Coll. Turner.

N.S.W., Ebor (4,000ft.), in January; one specimen.

Gen. TRIGONOBELA, *nov.*

τριγονοβελος, with triangular weapons (palpi).

Frons flat. Tongue well-developed. Palpi moderately long, curved, ascending; basal and second joint densely clothed with long scales beneath, forming a triangular mass on second joint; terminal joint triangularly scaled, and forming an angle with second joint. Maxillary palpi filiform. (Antennæ in ♂ unknown). Posterior tibiæ with outer spurs about $\frac{1}{2}$ inner. Forewings with 3, 4, 5 approximated at base, 6 from above middle, 7 approximated at base to 8 and nearly straight, 8, 9 long-stalked, 10 separate but closely approximated to their common stalk. Hindwings with 3, 4, 5 approximated at base, and 4, 5 approximated for a short distance, 6 and 7 connate, 7 anastomosing with 8 for about $\frac{1}{2}$ its length.

The terminal joint of labial palpi resembles that of *Agrotera*, but in that genus the scaling of the first and second joints forms three distinct triangles.

TRIGONOBELA NEBRIDOPEPLA, *n. sp.*

νεβριδοπεπλος, clad in a fawn-skin.

♀ 34 mm. Head whitish-ochreous. Palpi fuscous-brown, base sharply ochreous-whitish. Antennæ pale-brown. Thorax and abdomen pale-brown. Legs brown-whitish; anterior tibiæ and tarsi annulated with fuscous. Forewings elongate-triangular, costa scarcely arched, apex round-pointed, termen bowed, strongly oblique; pale-brown with pale-fuscous markings, and pale-ochreous spots; a dentate transverse line at $\frac{1}{4}$; a pale-centred discal spot before middle; a dentate line from $\frac{3}{4}$ costa, obsolete towards dorsum, preceded and followed by some small pale-ochreous spots; a subterminal series of pale-fuscous spots, succeeded by a series of pale-ochreous spots; cilia pale-fuscous. Hindwings with termen slightly sinuate; colour and markings as forewings but lines not dentate.

In its peculiar colouring and faint ill-defined markings this species is not like any other.

Type in Coll. Turner.

N.A., Port Darwin, in October; one specimen received from Mr. F. P. Dodd, with the note that the larva is an internal feeder in a species of scrub cane.

Sylepta polytimeta, *n. sp.*

πολυτιμητος, precious.

♂ 25 mm. Head yellow; face whitish-yellow. Palpi whitish-yellow; basal joint black. Antennæ whitish-ochreous; ciliations in ♂ 1. Thorax yellow. Abdomen yellow, apices of segments white, but apices of ninth and tenth segments black. Legs whitish-yellow; anterior tarsi, apex of anterior tibiæ and base of anterior and middle tibiæ annulated with black. Forewings triangular, costa straight, gently arched beyond middle, apex round-pointed, termen slightly bowed, oblique; whitish with five partly-connected deep-yellow transverse fasciæ, near base, at $\frac{1}{4}$, at middle, at $\frac{3}{4}$, and on termen; four conspicuous black spots, on costa near base, on costa at $\frac{1}{4}$, in disc beneath midcosta, and on costa at $\frac{3}{4}$; a fine blackish terminal line, broader beneath apex; cilia whitish. Hindwings with termen slightly sinuate; as forewings but with only four yellow fasciæ, which are obsolete towards costa, and with only one black spot at apex.

Type in Coll. Turner.

N.A., Port Darwin, in December; one specimen received from Mr. F. P. Dodd, and I have seen another from the same locality.

SYLEPTA ZOPHOSTICTA, *n. sp.*

ζοφοστικτος, dark-spotted.

♂ 24 mm. Head whitish-ochreous; lower half of face fuscous. Palpi white; terminal joint and apices of first and second joints dark-fuscous. Antennæ whitish; ciliations in ♂ 1. Thorax whitish-ochreous; shoulders narrowly dark-fuscous. Abdomen ochreous-whitish with a pair of dark-fuscous dots on apex of second segment. Legs whitish, base and apex of anterior tibiæ and terminal joints of anterior tarsi dark-fuscous. Forewings triangular, costa straight, arched towards apex, apex round-pointed, termen slightly bowed, oblique; whitish-ochreous; a fuscous streak along costa throughout; dots dark-fuscous; one on dorsum near base; one at $\frac{1}{3}$ just beneath costal streak; another larger similarly placed at middle; a line of fine dots from $\frac{3}{4}$ costa, bent outwards in disc, again bent inwards, and ending in a dot above $\frac{2}{3}$ dorsum; cilia whitish. Hindwings with termen gently rounded; colour and cilia as forewings; a large median discal dot at $\frac{1}{3}$; a line of fine dots from costa at $\frac{3}{4}$, slightly bent outwards in disc, obsolete towards dorsum, but represented by a dot on dorsum at $\frac{3}{4}$; a spot on apex.

Type in Coll. Turner.

N.A., Port Darwin, in December; one specimen received from Mr. F. P. Dodd.

SYLEPTA EMMETRIS, *n. sp.*

ἐμμετρις, measured, moderate.

♀ 27 mm. Head whitish-ochreous; face whitish. Palpi whitish, towards apex greyish. Antennæ whitish-ochreous. Thorax whitish-ochreous. Abdomen ochreous-whitish. Legs whitish; base and apex of anterior tibiæ pale-fuscous. Forewings triangular, costa straight, arched towards apex, apex round-pointed, termen nearly straight, oblique; whitish-brown-ochreous; markings fuscous; a line from $\frac{1}{6}$ costa to $\frac{1}{4}$ dorsum, slightly curved outwards; a transverse discal mark before middle; a line from $\frac{2}{3}$ costa, slightly dentate at commencement, curved a little outwards in disc, then bent inwards at a right angle to beneath discal mark, bent again at a right angle, and ending on $\frac{3}{5}$

dorsum; cilia ochreous-whitish. Hindwings with termen rounded; as forewings but without first line.

Type in Coll. Turner.

N.A., Port Darwin, in November; one specimen received from Mr. F. P. Dodd.

Sylepta placophæa, *n. sp.*

πλακοφαιος, broadly fuscous.

♀ 36 mm. Head and thorax fuscous. Palpi with terminal joint slender, acute; fuscous. Antennæ fuscous. Abdomen fuscous, towards base fuscous-whitish. Legs fuscous; anterior tibiæ and all tarsi annulated with whitish-ochreous. Forewings triangular, costa gently arched, more strongly towards apex, apex round-pointed, termen bowed, oblique; brown-whitish, markings fuscous; a moderate basal patch; a subcostal spot at $\frac{1}{3}$, succeeded by an oval pale-centred subcostal spot; a dentate line from $\frac{2}{3}$ costa, bent inwards below middle to beneath second spot, and then at a right angle to $\frac{2}{3}$ dorsum; a broad terminal fascia separated from the preceding by a fine dentate whitish line; cilia fuscous, bases barred with whitish. Hindwings with termen rounded; fuscous, towards base suffused with brown-whitish; a median fuscous pale-centred spot at $\frac{1}{3}$; a whitish subcostal spot at $\frac{1}{3}$, giving rise to a fine dentate whitish line as far as vein 2; a whitish line from vein 2 at middle of disc nearly to tornus; cilia as forewings.

Type in Coll. Turner. Referred to this genus for the present, but the slender acute terminal joint of palpi renders its position doubtful.

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

Sylepta hicana, *n. sp.*

ἱκανος, befitting.

♂ ♀ 17-21 mm. Head whitish-ochreous. Palpi fuscous; base sharply white; terminal joint short, obtuse, whitish. Antennæ whitish-ochreous; ciliations in ♂ extremely minute. Thorax whitish-ochreous, towards base mixed with white; terminal segment white with fuscous apex and whitish-ochreous tuft. Legs whitish; anterior coxæ and femora pale-fuscous; anterior tibiæ and tarsi annulated with fuscous. Forewings triangular, costa straight to near apex, apex round-pointed, termen bowed, strongly oblique; whitish-ochreous with some pale-fuscous suffusion especially on costa; a white subcostal dot at $\frac{1}{5}$; a squarish white subcostal spot, outlined with fuscous, at $\frac{1}{3}$; a fuscous line from anterior margin of this to $\frac{1}{3}$ dorsum; a fuscous line from $\frac{2}{3}$ costa very obliquely outwards for a short distance, then acutely toothed and transverse to middle of disc; space between this and following line clear white; a dentate line from shortly beyond preceding, at first transverse, then bent inwards at a right angle to beneath middle of disc, again bent and sinuate to $\frac{3}{5}$ dorsum; cilia fuscous, apices clear white. Hindwings with termen slightly rounded; whitish-ochreous with fuscous lines; a dentate transverse line at $\frac{1}{3}$; a dentate line from $\frac{2}{3}$ costa gradually approaching termen, beyond middle sharply bent inwards and continued to $\frac{2}{3}$ dorsum; a fuscous terminal line; cilia white, towards tornus with a fuscous basal line.

Sir Geo. Hampson refers this species to the genus *Samea*.

Type in Coll. Turner.

N.A., Port Darwin, in October and January; two specimens received from Mr. F. P. Dodd.

Tyspanodes metachrysialis.

Tyspanodes metachrysialis, Low., Tr. R.S.S.A., 1903, p. 63.
Tyspanodes phæosticha, Turn., P.R.S.Q., 1912, p. 146.

Gen. Torqueola.

Torqueola, Swin., A.M.N.H. (7), xvii., p. 382 (1906).

Frons flat. Tongue well-developed. Palpi moderately long, ascending, appressed to face; second joint moderately thickened with loosely appressed scales, but not dilated nor tufted, terminal joint short, obtuse, dilated fanwise with loose scales. Maxillary palpi minute. Antennæ of ♂ with basal joint much dilated and excavated into a deep notch on inner side, with a short corneous spine from lower margin of notch, then simple to $\frac{1}{6}$, from $\frac{1}{6}$ to middle dilated and shortly bipectinate, from middle to apex slightly serrate with short ciliations. Forewings with 7 curved at base, 10 closely approximated to 9. Hindwings with 4 and 5 approximated for a short distance, 6 and 7 connate, 7 anastomosing with 8 for half its length.

Type *Botys ophiceralis,* Wlk., from Java. The ♂ antennæ are highly specialised. Sir Geo. Hampson makes it a section of the genus *Glyphodes,* but I think the palpi are very different.

TORQUEOLA HYPOLAMPRA, *n. sp.*

ὑπολαμπρος, brilliant beneath.

♂ 36 mm. Head, palpi, and antennæ dark-fuscous. Thorax and abdomen dark-fuscous; pectus shining snow-white. Legs fuscous. Forewings elongate-triangular, costa rather strongly arched, apex round-pointed, termen nearly straight, very oblique; dark-fuscous with a purple gloss; cilia fuscous. Hindwings rather elongate, termen slightly rounded; colour and cilia as forewings.

Type in Coll. Turner.

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

MARGARONIA HYALOPTILA, *n. sp.*

ὑαλοπτιλος, with transparent wings.

♀ 28 mm. Head fuscous-whitish; face and palpi pale-fuscous. Antennæ grey. Thorax and abdomen whitish irrorated with pale-fuscous. Legs whitish; anterior pair pale fuscous. Forewings elongate-triangular, costa straight, towards apex arched, apex round-pointed, termen slightly bowed, oblique; whitish, thinly-scaled, semi-transparent, with a purplish gloss when viewed obliquely; markings pale-fuscous outlined with darker fuscous; a dot on dorsum near base; a thick streak on basal fourth of costa, with two triangular expansions, first in middle, second near distal end; an incomplete fascia from immediately beneath mid-costa with crenated margins, bent inwards in disc, and ending in a rounded extremity above mid-dorsum; a thick interrupted dentate subterminal line; a fine terminal line; cilia whitish. Hindwings with termen gently rounded; colour as forewings; a fine fuscous streak along median vein, ending in an irregular fuscous annulus before mid-disc ; subterminal and terminal lines and cilia as forewings.

Type in Coll. Turner.

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

Marasmia loxodesma, *n. sp.*

λοξοδεσμος, obliquely banded.

♂ 14 mm. Head and thorax fuscous-whitish. Palpi fuscous, base sharply white. Antennæ whitish ; ciliations in ♂ minute. Abdomen fuscous-whitish, base whitish. Legs whitish ; anterior pair fuscous. Forewings triangular, costa straight almost to apex, apex round-pointed, termen bowed, oblique ; whitish with some fuscous suffusion at base and on costal part of disc, lines fuscous ; a line from $\frac{1}{4}$ costa, obliquely curved in disc to $\frac{1}{4}$ dorsum ; a similar line from costa before middle to dorsum before middle ; a third line from $\frac{3}{4}$ costa to $\frac{3}{4}$ dorsum ; a subterminal line from costa shortly before this, sinuate, not reaching tornus ; a fuscous terminal line ; cilia fuscous, bases narrowly whitish. Hindwings with termen gently rounded ; as forewings.

Type in Coll. Turner.

N.A., Port Darwin, in October ; one specimen received from Mr. F. P. Dodd.

Metasia phragmatias.

Metasia phragmatias, Low., Tr. R.S.S.A., 1903, p. 66.

Metasia diplophragma, Turn., Tr. R.S.S.A., 1908, p. 97.

N.Q., Townsville.

Metasia orphnopis, *n. sp.*

ὀρφνωπις, dusky.

♂ ♀ 20 mm. Head and thorax fuscous. Palpi 3 ; fuscous, beneath white. Antennæ fuscous ; ciliations in ♂ $\frac{1}{4}$. Abdomen fuscous, beneath whitish. Legs fuscous-whitish ; anterior pair fuscous, tarsi annulated with whitish. Forewings triangular, costa slightly sinuate, arched towards apex, apex rounded, termen sinuate, oblique ; fuscous ;

lines dark-fuscous; antemedian from $\frac{1}{4}$ costa to $\frac{1}{3}$ dorsum, indistinct; postmedian from $\frac{3}{4}$ costa to $\frac{2}{3}$ dorsum, slightly dentate, partly edged posteriorly with whitish, at first straight, then bent outwards, and again inwards, and finally bent at a right angle towards dorsum; a square whitish subcostal discal spot before middle; cilia fuscous, bases narrowly whitish. Hindwings with termen rounded; as forewings; antemedian line curved, interrupted; postmedian line not reaching much more than half across disc.

Type in Coll. Turner.

Q., Killarney, in November; eight specimens.

METASIA CROCOPHARA, *n. sp.*

κροκοφαρος, saffron-robed.

♂ 11 mm. Head ochreous. Palpi fuscous, lower edge towards base sharply white. Antennæ whitish-grey. Thorax orange-yellow. Abdomen ochreous. Legs white; anterior pair fuscous anteriorly. Forewings triangular, costa straight to near apex, apex pointed, termen sinuate, oblique; orange-yellow, towards apex brownish-tinged; a broad brown-fuscous streak along costa to $\frac{2}{3}$; a fuscous line from $\frac{2}{3}$ costa, distinct at commencement, but soon becoming slender and very obscure, apparently looped inwards in disc and then bent to end in $\frac{2}{3}$ dorsum; a fuscous terminal line; cilia with basal half white, apical half dark-fuscous. Hindwings with termen rounded towards tornus; yellow, towards termen brownish-tinged; terminal line and cilia as forewings.

Type in Coll. Turner.

Q., Stradbroke Island, in December; one specimen. I have a second ♀ example from Stanthorpe, Q., in November, larger, more brightly coloured, and with the apices of the cilia white.

METASIA ASPHYCTA, *n. sp.*

ἀσφυκτος, feeble.

♂ ♀ 10 mm. Head whitish-ochreous. Palpi fuscous, lower edge narrowly whitish. Antennæ with joints slightly dilated at apices; ochreous-whitish; ciliations in

♂ minute. Thorax and abdomen whitish-ochreous. Legs whitish; anterior pair pale-fuscous. Forewings elongate-triangular, costa straight, apex round-pointed, termen slightly sinuate, oblique; whitish suffused with brownish-ochreous and on costa and termen with fuscous; lines fuscous; first from $\frac{1}{3}$ costa to $\frac{1}{3}$ dorsum, nearly straight; second from $\frac{3}{4}$ costa, bent outwards in disc, and then bent inwards below middle, ending on $\frac{2}{3}$ dorsum; cilia fuscous, apices whitish. Hindwings with termen gently rounded; whitish with faint brownish-ochreous suffusion; an outwardly curved transverse line at $\frac{2}{3}$; a broad pale-fuscous terminal suffusion; cilia as forewings.

Type in Coll. Turner.

N.A., Port Darwin, in February; two specimens received from Mr. F. P. Dodd.

Metasia ecbleta, *n. sp.*

ἐκβλητος, despised.

♂ 11 mm. Head, thorax, and palpi fuscous. Antennæ fuscous; ciliations in ♂ minute. Abdomen grey. Legs whitish; anterior pair fuscous. Forewings narrowly triangular, costa gently arched, apex round-pointed; termen slightly rounded, oblique; ochreous-whitish with fuscous markings and irroration; a fuscous streak along costa to middle, another from base expanding into an irregular spot in mid-disc before middle, and a third much shorter on base of dorsum; an outwardly curved line from mid-costa to mid-dorsum; a terminal suffusion containing five or six ochreous-whitish terminal dots; cilia fuscous-whitish. Hindwings with termen rounded; grey; cilia grey.

Type in Coll. Turner.

N.A., Port Darwin, in October; one specimen received from Mr. F. P. Dodd.

Calamochrous aspilus, *n. sp.*

ἀσπιλοσ, spotless.

♀ 25 mm. Head, thorax, and antennæ whitish-brown. Palpi 3; whitish-brown; lower edge of basal and terminal joints whitish. Abdomen whitish-brown, sides whitish.

Legs whitish-brown; posterior pair whitish. Forewings triangular, costa straight, (apices broken), termen obliquely rounded; uniform whitish-brown without markings; cilia pale-brown. Hindwings with termen rounded; whitish, thinly scaled, towards apex slightly brownish-tinged; cilia whitish, slightly brownish-tinged except on tornus and dorsum.

Type in Coll. Turner.

N.A., Port Darwin, in November; one specimen received from Mr. F. P. Dodd.

Noorda amethystina.

Autocharis amethystina, Swin., A.M.N.H. (6), xiv., p. 149.

Noorda hedyphaës, Turn., P.R.S.Q., 1912, p. 155.

Distinct from *N. fessalis*, Swin., I think.

Pyrausta epicroca.

Pyrausta epicroca, Low., Tr. R.S.S.A., 1903, p. 67.

Pyrausta perflavalis, Hmps., A.M.N.H. (8), xii., 23 (1913).

N. Q., Cairns, Stannary Hills, Townsville. Q., Brisbane, Mt. Tambourine. N.S.W., Sydney. Also from Louisiades.

Pyrausta petrosarca.

Pyrausta petrosarca, Low., Tr. R.S.S.A., 1903., p. 68.

Pyrausta apocrypha, Turn., Tr. R.S.S.A., 1908, p. 101.

N.Q., Cooktown ? (Lower). Q., Brisbane.

Myriostephes callipepla, *n. sp.*

καλλιπεπλος, beautifully clothed.

♂ 12 mm. Head brown-whitish; face fuscous. Palpi 3; fuscous, beneath white. Antennæ dark-fuscous; in ♂ with a double row of long pectinations (3). Thorax dark-fuscous. Abdomen whitish. Legs dark-fuscous; posterior pair whitish; anterior and middle tarsi annulated with white. Forewings triangular, costa straight to near apex, apex rounded, termen obliquely rounded; dark-fuscous; markings snow-white; a broad bar from $\frac{1}{6}$ dorsum nearly reaching costa; a fascia from $\frac{2}{3}$ costa to $\frac{2}{3}$ dorsum, expanded on costa, its posterior edge irregular; a subterminal streak from tornus not reaching apex; a series of minute submarginal lunules; cilia fuscous with a pale median line. Hindwings with termen rounded; white; a pale-fuscous line at $\frac{2}{3}$ not reaching dorsum; a similar line on termen; cilia white, bases pale-fuscous.

Differs from the other species in the ♂ pectinate antennæ, but I doubt whether this will justify generic separation.

Type in Coll. Turner.

N.A., Port Darwin; one specimen received from Mr. G. F. Hill.

Gen. PERIMECETA, *nov.*

περιμηκετος, long.

Frons flat, oblique. Tongue well-developed. Palpi long, porrect; second joint very long, stout, smooth-scaled; terminal joint exposed, rather long, obtuse. Antennæ of ♂ (unknown). Posterior tibiæ with outer spurs half inner. Forewings very long; 8, 9, 10 stalked. Hindwings normal.

Probably allied to *Otiophora*, Turn., in spite of the stalking of vein 10. The ♂ may show additional characters.

PERIMECETA NIPHOTYPA, *n. sp.*

νιφοτυπος, snow-marked.

♀ 30 mm. Head fuscous-brown; lateral margins of face whitish. Palpi 3; fuscous-brown, extreme base white. Antennæ fuscous-brown. Thorax fuscous-brown; pectus white. Abdomen and legs brown. Forewings narrow-elongate-triangular, costa gently arched, apex rounded, termen obliquely rounded; fuscous-brown; a snow-white streak from base to $\frac{1}{4}$, at first subcostal, then bent downwards along fold, twice interrupted so as to form three spots in longitudinal series; an inverted "comma" shaped snow-white spot in disc just beyond middle; a white costal mark at $\frac{4}{5}$; a white dot on termen beneath apex, from it a series of dark dots in a straight line towards $\frac{2}{3}$ dorsum; cilia brown, a darker basal line interrupted by white dots. Hindwings broad, termen slightly sinuate; pale-brownish, rather thinly scaled; cilia whitish with a brown basal line.

Type in Coll. Goldfinch.

N.S.W., Taree, in September; one specimen.

Gen. THESAURICA, *nov.*

θησαυρος, a treasure.

Frons with a bluntly triangular prominence. Tongue well-developed. Palpi moderate, porrect, terminal joint downcurved. Maxillary palpi filiform. Forewings with tufts of raised scales; 2 from $\frac{3}{4}$, 3 from just before angle, 4, 5 approximated at base from angle, 8, 9 stalked, 10 approximated to them. Hindwings with 4, 5 approximated for a short distance, 6, 7 connate, 7 anastomosing with 8 for less than half its length.

The combination of a triangularly projecting frons with tufted forewings makes this a very distinct genus.

THESAURICA ARGENTIFERA.

Sameodes argentifera, Hmps., A.M.N.H. (8), xi., 325 (1913).

♂ 16 mm. Head orange; face whitish-ochreous. Palpi orange, base and upper edge white. Antennæ grey; in ♂ thickened and with minute ciliations. Thorax orange with three whitish-ochreous spots on each side. Abdomen ochreous, bases of segments fuscous 5th to 8th segments with broad basal fuscous bands. Legs orange-ochreous, ventral aspect whitish; tarsi brownish-ochreous annulated with white. Forewings rather broadly triangular, costa gently arched, apex rounded, termen slightly bowed, moderately oblique; orange partly brownish-tinged; a whitish-ochreous spot on base, connected with a spot just beyond, and this again with an irregular spot resting on $\frac{1}{5}$ dorsum; three steely metallic streaks between this spot and costa, and a similar dot on $\frac{1}{5}$ dorsum; an elevated ridge of similar metallic scales from $\frac{1}{4}$ costa to $\frac{1}{3}$ dorsum; a squarish whitish-ochreous subcostal spot beyond this; a broken series of raised metallic dots from mid-costa to $\frac{2}{3}$ dorsum; a whitish-ochreous subcostal dot at $\frac{2}{3}$; a line of raised metallic dots from $\frac{4}{5}$ costa angulated outwards in disc, joining previous line on dorsum; two elongate subterminal whitish-ochreous spots interrupting a subterminal line of metallic dots: cilia orange, apices paler, on tornus grey. Hindwings with termen gently rounded; fuscous; terminal edge and cilia pale orange-ochreous.

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

HELIOTHELA DIDYMOSPILA, *n. sp.*

διδυμοσπιλος, twin-spotted.

♂ 10-11 mm. Head blackish. Palpi blackish, towards base beneath sharply white. Antennæ blackish; in ♂ thickened and slightly laminate with very short ciliations. Thorax blackish. Abdomen blackish; apices of first and third segments whitish. Legs dark-fuscous irrorated, and tarsi annulated with whitish. Forewings narrowly triangular, costa first straight then gently arched towards apex, apex rounded, termen obliquely rounded; blackish; a broad whitish line from ⅔ costa reaching half across disc; cilia dark-fuscous, on apex with apices sometimes white. Hindwings with termen rounded: blackish; an oval orange-ochreous spot near base nearly reaching dorsum; a similar spot in disc rather to the costal side of middle; cilia dark fuscous.

Type in Coll. Turner.

N.Q., Herberton, in February. Q., Brisbane; Stradbroke Island in December and January. This little species appears to be scarce, for though I have known it for many years, I have only four examples.

HELIOTHELA OREIAS, *n. sp.*

ὀρειας, daughter of the mountain.

♂ ♀ 15-17 mm. Head blackish. Palpi with a fairly long dense tuft on apex of second joint beneath; blackish, bases of second and third joints white. Maxillary palpi blackish with three slender white rings. Antennæ blackish; ciliations in ♂ minute. Thorax dark-fuscous. Abdomen dark-fuscous with some ochreous irroration on sides, apices of segments whitish. Legs dark-fuscous irrorated, and tarsi annulated with whitish. Forewings narrowly triangular, costa straight or slightly sinuate, apex round, termen obliquely rounded; dark-fuscous with obscure blackish lines ; first from $\frac{1}{4}$ costa slightly bent in disc to $\frac{1}{3}$ dorsum, and followed by a blackish subcostal dot ; second similar but more obscure from $\frac{3}{5}$ costa, rather strongly bent inwards in disc, and bent again to $\frac{2}{3}$ dorsum ; between upper bend and costa is a short straight transverse mark ; a third line shortly posterior and parallel to second, not reaching dorsum ; space between second and third lines irrorated with white from costa to mid-disc ; a few white scales on termen ; cilia dark-fuscous. Hindwings with termen rounded ; bright orange ; basal hairs, a line along dorsum, a discal spot, and a broad terminal band narrowed in middle, blackish ; cilia dark-fuscous, towards tornus paler with whitish apices.

This mountain species may be distinguished from *H. ophideres* by the blackish dorsum of hindwings, from *H. paracentra* by the absence of a white mark on dorsum of forewings, and from both by the tufted palpi.

Type in Coll. Lyell.

V., Mount St. Bernard, in January and February ; four specimens received from Mr. Geo. Lyell.

ECLIPSIODES ACROCAPNA, *n. sp.*

ἀκροκαπνος, with smoky apex.

♂ 18 mm. Head dark-fuscous mixed with whitish on crown. Palpi dark-fuscous, beneath whitish towards base. Antennæ fuscous ; ciliations in ♂ minute. Thorax dark-fuscous. Abdomen dark-fuscous, bases of segments whitish-ochreous. Legs dark-fuscous irrorated, and tarsi annulated with whitish-ochreous ; posterior pair mostly whitish-ochreous. Forewings triangular, costa gently arched, apex rounded, termen obliquely rounded ; whitish-ochreous much suffused with dark-fuscous ; a dentate dark-fuscous transverse line from $\frac{1}{4}$ costa to $\frac{1}{3}$ dorsum ; a dark-fuscous median subcostal annulus ; a dentate dark-fuscous line from $\frac{3}{4}$ costa bent inwards in disc and again downwards to dorsum beyond middle ; this is outlined posteriorly by a whitish line, beyond which terminal area is broadly infuscated ; a terminal series of dark-fuscous spots ; cilia dark-fuscous, apices whitish. Hindwings with termen slightly rounded ; whitish-ochreous with a very broad dark-fuscous terminal band; cilia fuscous, apices whitish-ochreous.

Type in Coll. Turner.

Q., Gayndah; one specimen received from Dr. Hamilton Kenny.

SCOPARIA EMMETROPIS, *n. sp.*

ἐμμετρωπις, precise.

♂ ♀ 20-22 mm. Head fuscous with some white scales. Palpi 2½, tufts on second and third joints slightly separate; fuscous with some white scales, base white. Antennæ grey; ciliations in ♂ ¼. Thorax fuscous. Abdomen grey. Legs whitish irrorated with dark-fuscous; anterior pair mostly dark-fuscous; all tarsi dark-fuscous with whitish annulations. Forewings elongate-triangular, costa gently arched, apex rounded, termen rounded, slightly oblique; whitish irrorated with pale-grey and with a few scattered dark-fuscous scales; markings blackish; a short streak from base of costa along fold; first line dentate, oblique, from ⅓ costa to ¼ dorsum; orbicular distinct, pale centred, touching first line; claviform dot-like, just beyond first line; reniform 8-shaped with two pale centres, but lower edge obsolete, connected with a dot on costa beyond middle; second line from ⅘ costa, angled obtusely above middle, very slightly dentate, ending on ¾ dorsum; a suffused dark-fuscous subapical spot, and another on mid-termen; cilia whitish, bases barred with fuscous. Hindwings 1½; grey-whitish; indications of a subterminal grey line; cilia whitish.

Characterised by the uniform groundcolour, dark lines, and distinct markings. The palpi approximate to those of *Tetraprosopus*.

Type in Coll. Turner.

N.S.W., Mount Kosciusko (5,000ft.), in January; three specimens.

SCOPARIA OCHROPHARA, *n. sp.*

ὠχροφαρος, pale-robed.

♀ 22 mm. Head grey. Palpi 3; fuscous, base sharply white. Antennæ grey. Thorax grey. Abdomen grey-whitish. Legs whitish with some grey irroration; anterior and middle tarsi fuscous with whitish annulations. Forewings narrow, elongate, costa moderately and evenly arched, apex rounded, termen straight, oblique; pale-grey irrorated with white and with a few scattered blackish scales; a short fine blackish streak from base; first line obsolete, indicated only by a few blackish scales; orbicular indicated by a short longitudinal blackish streak touching first line; claviform by a few blackish scales just beyond first line; reniform by a short blackish streak with some blackish suffusion on its costal edge; second line distinct, whitish, anteriorly dark-edged, slightly dentate, from $\frac{3}{4}$ costa obliquely outwards, then obtusely bent above middle of disc, and ending on $\frac{2}{3}$ dorsum; some blackish streaks on veins towards termen; cilia white, bases barred with grey. Hindwings 2; whitish, thinly scaled; cilia whitish.

Distinguished by the pale forewings with orbicular and reniform reduced to streaks, and the whitish hindwings.

Type in Coll. Turner.

N.S.W., Mount Kosciusko (3,500ft.), in March; two specimens.

Fam. ZEUZERIDÆ.

Zeuzera æglospila, *n. sp.*

αἰγλοσπιλος, lustrous-spotted.

♂ 45 mm., ♀ 80 mm. Head whitish; face blackish. Antennæ whitish, apical half blackish; in ♂ with long pectinations, apical half simple. Thorax whitish with thirteen dark-fuscous spots, which show greenish lustre on oblique illumination; a double median row of four spots each, two lateral rows of two each, and a median posterior spot. Abdomen whitish with median lateral, and sublateral series of spots similar to those on thorax. Legs dark-fuscous with blue and purple lustre; coxæ and basal part of femora whitish; anterior coxæ fuscous anteriorly. Forewings very elongate-triangular, costa gently and evenly arched, apex round-pointed, termen very obliquely rounded; whitish, thinly scaled, semi-translucent with numerous dark-fuscous or blackish spots, with greenish or purple lustre; a row on costa, the last spot before apex larger; three rows in cell between the dividing veinlets; a row in each interneural space, a dorsal and a terminal row, both blackish; cilia whitish, on spots blackish and lustrous. Hindwings narrow, termen sinuate, tornus strongly produced; vein 6 from below upper angle of cell, parallel with 7; colour and cilia as forewings; a terminal series of minute spots similar to those on forewings, on tornal projection and just beyond these are fused into an elongate spot.

Type in Coll. Turner.

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

XYLEUTES OLBIA, *n. sp.*

ὄλβιος, happy.

♂ 90 mm., ♀ 135 mm. Head and palpi dark-fuscous irrorated with whitish. Antennæ whitish with dark-fuscous irroration, in ♀ dark-fuscous; pectinations in ♂ 6, dark-fuscous, apical $\frac{2}{5}$ simple. Thorax dark-fuscous with a few whitish scales, patagia except bases densely irrorated with whitish. Abdomen dark-fuscous, apices of segments grey-whitish; apical segments and tuft grey-whitish. Legs fuscous irrorated with grey-whitish; tarsi dark-fuscous with whitish rings. Forewings elongate, not dilated, costa nearly straight, apex rounded, termen scarcely rounded, strongly oblique, dorsum sinuate; pale grey, towards apex and termen grey-whitish, markings blackish; a series of spots on basal half of costa more or less confluent; a subcostal basal blotch with irregular outline; a series of fine transverse streaks through mid-disc as far as middle; a longitudinal streak above middle third of dorsum; a network at mid-disc, connected by a thick blackish irregular streak to termen beneath apex; between this streak and termen is a network extending to tornus; cilia whitish, barred with fuscous. Hindwings with apex narrowly rounded, pointed, termen nearly straight, tornus somewhat prominent; pale grey with some fuscous irroration and a network between middle of disc and middle half of termen.

Type in Coll. Turner.

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

Xyleutes dictyoschema, *n. sp.*

δικτυοσχημος, with netted pattern.

♂ 62 mm., ♀ 94 mm. Head, palpi, and thorax dark-fuscous. Antennæ dark-fuscous; pectinations in ♂ 5, apical $\frac{1}{4}$ simple. Abdomen fuscous, apices of segments whitish. Legs dark-fuscous; tarsi with obscure whitish annulations. Forewings elongate-oblong, costa moderately and evenly arched, apex rounded, termen obliquely rounded, dorsum sinuate; dark-fuscous closely reticulated with blackish; some whitish irroration of costal edge, a sub-apical patch, above dorsum, and on termen; cilia fuscous mixed with whitish. Hindwings elongate, apex rounded, termen gently rounded; whitish, in ♀ grey, with dark-fuscous network on apical half; cilia as forewings.

Type in Coll. Turner.

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

Xyleutes leucomochla, *n. sp.*

λευκομοχλος, white-barred.

♂ 120 mm. Head fuscous mixed with white; face and palpi dark-fuscous. Antennæ ochreous-fuscous; pectinations in ♂ 6. Thorax white irrorated with fuscous, a v-shaped blackish mark, its apex anterior, surrounds a central fuscous area. Abdomen whitish, bases of segments dark-fuscous. Legs fuscous. Forewings elongate, rather narrow, costa slightly arched, apex round-pointed, termen straight, oblique; dark-fuscous with scanty whitish irroration; a broad whitish median bar from base to beyond middle; connected with apex by ill-defined broad whitish streaks, partly strigulated with dark-fuscous; cilia dark-fuscous with some whitish scales. Hindwings broader than forewings, termen somewhat sinuate; fuscous-grey, darker towards base; some whitish suffusion at apex and tornus; cilia whitish with some dark-fuscous bars.

Type in Coll. Illidge.

W.A., Cunderdin, in November; one specimen taken by Mr. R. Illidge.

Xyleutis eremonoma.

Xyleutis eremonoma, Turn., Tr. R.S.S.A., 1906, p. 139.

Q., Cunnamulla. N.S.W., Brewarrina; one ♂ example received from Mr. W. W. Froggatt, who states that the larvæ feed in the roots of the "Roley Poley," the plants snapping off and blowing away through their infestation.

Fam. HEPIALIDÆ.

Hepialus astathes, *n. sp.*

ἀσταθης, unstable.

♂ 41-44 mm. Head whitish sometimes pinkish. Palpi fuscous, internal surface whitish. Antennæ very short, ochreous-whitish. Thorax with a posterior crest; whitish, sometimes pinkish; an ill-defined transverse median greenish band. Abdomen whitish, towards apex greenish or pinkish. Legs ochreous-whitish or pinkish. Forewings triangular, costa strongly sinuate, apex acute, termen sinuate, oblique; pale green, or pinkish with or without greenish suffusion, some irregular darker striæ; a whitish streak on basal $\frac{2}{3}$ of costa; a slender whitish streak from mid-disc at $\frac{1}{8}$ towards but not reaching dorsum beyond middle, then curved and continued parallel to termen to $\frac{3}{4}$ costa; cilia whitish. Hindwings with termen sinuate; white; tinged with greenish or pinkish at tornus; cilia whitish.

♀ 46-72 mm. Forewings fuscous-reddish; a large triangular green blotch beneath costa from $\frac{1}{8}$ to $\frac{3}{4}$, its rounded lower angle approximating to mid-dorsum; a broad green terminal band not reaching tornus, sometimes with a projection on its anterior border in mid-disc; cilia fuscous-reddish. Hindwings with termen sinuate; pale red; some fuscous suffusion at tornus; cilia reddish.

Allied to *H. lignivorus*; the females of the two species are hardly distinguishable. The males are very distinct in the discal curved line, which in *astathes* is more like that of *lewinii*. The colouration of the ♂ varies much.

Type in Coll. Illidge.

W.A., Albany and Waroona; larvæ taken by Mr. R. Illidge emerged in February.

Hepialus tephroptilus, *n. sp.*

τεφροπτιλος, ashy-winged.

♀ 112 mm. Head and palpi green. Antennæ ochreous-whitish. Thorax grey, anteriorly greenish-tinged. Abdomen whitish-ochreous, dorsum fuscous except three basal segments, and bases of other segments. Legs whitish-ochreous, greenish-tinged; tarsi grey. Forewings broadly triangular, costa nearly straight, arched towards apex, apex round-pointed, termen straight, oblique, rounded towards tornus; grey, at base and along costa greenish; several triangular whitish spots in basal half; a straight interrupted narrow whitish band from $\frac{4}{5}$ costa towards but not reaching mid-dorsum; a fainter similar band midway between this and termen; cilia grey. Hindwings broad, termen strongly rounded; grey; cilia grey.

Type in Coll. Illidge.

W.A., Albany; one specimen, which emerged in March, from a larva obtained by Mr. R. Illidge.

NOTES ON AN EXHIBIT OF SPECIMENS OF CERATODUS

DR. T. HARVEY JOHNSTON AND DR. T. L. BANCROFT.

(*Before the Royal Society of Queensland, May* 31*st,* 1915.)

DR. T. HARVEY JOHNSTON exhibited a series of specimens of *Neoceratodus forsteri* (Krefft), forwarded to him by Dr. T. L. Bancroft, of Eidsvold, Burnett River.

The largest measured exactly 40 cm. (16 inches), and its weight was approximately a pound and a-half. Only one Ceratodus of a smaller size, a fourteen inch specimen, appears to have been taken previously.

Another of the exhibits was 75 mm. in length with a maximum dorsoventral breadth of 13.5 mm. which was in the anterior part of the tail region, the greatest breadth in the trunk reaching 13 mm. The maximum width, *i.e.*, from side to side, was in the head region and measured 10.0 mm. The dorsal fin extended relatively much further forward than in the adult, reaching to within a few millimetres of the opercular region. The opercula were much more evident than in an adult, the two meeting ventrally to form a V, whose apex was directed forwards, whereas in the adult exhibited, they were separated by a considerable interval. Each covered relatively more of the base of the corresponding pectoral fin than in an adult lung-fish. The inequality in the size of the pectoral and pelvic fin was relatively much greater than in adults, the pelvic fin being much smaller. The ratio of the length of the tail, *i.e.*, the region behind the anus, to the rest of the body was nearly the same as in the case of an adult, being 5 : 6 and 5.27 : 6 respectively.

This specimen was just seven months old and had been reared, along with a few others, from the egg stage by Dr. Bancroft. It was killed to serve as a record of the work, the remaining fish being still alive. Pelvic fins were distinctly visible to the naked eye when the fish were two and a-quarter inches long and about six and a-half months old.

The third exhibit was a very young Ceratodus, six weeks old (*i.e.*, after hatching), and measuring 17 mm. in length, the tail being only a little over one third of the total length of the animal. It possessed very simple pectoral fins, but there was no trace of the pelvics. The specimen showed a distinct advance in development on the four-weeks-old larva figured by Semon.

HERPETOLOGICAL NOTES.

By Dene B. Fry,
Australian Museum, Sydney.

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(Plates I—IV, text-figures 1—7.)

(*Read before the Royal Society of Queensland, May* 31*st and June* 28*th*, 1915.)

The present paper consists of notes on, and descriptions and redescriptions of, new or little known Reptiles and Batrachians from Australia and New Guinea, based mainly on specimens in the collection of the Australian Museum. The 'notes' mostly consist of additions to the faunæ of the different States of Australia and New Guinea, together with remarks on affinities and distribution. There are four new species and two new varieties proposed.

The following species are dealt with:—

Austrochaperina brevipes, sp. nov.
Limnodynastes tasmaniensis, Gthr.
,, *platycephalus*, Gthr.
,, *fletcheri*, Blgr.
,, *olivaceus*, de Vis.
,, *dorsalis*, *v. terræ-reginæ var. nov.*
Phanerotis fletcheri, Blgr.
Phractops brevipalmatus, Gthr.
Philocryphus australiacus, Shaw.
Lechriodus melanopyga, Doria.
Hyla macgregori, Ogilby.
,, *ewingii* v. *alpina, var. nov.*
,, ,, v. *calliscelis*, Ptrs.
,, *lesueurii* v. *vinosa*, Lamb.
Œdura monilis, de Vis.

Calotes cristatellus, Kuhl.
Gonyocephalus spinipes, A. Dum.
Chelodina intergularis, *sp. nov.*
Pseudelaps christieanus, *sp. nov.*
,, *minutus*, *sp. nov.*

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i. NOTES ON, AND DESCRIPTIONS OF NEW OR LITTLE KNOWN AUSTRALIAN AND PAPUASIAN FROGS.

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1. Austrochaperina brevipes, *sp. nov.*

Austrochaperina robusta (part), Fry, Rec. Austr. Mus., ix, 1912, p. 89, pl. viii, fig. 2-2*b*.

Habit very stout. Head two-thirds as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, very slightly prominent, shorter than the orbital diameter. Nostril much nearer the tip of the snout than the eye. Canthus rostralis moderately rounded; loreal region slightly concave. Interorbital space broader than the upper eye-lid. Tympanum rather distinct, slightly less than half the diameter of the eye. Lower jaw rounded, tri-lobed. Tongue very large, oval, entire, free right along the sides and for about half its length posteriorly. Two dermal æsophageal ridges; anterior very weak although nearly as extensive as the posterior, with a well developed median lobe and pappillose laterally; posterior ridge extending right across the hinder palate and strongly and evenly serrated. Arms weak. Fingers depressed; discs distinct but not enlarged; a thick fringe present; first nearly as long as second, cylindrical and not disced; an indistinct metacarpal pad on the base of the first finger. Hind limb very stout. Toes rather short, depressed; third, fourth and fifth with a distinct rather thick fringe; discs larger than the finger discs. A very small oval inner metatarsal tubercle. The length of the outstretched hind-limb, from the anus to the tibio-tarsal articulation, equals the distance between the anus and the shoulder.

Colour (*spirits*):—Upper-surfaces uniform fawn brown, spotted and speckled with chocolate brown. A dark streak from the tip of the snout through the eye to the shoulder. Under-surfaces uniform creamish.

Total length of type .. .. .. 28.5 mm

Localities :—One specimen from the Bloomfield River, near Cooktown, North-eastern Queensland, collected by Mr. Geo. Hislop, in 1897.

The specimen on which this new species is founded was regarded in my original description of *Austrochaperina robusta** as a variety of that species. It was placed in var. B. of *A. robusta,* a variety which may still be distinguished amongst the collection of type specimens by the absence of a thread-like dorsal stripe. *A. brevipes* is distinguished from *A. robusta* by its larger size, the type of the latter being only 23mm. in length, its broader head, its much shorter and stouter hind-limbs, and the more accentuated markings. The colouration of the type of *A. brevipes,* after 17 years immersion in spirits, resembles markedly that of *Chaperina polysticta* as shown by von Méhelÿ's† figure. However, in that species the spots are rather fewer and larger than in my new *Austrochaperina.*

I have examined the sternal apparatus of *A. brevipes* and find that it differs from *A. robusta* in the greater development of the procoracoid cartilage, showing a condition intermediate between the latter and *Chaperina punctata,* v. Kampen,‡ for a specimen of which I am indebted to the author.

2. Limnodynastes tasmaniensis, Gthr.

Limnodynastes tasmaniensis, (Gthr.) Boulenger, Brit. Mus. Cat. Batr., 1882, p. 260. *Id.,* Fletcher, Proc. Linn. Soc., N.S.W. (2), iv, 1889, pp. 365 and 374. *Id.,* Fletcher, *loc. cit.,* v, pp. 667-676. *Id.,* Fletcher, *loc. cit.,* vi, 1891, p. 271. *Id.,* Fletcher, *loc. cit.,* vii, pp. 7-18 (*L. fletcheri,* Blgr., a var. of *L. tasmaniensis*). *Id.,* Fletcher, *loc. cit.,* xxii, 1898, p. 662. *Id.,* Lucas and le Souef, Anim. Austr., 1909, p. 269. figs. *Id.,* English, Proc. Zool. Soc., 1910, p. 268, pl. li, figs. 1-2.

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* Fry—Rec. Austr. Mus., ix, 1912, p. 89.

† Mèhelÿ—Termés. Füzeteck, xxiv, 1901, pl. xii.

‡ Van Kampen—Nova Guineæ, ix, 1913, p. 463, pl. xi, fig. 7.

There is a reason to doubt Gerard Krefft's record* of this species from South Australia, for it is probable that the specimens were those afterwards described by Dr. Gunther as *L. platycephalus.* The only other record is that of Peters.† This record is substantiated by a specimen forwarded recently to the trustees by Miss A. M. Sharply from Narracoorte, a township near the Victorian border in South Australia.

In this specimen there is no trace of an outer metatarsal tubercle so distinct in *L. platycephalus,* although it sometimes does occur in Eastern Australian examples. The toes are normally fringed, and the width of the head is normal. Whether *L. platycephalus* is distinct or not, there can be no doubt that the true *L. tasmaniensis* shares with it or lives closely approximated to its habitat.

3. Limnodynastes platycephalus, Gthr.

Limnodynastes platycephalus (Gthr.) Boulenger, Brit. Mus. Cat. Batr., 1882, p. 260, pl. xvii, fig. 3.

Redescription of *Limnodynastes platycephalus,* Gthr.

Habit moderate. Head, three-quarters as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana; very depressed. Snout bluntly rounded, not prominent, less than the diameter of the eye; nostril much nearer the tip of the snout than the eye; canthus rostralis rounded, loreal region with a concavity in the form of a narrow groove. The outline of the tympanum is very slightly visible, about half the diameter of the eye. Interorbital space considerably broader than the upper eye-lid. Vomerine teeth in two long contiguous series, perfectly transverse and not arched, behind, and extending beyond the outer edge of the widely separated choanæ. Tongue sub-circular, entire. Skin smooth with very obscure flat warts; no fold above the tympanum, but a glandular thickening along the side; a yellowish gland from below the eye past the angle of the mouth; under-surfaces smooth

* Krefft:—Cat. Industr. Nat. Prod., N.S.W., Paris Exhib., 1867, App., p. 107.

† Mon. Berl. Ac. 1863.

except for some small whitish granules on the hinder side of the thighs. Limbs moderate. Fingers with a slight fringe, the first shorter than the second; sub-articular tubercles distinct but not prominent; three well developed metacarpal tubercles, one at the base of the first finger. Toes with a slight fringe and the merest indication of a web between their bases; sub-articular tubercles prominent; a small oval inner and a distinct round outer metatarsal tubercle. The distance between the anus and the tibio-tarsal-articulation equals the distance between the latter and the tympanum.

Colour (*Spirits*) :—Dark-grey above, speckled, spotted and marbled with darker. An indication of an interrupted light dorsal stripe. A black streak along the canthus; lips spotted; sub-orbital gland a yellow streak. Shank spotted but not barred. Under-surfaces yellowish to brownish; throat grey. Sides, thighs, and shank with brownish freckles.

Measurements in Millimetres.

Length of head to tympana	12 mm.
Width of head at tympana	16 mm.
Length of hind limb, anus to tarso-metat-art.	40 mm.
Total length, anus to tip of snout ..	40 mm.

Loc. :—One specimen from Wilcannia, Darling River, Western New South Wales, collected by R. Helms in 1890.

At present there appear to be only three specimens of this species known. These certainly warrant our recognising it as distinct from its ally, *L. tasmaniensis*. The distinguishing characters are the most extensive vomerine teeth, which extend outwards well beyond the choanæ, the broader head, and to a lesser extent, the disposition and nature of the colour markings. Several other differences noted may be due to individuality, but we require further specimens to prove this. The species has arisen at the western limit of *L. tasmaniensis*, and its presence on the Darling River in Western New South Wales proves that it has followed the watercourses northward in that state. Although it is here found in company with *L. fletcheri*, I regard the latter as having arisen after isolation from the true Eastern *L. tasmaniensis*, either (1) after crossing the Dividing Range or entering Western

New South Wales by way of the upper reaches of the Murray River from Gippsland, or (2), after crossing the low watershed of Southern Queensland.

4. Limnodynastes fletcheri, Blgr.

Limnodynastes fletcheri, Boulenger, A.M.N.H., (6), ii, 1888, p. 142. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, pp. 672 and 675.

Limnodynastes tasmaniensis (Gthr.) var. (?) Fletcher, *loc. cit.*, vii, 1892, pp. 16-18. *Id.*, Fletcher, *loc. cit.*, viii, 1894, p. 529.

Limnodynastes marmoratus, Lamb, Ann. Q'land. Mus., No. 10, 1911, p. 28. *Id.*, Fry, Rec. Austr. Mus., ix, 1912, pp. 98 and 106. (= *L. fletcheri.*)

There are seven examples of this species in the Museum collection taken by Mr. Robt. Helms, at Wilcannia, Darling River, Western New South Wales. Besides these, are two unlocalised examples and a co-type specimen of Lamb's *L. marmoratus*. The latter agrees well with the Western New South Wales examples.

Limnodynastes fletcheri is a larger and stouter species than *L. tasmaniensis* and may be distinguished by the following characters:—The toes are very much more pointed and fringed and have a prominent basal web. (This was suggested by Mr. Fletcher, who forwarded the types to Dr. Boulenger, to be possibly due to immersion in too strong a preserving fluid, but my specimens dispel all doubt and show that the condition is natural). The skin is rough and glandular. The markings on the back consist of coarse marmorations of dark brown (sometimes grey) with noticeable suffusions of bright carmine or pink, most pronounced on the eyelids. There is always only one metatarsal tubercle, an outer.

5. Limnodynastes olivaceus, de Vis.

Limnodynastes olivaceus, de Vis, Proc. Linn. Soc., N.S.W., ix, 1884, p. 66. *Id.*, Boulenger, A.M.N.H., (5), xvi, 1885, p. 387.

Re-description of *Limnodynastes olivaceus*, de Vis.

Habit moderate. Head three-quarters to four-fifths as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rather prominent and pointed when seen from above, longer than the orbital diameter; nostril equidistant between the eye and the tip of the snout; canthus rostralis very rounded; loreal region grooved. Tympanum hardly discernible or completely hidden. Interorbital space as broad as the upper eye-lid. Tongue large, oval or sub-circular, entire, free behind and a little on the sides. Vomerine teeth in two long straight or slightly arched series behind, and extending well beyond the outer edge of the choanæ. Limbs moderate. Fingers free, cylindrical, not fringed, first as long as second; sub-articular tubercles very prominent; two outer metacarpal tubercles and a third large one at the base of the first finger. Toes cylindrical, tapering, quite free; sub-articular tubercles very prominent, conical; a conical outer, but no inner metatarsal tubercle. Skin warty; sometimes with short plicæ; sometimes the warts are large oval and raised, or round and flat, but always profusely present (they are often exactly covered by a dark spot). A weak gland from below the eye to above the forearm. Sides with a distinct fold; no fold across the chest or along the inner edge of the tarsus. Under-surfaces uniformly smooth. The distance between the anus and the tibio-tarsal articulation is equal to the distance between the latter and the tympanum.

Colour (*spirits*):—Uniform greyish above (perhaps olive in life) with numerous roundish black spots, which sometimes form more or less broken bands of which a broad dorsal one—commencing between the eye-lids, and a lateral one can usually be traced. Upper-surface of snout usually with a light triangular mark. No dorsal stripe. Lips barred or spotted. Limbs spotted. Under surfaces uniform white or with a few spots of grey on the chin.

Measurements in Millimetres.

Total length, from tip of snout to anus	45 mm.
Length of head, to tympana	14 mm.
Width of head, at tympana	18 mm.
Length of hind-limb to tarso-metat-articul.	40 mm.

Locs.:—Four specimens from Mapoon, Gulf of Carpentaria, North Queensland, collected by Mr. Charles

Hedley. There are also two unlocalised specimens and one from Herbert River, North-east Queensland.

L. olivaceus differs from *L. tasmaniensis* which it replaces on the north and central coast of Queensland, by the following characters:—The toes are cylindrical, generally devoid of a basal web or any trace of fringe; the sub-articular tubercles are very prominent and conical; only one metatarsal tubercle always; the back has prominent warts; the snout is more pointed; and more or less by the broken up nature of the markings of the back, and their tendency to distribution in characteristic bands.

The four species of *Limnodynastes* so far noticed, *e.g.*, *L. tasmaniensis*, *platycephalus*, *fletcheri*, and *olivaceus*, form a natural group more or less distinct from the rest of the genus. They are closely allied to each other, and it becomes a question whether we should regard them as distinct species or as geographical varieties of one, *L. tasmaniensis*. Of all but *L. platycephalus* I have examined a series of specimens, but of that species I have only seen one. This, however, certainly supports its separation from *L. tasmaniensis*. The distinguishing characters of the four species are of relative value, and although to an extent variable, do not merge completely with one another. The habitat of each, with the exception of *L. platycephalus*, is distinct. While at present their validity as species is perhaps a matter of opinion, I am inclined to believe that they are correctly regarded as such.

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6. LIMNODYNASTES DORSALIS, *var.* TERRÆ-REGINÆ, *var. nov.*

(Text fig. 2*a*, sacral verteb.)

L. dorsalis, v. *dumerilii*, Ptrs. (part), Fry, Rec. Austr. Mus., x, 1913, pp. 26-28, 30, pl. iii, fig. 2.

A variety proposed for north and central coastal Queensland examples, differing from *L. dorsalis* v. *dumerilii* confined to South Australia, Victoria, Tasmania, New South Wales and Southern Queensland, in the following characters:—The habit is excessively stout and the size very large; *the hind-limb is very short* being 1.1 to 1.25

in the total length ; the head is usually broader, but occasional New South Wales specimens are found with just as broad heads ; vomerine teeth very strong, always extending well beyond the outer edge of the choanæ ; toes short and cylindrical, *usually devoid of fringe* ; in far northern examples the spots are disposed in well marked bands and a light dorsal stripe may be present ; under-surfaces often with bright red suffusions.

Specimen No.	1	2
	mm.	mm.
From snout to vent	79.5	78
Head, to level of tympana	24	22
Width of head at tympana	37.5	36
Hind-limb, anus to tip of toe	87	100

Specimen No. 1 from Cape York (one of the types).

Specimen No. 2 from Burnett River. Shows how the length of the hind-limb lengthens as we go south. The other characters, too, show a gradual passing into the southern variety.

Type :—In the Australian Museum, Sydney. Reg. No. R.4525.

Loc. :—Somerset, Cape York, N. Queensland, collected by Messrs. Hedley and McCulloch in 1907.

Since writing the paper referred to above on the varieties of *L. dorsalis*, Gray, it has become evident that the characters noted on p. 30 of some Cape York examples are to a great extent constant throughout specimens as far south as the Burnett River in Queensland. The inclusion of these specimens in var. *dumerilii* makes that variety so comprehensive that I think it best to separate off this distinct form as a separate variety. The var. *terræ-reginæ* then, will stand for all specimens from the area north of the Burnett River, including the district drained by the river itself. At some locality south of the Burnett River and probably north of the Brisbane River, this new variety blends with var. *dumerilii*, for specimens from Brisbane possess the characters of the latter.

7. Phanerotis fletcheri, Blgr.

(Pl. I, fig. 2, mouth only. Text fig. 1.)

Phanerotis fletcheri, Boulenger, Proc. Linn. Soc. N.S.W., (2), v, 1890, p. 593. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, p. 669. *Id.*, Fry, Mem. Q'land Mus., ii, 1913, p. 47.

The types of this rare frog were taken at Dunoon, Richmond River, north coast of New South Wales, by Richard Helms, in 1890. In the Australian Museum collection is a single adult specimen collected by the late J. A. Thorpe, in the year 1886, at Ourimbah, near Gosford, N.S. Wales. Ourimbah is about forty miles north of Sydney and is the southern termination of a stretch of "Dorrigo Scrub" country possessing the same geological and botanical features as that in which the types were procured. Its range is thus extended about two-hundred miles southwards.

Fig. 1.—*Phanerotis fletcheri*, Blgr. Superior and lateral view of head of a specimen from Ourimbah, N.S. Wales. Slightly enlarged.

This specimen differs slightly from the types as follows :—In transverse diameter the tympanum is two-thirds the eye, perpendicularly it is four-fifths ; the ∧-shaped fold between the shoulders is absent. The colouration is here described in detail :—Upper-surface of body and limbs greyish green to putty colour, with obscure faint blotches of darker grey on the back ; a fairly distinct dark cross-bar between the eye-lids ; sides of head with faint marks, one of which runs from the eye to the lip ; a thin, broken rostral streak of chocolate-brown which continues from behind the eye to the posterior edge of the tympanum, where it breaks into a few disconnected spots on the shoulder : front, hinder and under-surfaces of limbs reddish-brown with small grey spots; lower-surfaces of body yellowish, the gular region with faint brown spots; with the exception of the sides of the body the colour of the upper and lower surfaces shows a sharp line of demarcation; the limbs bear indistinct cross-bars.

8. Phractops brevipalmatus, Gthr.

Chiroleptes brevipalmatus, (Gthr.), Boulenger, Brit. Mus. Cat. Batr., 1882, p. 269, pl. xvii, fig. 5. *Id.*, Spencer, Rep. "Horn." Sci. Expd., 1896, p. 165. *Id.*, Fletcher, Proc. Linn. Soc., N.S.W., xxii, 1898, pp. 678 and 682. *Id.*, Lucas and le Souef, Anim. Austr., 1909, p. 277.

This species is known from the following localities:—Port Denison, Cape York, Gayndah and Peak Downs, in Queensland (Boulenger, 1882), Central Australia (Spencer, 1896), King's Sound, Fitzroy River, and Margaret Creek in Western Australia (Fletcher, 1898). It does not, however, appear to have been recorded from New South Wales, but in the Museum collection are eighty well preserved specimens from Wilcannia on the Darling River, in the far west of that State.

9. Philocryphus australiacus, Shaw.

Rana australiaca, Shaw, Nat. Misc., vi, 1795, pl. 200, and text. *Id.*, Andersson, Kungl. Sv. Ak. Handl., Bd. 52, 1913, p. 3.

Rana spinipes, Schneider, Hist. Amphi. i, 1799, pp. 129 and 139. *Id.*, Shaw, Gen. Zool., iii, i, 1802, p. 112. *Id.*, Andersson, *loc. cit.*

Heleioporus albopunctatus, Gray? Fletcher, Proc. Linn. Soc., N.S.W., (2), v, 1890, p. 671.

Philocryphus flavoguttatus, Fletcher, *loc. cit.* (2), viii, 1894, p. 233. *Id.*, Lucas and le Souef, Anim. Austr., 1909, p. 282, fig. *Id.*, Steel, Austr. Nat., ii, 1912, p. 135, (habits). *Id.*, Fry, Rec. W. Austr. Mus., i, 1914, p. 205, figs. 8*a* and 9.

Whilst recently referring to Shaw's "Naturalists' Miscellany" (1795) I was struck with the resemblance between the frog figured on plate two-hundred as *Rana* *australiaca* and that described a century later by Mr. J. J. Fletcher as *Philocryphus flavoguttatus*. In comparison to recent figures Shaw's figure is of course very crude, but it permits of identification just as well as the figures of *Rana cœrulea*, *Coluber porphyriacus*, etc., which form the basis of present recognised species. As will be shown later the two frogs are almost certainly identical, so that no course is open but to replace Fletcher's well founded name. This is to be regretted, for *Rana australiaca* was founded on a drawing sent to Dr. Shaw from New Holland and no specimen type exists, while the types of *Philocryphus* are beautifully preserved specimens in Mr. Fletcher's private collection.

As Shaw's work (Nat. Misc.) is rare and not easily accessible the concise description and remarks are here given in toto :—

RANA AUSTRALIACA.

Character Genericus.

Corpus tetrapodum, ecaudatum, nudum.

Linn. *Syst. Nat.*, p. 354.

Character Specificus.

RANA FUSCA, subtus cærulescens, lateribus gilvo punctatis, digitis anterioribus spinosis.

On the following page, not numbered, facing plate 200, Dr. Shaw remarks :—

" This animal certainly cannot be numbered amongst the most beautiful of its genus : it is a species, however, which has never before been described, and is more particularly interesting from the circumstances of its being a native of the distant regions of New Holland, which has added so many zoological treasures to the cabinets of natural history. Its rarity must, therefore, apologise for its deformity."

In General Zoology (1802), Shaw gives a useful reference and some supplementary remarks as follows:—

"Rana Australiaca. Australian Frog. *Naturalists' Miscellany*, vol. 6, pl. 200.

Rana spinipes. *Schneid. Amph., p.* 129-139.

"This was first described in the Naturalists' Miscellany; and so careful has Mr. Schneider been to preserve it from oblivion, that he has twice described it in his own work within the compass of a few pages. He is mistaken, however, in supposing it to exist in the British Museum; the figure having been etched from a drawing made in New Holland, its native country. Its size appears to be somewhat larger than that of the common European Frog, and its habit approaches rather to that of a toad, or a Natter-Jack, which latter it seems to resemble in its manner of walking, viz., with the limbs elevated, or in the manner of the generality of quadrupeds. All the feet are unwebbed."

There are only two Australian frogs which could reasonably be compared with *Rana australiaca*, Shaw, namely, *Philocryphus flavoguttatus*, Fletcher, and *Limnodynastes dorsalis*, Gray (eastern form, var. *dumerilii*, Ptrs.). The "spines" on the hands, which, no doubt, prompted Schneider to rename the species "spinipes," are secondary sexual characters developed only in males, and are of course seasonal. It is this character which prevents us further considering it with *Limnodynastes dorsalis*. In that frog, as in *Hyla aurea*, Lesson, the nuptial excresence is in the form of a flat, horny, brown plate on the inner side of the first finger, spines being quite absent. The distribution of these spines in Shaw's figure is not exactly as shown by my specimens of *Philocryphus*, but gives a general representation. The tympanum is figured as hidden. As in the case of the spines this must not be seriously considered. Even though the tympanum of *Philocryphus* is described as 'distinct,' it is nevertheless not obvious and may easily have escaped notice by a colonial artist, or if indicated by him, not reproduced in Shaw's etching. Such a character did not then have the significance it has to-day, and the obscure tympanic rim and undifferentiated colouration makes it easy to understand its absence in the figure, which undoubtedly gives a striking, if a little impressionistic, representation of this ungainly frog. The colouration resembles closely one of my specimens. In *L. dorsalis* there is a yellowish glandular band laterally, but the row of spots figured are typically those of *Philocryphus*, giving the suggestion for Fletcher's specific name *flavoguttatus*. Hence I regard *P. flavoguttatus*, described in 1894, as identical with *Rana australiaca*, described a century earlier. As has been shown* recently *Philocryphus* is not, as afterwards supposed by Fletcher, synonymous with *Heleioporus*, therefore the name will be altered to *Philocryphus australiacus*.

The disappearance of a well figured, named, and localised frog from literature is unaccountable. L. G. Andersson recently called (see syn.) attention to the fact that the name *Rana australiaca* had disappeared from literature subsequent to the mention by Schneider in 1799 and Shaw in 1802. After examining the works of Daudin, Cuvier and Merrem, he says that "but a single Australian species is recorded, viz., White's *Rana* (*Hyla*) *cœrulea*." He also suggests the likelihood of Shaw's locality being erroneous, suggesting that perhaps the frog really came from the East Indies and not New Holland, in which case it would probably prove identical with *Bufo melanostictus*. We have no need to assume this, however.

10. Lechriodus melanopyga, Doria.

(Plate I, fig. 1, Text fig. 2*c*.)

Asterophrys melanopyga, Doria, Ann. Mus. Civ. Genov., vi, 1874, p. 355, pl. xii, fig. *k*. *Id.*, Ptrs. and Doria, *loc. cit.*, xiii, 1878, p. 417.

Batrachopsis melanopyga, Boulenger, Brit. Mus. Cat. Batr. Sal., 1882, p. 439. *Id.*, Lucas, Proc. Linn. Soc., N.S.W., xxiii, 1898, p. 359.

* Fry :—Rec. W.A. Mus., I, 1914, p. 206, fig. 8*a* and 9.

Lechriodus melanopyga, Boulenger, Brit. Mus. Cat. Batr. Grad., 1882, p. 116 (footnote). *Id.*, Fry, Mem. Q'land. Mus., ii, 1913, p. 48.

There are three specimens of this frog in the Museum collection. Two were presented to the trustees by Mr. Thos. Steel, F.L.S., and are those mentioned by Lucas (see synonymy), from Fife Bay, British New Guinea. The third example was collected by the Royal Geographical Societies' Expedition of 1885, in the St. Joseph's River District, British Papua. Barbour's* tables of distribution published in 1912, record this frog from Dutch Papua only.

Lucas notes that the "tympanum is nearly as long in vertical diameter as the eye is wide. There is no perceptible dark streak on the canthus rostralis." In my third example these differences may also be noted. All three specimens differ strikingly from Doria's figure and Boulenger's description by the broader head, the more slender habit, and longer limbs. Shrinkage due to preservation might account for the more slender habit, but the broad head and longer limbs make it difficult to believe that my specimens really belong to this species. The figure of the St. Joseph's River example will assist those more fortunately situated to determine this point.

The striking resemblance between certain Cystignathids, notably *Limnodynastes*, *Phanerotis*, and *Ranaster*,† and the Pelobatid genus *Lechriodus*, has previously‡ been referred to. So complete is the resemblance of *Phanerotis* to *Lechriodus* that it is difficult to find even specific characters with which to distinguish them. *Limnodynastes*, however, is easily separated from *Lechriodus* by its hidden tympanum, while *Ranaster* is at present only doubtfully distinct from *Phanerotis*. A striking feature in common is mentioned by Boulenger|| "in the female (of *Lechriodus*) the two inner fingers are lobate, as in many *Limnody-*

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* Barbour—Mem. Mus. Comp. Zool. Harv., xliv, No. 1, 1902, p. 177.

† Van Kampen has shown (Nov. Guin., v, i, 1909, p. 136), that this frog, which he mentions under the name of *Phanerotis novæ*-guineæ, belongs to the Cystignathidæ.

‡ Fry—Mem. Q'land Mus., ii, 1913, p. 48.

|| Boulenger—Brit. Mus. Cat., 1882, p. 440.

nastes," a character which does not occur, so far as I am aware, in any other Pelobatid. As the chief difference between the Cystignathids mentioned and the Pelobatid *Lechriodus* appears to lie in the extent of dilation of the sacral vertebræ, I have figured those of two Australian genera showing close affinity, to show the fallacy of such a character for distinguishing purposes. A glance at the figure shows that a clear line of demarcation between the two families with regard to this character does not exist.

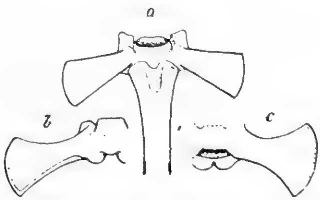

Fig. 2.—*a*. Sacrum of ***Limnodynastes dorsalis***, Gray.
b. Sacrum of ***Heleioporus albopunctatus***, Gray.
c. Sacrum of ***Lechriodus melanopyga***, Doria.
The anterior edge of the neural arch and the zygopophyses of *c* were badly broken during dissection.

In the Neotropical genera of Cystignathidæ, true cylindrical diapophyses are an almost invariable rule, but the Australian members of this family exhibit all stages between that of *Heleioporus* with considerably dilated diapophyses and the condition shown in South American genera. In *Crinia*, an Australian genus of Cystignathidæ, the sacral diapophysis is quite cylindrical ; in some *Limnodynastes* they are slightly dilated, most conspicuously so in *L. dorsalis*, here figured ; in *Chiroleptes* and *Heleioporus* they are so expanded as to be nearer the condition of the Pelobatid *Lechriodus* than to the typical Cystignathidæ. I think that these Australian genera should be considered as true Cystignathids, but Boulenger's definition of the sacral diapophysis—cylindrical or slightly dilated—hardly implies their true condition if we are to regard *Lechriodus* as possessing *strongly* dilated vertebræ.

The home of the Cystignathidæ is undoubtedly South America. It appears just as certain that our Australian members of this family have arisen directly from South American stock, though showing divergent lines of specialisation in several genera. *Lechriodus* is a Pelobatid of doubtful affinities (as regards other members of its family) and with *Asterophrys* exists well separated from other genera of the Pelobatidæ. Thus its affinity to the Australian Cystignathids and its propinquity of habitat point to a striking conclusion. A true Cystignathid, too, *Phanerotis* (=*Ranaster*), is now known from New Guinea.

11. Hyla macgregori, Ogilby.

(Plate II, Text figure 3.)

Hyla macgregori, Ogilby, Rec. Austr. Mus., i, 1890, p. 100.

Hyla thesaurensis (Ptrs.) *v.* Méhely, Term. Füzetek., xx., 1897, p. 414, pl. x, fig. 7.

Size small. Habit very slender. Head almost as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Eye large, its diameter a trifle longer than that of the snout; the latter rounded, slightly prominent; nostrils much nearer the tip of the snout than the eye; canthus rostralis very rounded; loreal region not concave. Inter-orbital region a little broader than the upper eye-lid. Tympanum very distinct, perfectly round; separated from the eye by a distance less than its diameter, which is about one-half that of the eye. Tongue oval or sub-circular, entire, sometimes with a median longitudinal groove or three small dimples; free a little behind and on the sides. Vomerine teeth always present; in two small oblique separated groups, their front edges on a level with the hinder edges of the widely distant choanæ. Skin smooth; a mere indication of a fold above the tympanum across the chest and along the inner edge of the tarsus; under-surfaces of the thighs and belly granular. Fingers with a distinct web, the deepest part of the concavity of the web between the third and fourth on a level with the proximal sub-articular tubercle; others less than one-third webbed; fringed to the discs; discs as large as the tympanum; sub-articular tubercles distinct; a number of swollen tubercle-like pads on the palm ; a metacarpal tubercle opposite the base of the first finger. Toes almost webbed to the discs except on the fourth ; discs a little smaller than finger discs ; sub-articular tubercles distinct ; a small inner metatarsal tubercle. The distance between the anus and the tibio-tarsal articulation of the outstretched hind-limb, equals the distance between the latter and the anterior border or a little in front of the eye.

Colour (*spirits*) :—Mr. Ogilby's colour description is so excellent that it is best to quote it *verbatim* :—

" Variable, those of the two extreme forms being as follows : (*a*) upper-surface of head and body dark brown, the former with small yellow spots, the latter with three broad yellow longitudinal bands ; the median band commences generally between the eyes, but is sometimes produced forwards to the tip of the snout, and terminates on the rump ; the lateral bands are broader, commence at the postero-superior angle of the orbit, and terminate abruptly at a point beyond the middle of the sides ; a row of yellow spots between the bands present or absent ;

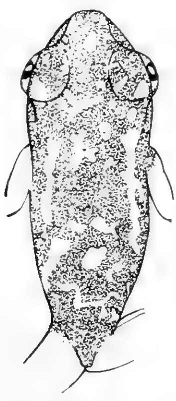

Fig. 3.—*Hyla macgregori,* Ogilby.
One of the types, a half-grown specimen. Enlarged about twice.

sometimes a well marked cross-band on the rump ; sides dark brown with yellow spots ; upper surface of limbs lighter brown with yellow spots, sometimes of moderate size and scattered, but more commonly in small freckles; lower parts creamy white. The yellow marks are frequently replaced by white; (*b*) general colour much lighter brown, the yellow or white spots or bands being replaced by pale brown or dirty white; otherwise as in var. *a*. In some young examples the upper parts are so profusely blotched with white as to almost entirely hide the dark ground colour, but, as a rule, the pattern of colouration, as given in the description of var. *a*, is not materially departed from."

"This Tree Frog appears to be common in the St. Joseph's River district, since no less than twenty-six specimens were sent down by Sir Wm. Macgregor, to whom I have much pleasure in dedicating this handsome species. The largest example measures 30mm. from snout to vent." (Ogilby.)

The affinities of this frog are with *H. thesaurensis*, Ptrs., differing in the amount of webbing, the length of the hind-limb and the position of the vomerine teeth. The colouration, too, although of the same type, differs in details.

The distribution credited to *H. thesaurensis* at present is German New Guinea and the Solomon Islands. The Papuan record is based on a specimen determined by Dr. von. Méhely as *thesaurensis*, but which I have not any hesitation in pronouncing to be a specimen of *H. macgregori*. The Austrian author's figure shows this beyond question, while the differences he notes between his specimen and Boulenger's* Solomon Island examples are precisely the characters in which *H. macgregori* differs from *H. thesaurensis*. Therefore, the distribution of each must be amended. *H. macgregori* is confined to British and German Papua, and *H. thesaurensis* to the Solomon Islands.

The specimen figured on Plate II, fig. 3, is not quite the largest specimen, but is, perhaps, the most typical: that figured in the text is only a half-grown example. I cannot account for the discrepancies between Mr. Ogilby's description and my own.

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* Boulenger:—Tr. Linn. Soc. Lond., xii, 1890, p. 60, pl. xi, fig. 4.

12. Hyla ewingii, D. and B. *var.* alpina, *var. nov.*

(Plate III, fig. 2, Text fig. 4.)

Hyla ewingii v. *orientalis*, Fletcher, Proc. Linn. Soc., N.S.W., xxii, 1898, p. 670 (part).

Habit moderate. Head two-thirds as long as broad, the measurement taken at a line drawn between the hinder margins of the tympana. Snout rounded, a little longer than the orbital diameter ; nostril elevated, slightly nearer the tip of the snout than the eye ; canthus rostralis distinct ; loreal region very oblique, concave. Tympanum upright-oval, perfectly distinct, separated from the eye by a distance equal to its own diameter, which is half to two-thirds that of the orbit. Interorbital space almost as broad as the upper eye-lid. Tongue broadly shield-shaped or oval, slightly nicked behind. Vomerine teeth in two fairly large, oblique, sometimes contiguous groups, between the choanæ. Limbs normal. Fingers tapering, with a very fine fringe which is very slightly enlarged at the bases between them so that it might be said that a rudiment of a web is present ; if anything, this is best developed between the first and second and second and third fingers ; first finger slightly shorter than the second ; discs swollen, but not enlarged, a little more than half the transverse diameter of the tympanum ; sub-articular pads tubercular ; several rows of tubercles on the metacarpals ; a large tubercle on the inner side of the base of the first finger which may bear a brown rugosity in breeding males. Toes moderate, not webbed to the discs ; the third and fifth about three-quarters, the fourth about two-thirds webbed, the fringe continuing to the discs ; the latter small, if anything smaller than the finger discs ; a well developed inner metatarsal tubercle, in adult specimens of quite an unusual size for a *Hyla* ; sub-articular tubercles distinct and a row of smaller tubercles on the under side of the phalanges and metatarsals. Tibio-tarsal articulation of the out-stretched limb reaching to the eye. Skin of back and limbs warty above, the vertebral region grooved and usually devoid of warts. The warts usually commence, with a distinct line of demarcation, between the eye-lids and sometimes border the tympanum posteriorly. A distinct glandular fold above the tympanum and also on the inner side of the tarsus; sides sometimes plicate. A distinct fold across the chest. Gular region, chest, belly, underside of thighs and arms coarsely granular.

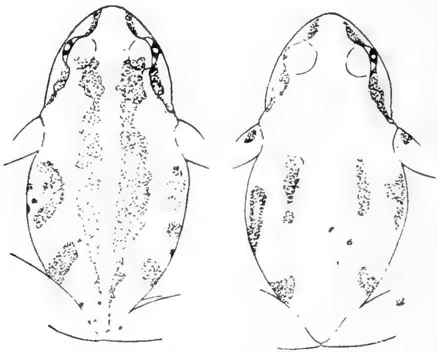

Fig. 4.—*Hyla ewingii*, var. *alpina*, Fry. Two co-type specimens showing variation in colour marking. Slightly enlarged.

Colour (*spirits*) :—Light olive green or purplish brown above, almost uniform or with dark bands which may be broken into isolated spots. Usually two broad brown bands commence between the eyes and continue to the sacral region, separated along the vertebral line. Sides with a chain of large blackish light-edged spots, the largest in the inguinal region running obliquely from the back to the groin. A narrow brown light-edged streak commences on the tip of the snout and borders the canthus to the eye; from the posterior border of the eye, whence it becomes much broader, it passes through the tympanum to the shoulder. Upper-surfaces of arms and legs variously blotched and spotted with brown. Some specimens are almost uniform greenish above, the bands being so broken as only to be represented by a few isolated spots, in which case a very large black inguinal spot is always present. Under-surfaces uniform creamy yellow.

The life colours of this frog are truly beautiful. The whole of the upper-surfaces may be either suffused with olive green or uniformly of the purest of pea-greens. The brown bands and spots do not change to any great extent when put into alcohol, but the green almost entirely disappears. The under-surfaces are lemon yellow. The resemblance of this frog to *Hyla regilla*, Bd. and Gir., of North America, as regards its life colours, is worthy of note. *H. regilla* has been beautifully figured by Miss Mary C. Dickerson,* two plates showing clearly the enormous range of colour and marking displayed by different individuals, many phases of which forcibly suggest those of *H. ewingii* v. *alpina*.

Length of head, to hinder edge of tympana	12 mm.
Width of head at tympana	17 mm.
Total length, snout to anus	48 mm.
Length of hind-limb to tib.-tars. art. ..	41 mm.

Locs.:—Twenty-two specimens from Mount Kosciusko, Monaro District, Southern tableland, New South Wales. Three specimens collected by Mr. A. R. McCulloch were taken at an altitude of 5,200 feet. Mr. Charles Hedley and Mr. Robert Helms have taken them at 5,500 feet, while four collected by Dr. T. H. Johnston are said to be from 7,000 feet altitude. I have to thank Messrs. Hedley, Johnston, and McCulloch for their kindness in bringing me specimens alive.

This new variety can be distinguished from the other varieties of *Hyla ewingii*, D. and B., by its warty back, scarcity of webbing, small discs and tapering fingers, and by the predominance of green in its life colouration. As regards the amount of webbing and size of the finger discs, however, var. *alpina* overlaps some examples which are true specimens of var. *orientalis*.

Type:—In the Australian Museum, Reg. No. R. 4644.

Mr. J. J. Fletcher† has gone very fully into the relative values and distribution of the proposed varieties of *H. ewingii*. As the result of a careful examination of over one hundred specimens, he arranges the varieties as follows:

* Dickerson:—The Frog Book, New York, 1907, col. pls., viii—ix.
† Fletcher:—Proc. Linn. Soc., N.S.W., xxii, 1898, pp. 665-73.

H. ewingii v. typica (Tasmania and Victoria).

H. ewingii v. calliscelis, Ptrs. (Tas., Vict., South and West Australia).

H. ewingii v. krefftii, Gthr. (New South Wales).

H. ewingii v. orientalis Flet. (Coast of N.S.W.).

The records of "South" and "West Australia" are based on Peters'* original type locality, and Boulenger's† record respectively, no specimens from these States being available to him.

H. ewingii v. orientalis‡ was described as a new variety, to receive the New South Wales specimens which would not fit in with *v. krefftii*, Gthr., and overlap the latter in range. Boulenger|| records *v. krefftii* from Port Denison, Queensland, but I am inclined to mistrust that locality, even with a specimen in the Australian Museum with a label, of doubtful validity, showing the locality "Queensland."

In the Australian Museum collection *H. ewingii* is richly represented by over one hundred specimens from many localities. After examining these I find my conclusions are slightly at variance with those of Mr. Fletcher. My understanding of the varieties is as follows :—

Hyla ewingii v. typica (Tas., Vic., Iss. Bass Str.)

H. ewingii v. calliscelis, Ptrs. (S. and W. Austr.)

H. ewingii v. krefftii, Gthr. (N.S.W.)

H. ewingii v. alpina, Fry (Tablelands, Southern N.S.W.)

H. ewingii v. orientalis, Flet. (Tas.?, Vic., N.S.W.)

Two specimens of *H. ewingii v. calliscelis*, Ptrs., from South Australia** show conclusively that it was a mistake to consider specimens with a spotted groin from Eastern Australia as belonging to that variety. Thus I regard *v. calliscelis* as confined to South and Western Australia.

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* Peters :—Mon. Berl. Ac., 1874, p. 620.

† Boulenger :—Brit. Mus. Cat. Batr. Sal., 1882, p. 407.

‡ Fletcher :—Proc. Linn. Soc., N.S.W., xxii, 1898, p. 670.

|| Boulenger :—Brit. Mus. Cat. Batr., Sal., 1882, p. 407.

** These two specimens are from Adelaide, Peters' type locality.

Mr. Fletcher's Tasmanian and Victorian specimens of *v. calliscelis* I have placed in his *v. orientalis*, which he had considered as confined to eastern New South Wales. Whether this latter course is correct or not I cannot be quite certain, for *v. orientalis* has not been definitely characterised by its author. At the same time I am unable to find sufficient differences between these Tasmanian and Victorian and the New South Wales examples with spotted groins, to warrant their being regarded as a distinct variety, with a new name. As the inguinal marks in Eastern specimens, unlike the South and West Australian examples, are not associated with any structural characteristics, this seems the most advisable course.

H. ewingii v. calliscelis may be distinguished from all other varieties, save *v. krefftii*, by the large finger discs, which are as large as or larger than the tympanum, by the more extensive webbing of fingers and toes, and by the large very accentuated purple blotches always present on the groin and hinder side of the thighs. From *v. krefftii* it is at once distinguished by the latter character alone. It reaches a larger size than all but *v. alpina*, and is slender in habit like *v. krefftii*. The inguinal and thigh marks of *v. calliscelis* are very different in nature to those which occur in occasional instances in Eastern Australian specimens of *v. orientalis*, and do not vary among themselves to such an extent. They stand out in bold relief on a pale ground and resemble deep, even-edged, purple ink-blotches. It is a most natural thing that, following Dr. Boulenger's meagre description of *v. calliscelis*, the Eastern Australian specimens with spotted groins should have been referred to that variety, but with two well-preserved specimens from Peters' type locality, Adelaide, I do not hesitate to put forward the correction as set out above.

No key to the varieties of *H. ewingii* could be quite satisfactory, for the various forms, though their extremes are very different, nevertheless overlap to a certain extent. The following will serve in the majority of cases :—

Key to varieties of *Hyla ewingii*, D. and B.

A. Discs of fingers as large as, or a little larger than, the tympanum. Fingers not merely fringed at the base but distinctly webbed.

b. Groin and hinder thigh with accentuated purple blotches. S. and W. Austr. .. .. .. *H. ewingii v. calliscelis*, Ptrs.

c. Groin and thighs yellowish with faint brown speckles. (N.S.W.) *H. ewingii v. krefftii*, Gthr.

A.A. Disc of fingers smaller than tympanum. Fingers with a web which is merely a continuation of a more or less obvious fringe.

d. Back warty. Gular region and undersurfaces of arms coarsely granular. Green or olive above. Kosciusko Plateau. *H. ewingii v. alpina*, Fry.

dd. Back smooth or minutely granular.

e. Back usually greyish. A distinct *silvery* streak from the corner of the mouth. Sides of body and thighs yellow or with delicate speckles. (Tas. and Vic.) *H. ewingii v. typica* (Blgr. and Flet.)

f. Back usually brownish. Streak at corner of mouth usually yellowish and not very distinct. Sides of body and thighs with brownish spots. (Tas.?, Vic., N.S.W.) .. *H. ewingii v. orientalis*, Flet.

13. *Hyla lesueurii*, D. and B., var. *vinosa*, Lamb.

(Plate II, Fig. 2, Text fig. 5.)

Hyla vinosa, Lamb , Ann. Q'land Mus., No. 10, 1911, p. 27.

Hyla lesueurii, D. and B., var., Fry, Rec. Austr. Mus., ix, 1912, p. 106.

Head slightly broader than long, the measurement taken at a line drawn between the hinder margins of the tympana. Snout prominent, longer than the diameter of the eye. Canthus rostralis angular, loreal region oblique, not concave. Nostril nearer the tip of the snout than the eye. Interorbital space as broad as the upper eye-lid. Tympanum very distinct, slightly more than half the diameter of the eye. Tongue sub-circular, slightly nicked and free on the sides and behind. Vomerine teeth in two slightly oblique contiguous groups between the middle of the choanæ. Fingers free, first and second equal; discs enlarged, that of the third finger slightly more than half the tympanum. A large tubercle on the base of the first finger; no external rudiment of pollex; two small approximated metacarpal tubercles, and several small indistinct palmar tubercles. Toes webbed to the discs except on the fourth; discs about as large as those of the fingers ; a small inner and a larger outer metatarsal tubercle. Skin smooth above, granulate on the belly and symphysis. A fold of skin runs from the eye to the shoulder,

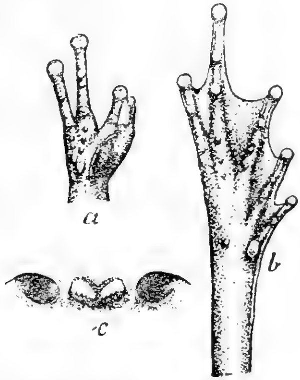

Fig. 5.—*Hyla lesueurii*, D. and B., var. *vinosa*, Lamb. *a* hand, *b* foot, *c* vomerine teeth (enlarged).

above the tympanum ; another along the inner edge of the tarsus. Tibio-tarsal articulation reaches far beyond the tip of the snout.

Colour (*formalin*) :—Vinous brown above, with faint irregular smudge . Sides lighter. Under-surfaces creamish. An indistinct dark band between the eye-lids. A brownish band commences behind the eye, and passes through the tympanum to the shoulder, where it breaks up. Groin with about half-a-dozen large dark brown spots, the largest, light-edged. Front side of thighs with an irregular brownish band of markings ; hinder-side black with white marblings. Shank with a few brown spots on the inner side.

The above description and the figure on Plate II. were drawn up from the type specimen of *Hyla vinosa*, Lamb., kindly lent to me by Dr. R. Hamlyn-Harris, Director of the Queensland Museum. In the original description this frog was compared to *Hyla nigrofrenata*, Gthr., but its affinities are more with *H. lesueurii* than that species. I am inclined to regard the differences as too slight to allow it specific distinction from the latter. Nevertheless, it is a good geographical race, although it does not wholly replace *H. lesueurii* in the northern State. I have recently received from Dr. T. L. Bancroft several specimens of *H. lesueurii* which resemble the typical form, *i.e.*, that found round Sydney, New South Wales. These were collected at Eidsvold, Burnett River, Queensland. Northern Queensland examples of var. *vinosa* are larger than any specimens of the typical form that I have seen, and they also possess relatively much larger discs. If with additional material these characters are proved quite stable, it may then be necessary to raise this form to specific rank. At present such a course could not be substantiated.

Mr. Lamb does not appear to have realised in his original description, the full significance of certain features of taxonomic value, and, as a consequence, my description will be found to differ considerably from that given by him, and at the same time, to be directly opposed in a number of salient points.

Type :—In the Queensland Museum, Brisbane.

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ii. DESCRIPTION AND NOTES ON THREE LIZARDS.

1. Œdura monilis, *de Vis.*

(Pl. III, fig. 2.)

Œdura monilis, de Vis., Proc. Linn. Soc., N.S.W. (2), ii, 1888, p. 812.

Head oviform, depressed (in the figured specimen the occipital region is convex and rather swollen). Snout as long as the distance between the eye and the ear opening, once-and-two-thirds to almost twice as long as the orbital diameter. Ear opening very small, one-third to almost half the diameter of the eye, sub-oval, very oblique. Rostral rectangular, the outer angles rounded by the nasal opening, half or a little less as high as broad, with a distinct median cleft above dividing it for barely half its height. Supranasals in contact; nostrils bordered by the rostral, first upper labial, a supranasal, and three post-nasal granules; behind these the granular scales of the snout are not visibly enlarged. Labials $\frac{9\text{-}10}{10\text{-}11}$. Head covered with hexagonal, sub-equal granules, smallest on the nape.

Mental shield slightly broader than the adjoining sub-labials, truncate, and tapering posteriorly. Scales of body flattened and mostly hexagonal, those of the middle of the back larger than those of the sides, but if anything, slightly smaller than those of the ventral surface. Limbs moderate. Tail rounded, tapering, covered by rings of quadrangular, brick-like scales. (The tail of the figured specimen is reproduced.) An enlarged, flattened granule laterally on the base of the tail. Seven to nine preanal and femoral pores in a series scarcely interrupted medially.

Colour (*spirits*) :—Light yellowish (faded) or greyish-brown above, with seven or eight pairs of ocelli (the fellows of each pair sometimes contiguous) of dark purplish-brown. The most anterior of these in the form of a half-moon-shaped nuchal mark. A dark line from the nostril to the occiput; another short one medially on the snout. Upper-labials yellowish. Upper surfaces of head and body covered (except for the ocelli) by delicate purplish reticulations or spots. Tail when intact, with three or four ocelli, but when reproduced it is irregularly streaked and spotted with purplish. Under-surfaces uniform yellowish.

Measurements of figured example :—

Length of body, snout to anus	78 mm.
Length of tail	42 mm.
Length of head	22 mm.
Width of head	14 mm.
Length of fore-limb	22 mm.
Length of hind-limb	28 mm.

Localities :—There are four specimens of this gecko in the Museum collection. One was collected by Mr. D. A. Porter at Tamworth, Northern Tableland, New South Wales; another was presented to the Trustees by Dr. S. J. Johnston, B.A., and was taken at Trangie, Western New South Wales. Two other very old, poorly conditioned examples are without data.

It is best not to regard this species as a local variety of its better known ally, *Œdura tryoni*. The colouration is characteristic and constant, while several other minor characters distinguish the two. Also, Mr. Porter has forwarded a specimen of a typical *Œdura tryoni* from Tamworth, a locality from which *Œ. monilis* is known.

2. Calotes cristatellus, *Kuhl.*

Calotes cristatellus (Kuhl.), Barbour, Mem. Mus. Comp. Zool. Harvard., 1912, xliv.

To the long list of localities in the East Indies from which this species is recorded by Barbour (see above) must be added Dutch New Guinea. In the Museum Collection are ten specimens from "North West New Guinea, presented to the Trustees in 1889 by Captain Strachan."

3. Gonyocephalus spinipes, *A. Dum.*

A young specimen which is referred to this species with some doubt comes from Ourimbah, near Gosford, about 40 miles north of Sydney, New South Wales. This extends the range of the widely dispersed genus *Gonyocephalus* about two hundred miles southwards. The extension of the East Indian genus *Gonyocephalus* into New South Wales contrasts markedly with the distribution of other Papuan migrants such as *Rana papua, Austrochaperina,* and *Tropidophorus,* which remain confined to the north-east coast of Queensland.

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iii. ON A NEW CHELODINA FROM AUSTRALIA, WITH A KEY TO THE GENUS.

(Plate IV.)

Chelodina intergularis, *sp. nov.*

Carapace not depressed, evenly arched, oval, broadest at a line drawn through the middle of the fourth vertebral shield. No vertebral groove in the adult. Shields and bones with a network of anastomosing grooves. Third to seventh marginal shields of each side with weakly deflexed margins. Nuchal shield large, a little broader than long. First vertebral shield only as large as the second; it is 1mm. broader and 1mm. shorter than the second. Plastron a little more than twice as long as broad, broadly rounded anteriorly and feebly bayed between the gulars, considerably narrower than the carapace in that region; posterior lobe deeply bayed behind, and constricted in the region of the femoro-anal suture; about as wide as the anterior lobe, and a little more than half the greatest width of the carapace ; the longest plastral shield is the intergular which is once-and-three-quarters as long as broad, longer than the pectorals, once-and-three-quarters as long as the suture of the pectorals, almost as long as its distance from the femorals ; it separates the gulars anteriorly, forming the median portion of the periphery of the anterior lobe. Humerals considerably larger than the gulars. The pectoral shields and their suture are slightly longer than the femorals and their suture. Suture between the abdominal shorter than that of any other pair of shields, twice-and-one quarter in the length of the intergular. Suture between the anals as long as that between the femorals. Depth of body twice-and-two-thirds in the total length. Soft parts, limbs and head absent.

Measurements in millimetres. Taken with callipers :—

Total length of carapace	192 mm.
Greatest width of same	132 mm.
Length of plastron, along median line..	142 mm.
Width of plastron, medially	72 mm.

Described from a single specimen consisting of a carapace and plastron, mostly devoid of shields. On the label is the somewhat vague locality " Australia ? "

Type :—In the Australian Museum, Sydney. Reg. No. R. 6255.

This new form combines the characters of several species. The outline is nearest to that of *C. expansa**, but in the condition of the first vertebral and the anal shields it approaches *C. novæ-guineæ*.† The nuchal shield and contour are much the same as in *C. siebenrocki*‡. From all the species of the genus, however, it is at once distinguished by the remarkable intergular shield, which completely separates the gulars anteriorly. In this character and in the condition of the first vertebral shield it approaches *Pseudemydura umbrina*,|| Siebenrock. In the genus *Chelodina* the condition exhibited by the intergular in this species is approached only by *C. oblonga*,§ in which species it

* Boulenger :—Brit. Mus. Cat. Chel., 1889, p. 216.

† Boulenger :—*l.c.* p. 215, pls. v.-vi.

‡ Werner :—Verh. Zool-bot. Ges. Wien., Vol. 51, 1901, p. 602, tab. 5.

|| Siebenrock :—Anz. Akad. Wiss. Wien., No. 22, 1901, pl. 1., and S.B. Akad. Wiss. Wien., Vol. cxvi, 1907, p. 1207, Tab.

§ Boulenger :—*l.c.* p. 216.

sometimes almost separates the narrow gulars, but the elongate form and the size of the first vertebral shield of the latter enable us to easily distinguish the two forms. In the genus *Emydura* the intergular always separates the gulars, but in that genus the humerals meet behind it and form an extensive suture. The first vertebral too, is not broader than the second. I have no hesitation, however, in placing such a globose form in the genus *Chelodina*. The key here given serves to show the relationships of the seven species.

Key to the species of the genus *Chelodina*:—

A. Intergular more than twice as long as the suture between the pectorals.

B. Front lobe of plastron much narrower than the carapace.

Suture between the anals twice as long as that between the pectorals and humerals, which are equal. *C. novæ-guineæ*, Blgr.

Suture between anals a little longer than that between the femorals, but much longer than that of the pectorals. *C. steindachneri*, Sbnrk.*

B.B. Front lobe of plastron nearly as wide as the front lobe of carapace. *C. longicollis*, Shaw.

A.A. Intergular not twice as long as the suture between pectorals.

C. First vertebral shield markedly broader than second. Gulars in contact.

d. Plastron (without bridge) twice as long or less than twice as long as broad.

Second and third vertebrals longer than broad. *C. expansa*, Gray.

Second and third vertebrals broader than long. *C. siebenrocki*, Werner.

dd. Plastron more than twice as long as broad. Second and third vertebrals considerably longer than broad. *C. oblonga*, Gray.

C.C. First vertebral shield as long as and as broad as second. Gulars separated by the intergular. *C. intergularis*, Fry.

* Siebenrock:—K. Ak. Wiss. Wien (Math-naturw.) Anz. No. xviii. 1914, p. 1.

iv. DESCRIPTIONS OF TWO NEW SPECIES OF PSEUDELAPS, AND A KEY TO THE GENUS.

1. PSEUDELAPS CHRISTIEANUS, *sp. nov.*

(Text fig. 6.)

Size moderate, habit moderate, tail rather stout. Head slightly distinct from neck; eye much larger than its distance from the mouth; rostral twice as broad as deep, plainly visible from above; internasals two-thirds the length of the præfrontals; præfrontals contained once-and-two-thirds in the length of the frontal, the lower posterior corner just in contact with the third labial; frontal much broader in front than behind, once-and-one-fifth as long as broad, three-quarters the length of the parietal, nearly as long as its distance from the tip of the snout, more than twice as broad as the small supraocular; nasal entire,

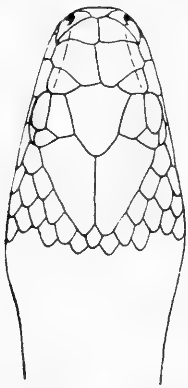


Fig. 6.—*Pseudelaps christieanus.* Drawn from type. Enlarged.

widely separated from the præocular, and separated from each other anteriorly by a backward projection of the rostral; præocular single, in contact with the front edge of the frontal; two postoculars; temporals 2 + 2, lower anterior wedged in between 5th and 6th upper labials; six upper labial, third and fourth entering the eye; seven or eight lower labials, the first four in contact with the anterior chin shields which are longer than the posterior. Scales smooth, highly polished, in 17 rows. Ventrals, 165; anal divided. Sub-caudals in 38 pairs.*

* The very tip of this tail appears as though it might be injured, in which case the above count will be slightly below what it should be.

Colour (*spirits*):—Scales of upper-surface fawn-brown, each with a yellow centre; on the sides of the body the scales are only brown edged, the row next to the ventrals not coloured. Upper-surface of head rich chocolate brown. A broad nuchal band of yellowish in which area the scales are spotted with brown; behind this, dark brown fading to the colour of the back. Upper-lips and under-surfaces creamy white.

Total length of type	255 mm.
Length of tail	45 mm.

Localities:—A single adult specimen from Port Darwin, Northern Territory, North Australia. This specimen formed part of a number of collections forwarded by Mr. Hugh W. Christie, Lighthouse-keeper, at Point Charles, and which I hope to deal with subsequently.

P. christieanus, Mihi, is easily distinguished from *P. diadema*, Schlegel, by having 17 rows of body scales, a larger eye, a narrower snout and frontal shield, and by having the præocular shield forming an extensive suture with the anterior edge of the frontal; this suture is of about the same extent as that between the præfrontal and frontal, an unique condition. In *P. diadema* the præocular in one or two cases just touches the antero-lateral angle of the frontal, the suture being immeasurably small, but quite the typical form is that in which it is separated from the frontal. the supraocular forming a suture with the præfrontal. When compared side by side, the narrower snout of my new species is a noticeable feature. Instead of the head being glossy black and the nuchal spot sharply defined as in *P. diadema*, it is brownish, the nuchal collar being spotted with the same colour.

In the British Museum Catalogue of Snakes, Dr. Boulenger records *P. diadema* from "North Australia"; perhaps this specimen belongs to *P. christieanus*, which at a cursory glance might be mistaken for that species. Messrs. Lönnberg and Andersson* however, mention a specimen which they refer to *P. diadema* from Western Australia, which undoubtedly belongs to this species. I think it quite possible that the true *P. diadema* does not occur in Western Australia.

* Lönnb. and Anderss.:—Kongl. Sv. Vet. Handl. Bd. 52, No. 3, 1913, p. 14.

2. Pseudelaps minutus, *sp. nov.*

(Text fig. 7.)

Size very small; habit moderate, tail short, tapering. Head slightly distinct from neck; eye much larger than its distance from the mouth; rostral a little broader than deep, visible from above; internasals shorter than the præfrontals, the latter contained twice or a little more in the length of the frontal; frontal once-and-three-quarters to twice as long as broad, broadest behind, shorter than the parietals, longer than its distance from the tip of the snout, about as broad as or a little broader than the supra-ocular; nasal entire, in contact with the præocular; nostril small; præocular single; two postoculars; tem-

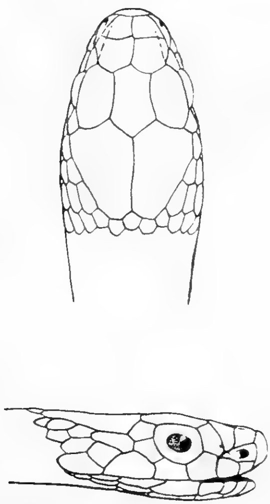


Fig. 7.—*Pseudelaps minutus*, Fry. Drawn from type. Enlarged.

porals 2 + 2, lower anterior wedged in between 5th and 6th upper labials, in one specimen united with the sixth on both sides of the head; six upper labials, third and fourth entering the eye; six lower labials, anterior four in contact with anterior chin shields, which are longer than the posterior. Scales in 15 rows, quite smooth, with a dull sheen. Ventrals 148-153; sub-caudals single, 51-59, tail terminating in a long cylindrical pointed scale. Anal entire.

Colour (*spirits*) :—Dark olive or black above, all the scales with minute punctations of olive grey. Head black, uniform or covered with grey speckles most profuse on the sides and lips where the black ground colour is proportionately at a minimum; sometimes a dark streak on the canthus. A curved yellowish nuchal collar. Chin and throat blackish, speckled with grey. Ventrals yellowish, not black bordered, but dark and light spotted on the outer ends. Under-surface of tail darker than body.

Total length of type	155 mm.
Length of tail	30 mm.

Localities :—Three specimens which, although very small, do not appear to be young snakes. One was collected and presented to the Trustees by Mr. Thos. Steel, F.L.S., and comes from Wilde's Meadow, near Moss Vale, eighty miles south of Sydney, New South Wales; another was presented by Mr. A. H. S. Lucas, M.A., and is from one of two localities, Tamworth or Guntawang, but the donor is not certain which; the third is from Colo Vale, south of Sydney, New South Wales, presented by Mr. J. Summers.

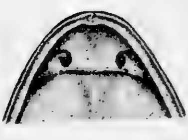
Type :—In the Australian Museum, Sydney, Reg. No. R.3971.

This species is probably one of the smallest snakes known. It appears to be adult or very nearly so when six inches long. It is allied to *P. krefftii*, Gthr., from which it differs in the temporals being 2 + 2, the narrower frontal, greater number of sub-caudals, entire anal shield, and colouration. The following is a key to the species of the genus *Pseudelaps* :—

A. Nasal in contact with or narrowly separated from the præocular.
    B. Nasal Shield divided.
        Temporals 2+2. *P. mulleri*, Scheg.
        Temporals 1+2. *P. squamulosus*, D. & B.
    B.B. Nasal shield entire.
        C. Temporals 2+2. Sub-caudals 51-59. Anal entire.
            A yellow occipital mark. *P. minutus*, Fry.
        C.C. Temporals 1+2. Sub-caudals, 26-38. Anal divided.
            Ventrals 146-156. *P. krefftii*, Gthr.
            Ventrals 167-172. *P. fordii*, Krefft.
            Ventrals 176-193. *P. harriettæ*, Krefft.
A.A. Nasal widely separated from the præocular. Temporals 2+2.
        Scales in 15 rows. *P. diadema*, Schleg.
        Scales in 17 rows. *P. christieanus*, Fry.

1

Lechriodus melanopyga, Doria.



2

Phanerotis fletcheri, Blgr.

1a

1

Hyla macgregori, Ogilby.

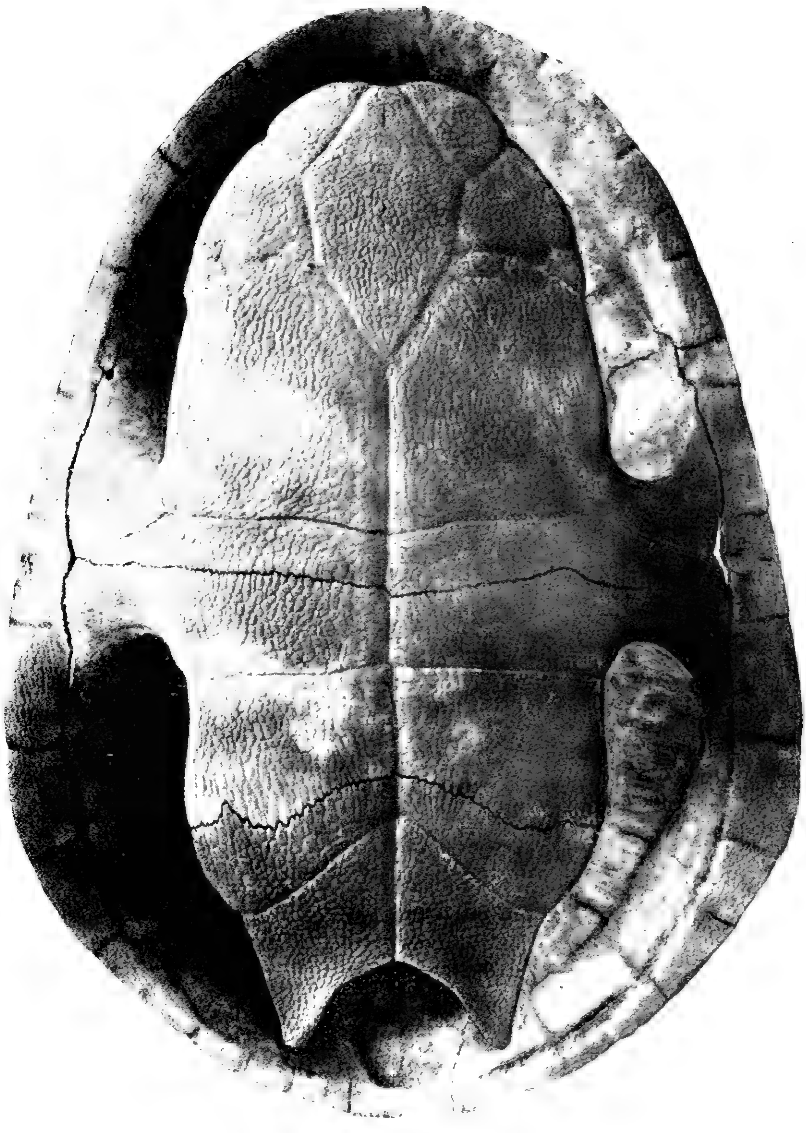
2

2a

Hyla lesueurii, v. *vinosa*, Lamb.

Fig. 1—*Hyla ewingii*, v. *alpina*, Fry.

Fig. 2.—*Œdura monilis*, de Vis.



Chelodina intergularis, Fry.

I have little doubt that *P. sutherlandi*, de Vis, is only a young *Demansia*. Mr. H. A. Longman, of the Queensland Museum, tells me that, should we admit this, an examination of de Vis' types of *P. warro*, and *P. bancroftii* shows that they also must be transferred. Therefore, I have not included those species in my key.

EXPLANATION OF PLATES I-IV.

Plate I. Fig. 1. *Lechriodus melanopyga*, Doria. British New Guinea. Enlarged.

Fig. 1*a*. *Lechriodus melanopyga*, Doria. Mouth of same specimen. Enlarged.

Fig. 2. *Phanerotis fletcheri*, Blgr. Ourimbah, New South Wales. Palate enlarged.

Plate II. Fig 1. *Hyla macgregori*, Ogilby. British New Guinea. Enlarged. (From one of the types).

Fig 2. *Hyla lesueurii*, D. and B. var. *vinosa*, Lamb. Brisbane, Queensland. Nat. size. From type.

Fig. 2*a*. *Hyla lesueurii*, D. and B., var. *vinosa*, Lamb., Brisbane, Queensland. Nat. size. Palate of same specimen.

Plate III. Fig. 1. *Hyla ewingii*, D. and B. var. *alpina*, Fry. Mt. Kosciusko, New South Wales. Slightly enlarged. From type.

Fig. 2. *Œdura monilis*, de Vis. Trangie, New South Wales. Enlarged.

Plate IV. *Chelodina intergularis*, Fry. Australia. Plastron slightly reduced. From type.

EXPLANATION OF TEXT FIGURES 1-7.

Fig. 1. *Phanerotis fletcheri*, Blgr. Dorsal and lateral view of head.

Fig. 2*a*. *Limnodynastes dorsalis*, Gray. Sacral vertebra.
2*b*. *Heleioporus albopunctatus*, Gray. Sacral vertebra.
2*c*. *Lechriodus melanopyga*, Doria. Sacral vertebra.

Fig. 3. *Hyla macgregori*, Ogilby. One of the types.

Fig. 4. „ *ewingii* var. *alpina*, Fry. Two co-types. Colour variation.

Fig. 5. „ *lesueurii* var. *vinosa*, Lamb. Hand, foot and vomerine teeth of type specimen.

Fig. 6. *Pseudelaps christieanus*, Fry. Upper head shields. From type.

Fig. 7. „ *minutus*, Fry. Dorsal and lateral view of head of type.

NOTES ON A FEW INTERESTING PLANTS FROM MORETON BAY.

BY C. T. WHITE.
(Botanic Gardens, Brisbane.)

(*Read before the Royal Society of Queensland, July 26th,* 1915.)

THE following notes relate to a few plants collected during the past couple of years around Moreton Bay, and which seem to be worthy of note. Except where otherwise stated, the specimens have been gathered personally by myself and several of them on excursions of the local Field Naturalists' Club.

MALVACEÆ.

HIBISCUS DIVERSIFOLIUS, *Jacq.* (var. *genuinus*, Hochr. Ann. du. Conserv. et du Jardin Bot. Geneva, (1900) 119).

Quite recently I have collected this species in swamps at Sandgate and Bribie Island (Moreton Bay) and Mudgeeraba (South Coast Railway). Flowers, yellow or greenish-yellow, with a dark centre. Previously the inclusion of this plant in the Queensland flora rested on doubtful specimens collected at Rockhampton by M. Thozet.

RUTACEÆ.

ASTEROLASIA WOOMBYE, *Bail.* Bribie Island; a very common shrub.

LEGUMINOSEÆ.

Desmodium polycarpum, *D.C.* Bribie Island.

Vigna luteola, *Benth.* Sandgate and Bribie Island.

Acacia cincinnata, *F. v. M.* Bribie Island.

The finding of this Acacia so far from the previously recorded habitats is of especial interest. It is a large tree with a dark rough bark, and is generally found on the edge of swamps. The trunk rises for a considerable height without any signs of branching.

RHIZOPHOREÆ.

Ceriops candolleana, *Arn.* Mangrove swamps between Sandgate and Humpybong.

MYRTACEÆ.

Leptospermum flavescens, *Sm.* var. *citriodorum,* Bail Q'land Ag. Jl., XV (1905), 781.

This variety is very common in the swamps in some places on Moreton and Stradbrooke Islands. Burleigh Heads (*J. E. Young*) is another additional habitat. It evidently has a wide range in Southern Queensland, but apparently is restricted to coastal swamps. This and *L. liversidgei,* Baker and Smith,* recorded from several coastal localities in N.S.W. are evidently identical.

Eucalyptus planchoniana, *F. v. M.* Stradbrooke Island.

These specimens show great variability in the length of the fruit-stalk, in one specimen it being ½ inch (12.5mm) long.

PROTEACEÆ.

Banksia serrata, *Linn. f.*

I have recently collected specimens of this from Stradbrooke Island and Bribie Island ; in the latter locality

*Journ. and Proc. Roy. Soc. N.S.W., xxxiv (1905), 124.

it is very common on the ocean side of the island. The trees, so far as I have observed, are always of a narrow pyramidal shape.

Banksia æmula, *R. Br.*

This is very common in coastal localities in Southern Queensland; the trees are generally of a very irregular spreading growth and reach large dimensions. Although very common, I have never seen it of shrubby growth as it is said to occur most commonly in New South Wales

RESTIACEÆ.

Leptocarpus tenax, *R. Br.*

This species, but recently recorded for Queensland. I have collected at the following localities: Russell Island, and Bribie Island (Moreton Bay), and Lake Wybah (North Coast Line).

CYPERACEÆ.

Cyperus conicus, *Boeckel.* Bribie Island.

The leaves and stems have a glaucous tint.

GRAMINEÆ.

Pollinia argentea, *Trin.* Bribie Island.

I have seen this grass growing in several localities in Southern Queensland, always in swampy land.

Arthraxon ciliaris, *Beauv.* var. australis, *Benth.* Myora (Stradbrooke Island).

The only other specimen of this grass in the Queensland Herbarium is a very poor one from Toowoomba, the var. *tenellus,* Benth.

Eragrostis brownii, *Nees,* var. pubescens, *Bail.*

This grass, previously only recorded from tropical Queensland, I have ound in great abundance in the sandy shore lands of Bribie Island, and have also gathered specimens at Fig Tree Pocket (Brisbane River) and Stradbrooke Island.

Specimens have also been gathered at Noosa, by Miss E. N. Parker, and at Yeppoon, by Mr. E. W. Bick, so the grass would appear to extend nearly along the whole range of the Queensland coast.

Lepturus repens, *R. Br.* Sand-hills, Bribie Island: not previously recorded from extra-tropical Queensland.

FILICES.

Lindsæa dimorpha, *Bail.* Bribie Island.

A LIST OF THE RECORDED FRESHWATER PROTOZOA OF QUEENSLAND

WITH A NUMBER OF NEW RECORDS.

By C. D. Gillies, B.Sc.
Biology Laboratory, University of Queensland.

(*Read before the Royal Society of Queensland, 30th August, 1915.*)

The following is a list of the recorded Freshwater Protozoa of Queensland, together with a number of new records for this State, the latter being indicated by an asterisk (*).

SPECIES.	RECORDER.	LOCALITY.
CLASS SARCODINA.		
Sub-class Rhizopoda		
Order Amoebina		
Amoeba limax, Duj. ..	Schewiakoff (1)	Brisbane, Dec., 1889.
* *Amoeba proteus*, Leidy.	.. ..	Sandgate, June, 1915.
Order Conchulina.		
* *Arcella angulosa*, Perty.	.. ..	Bribie Is., April, 1915.
* *Arcella discoides*, Ehrb.	.. ..	Bajool, April, 1915.
* *Arcella vulgaris*, Ehrb.	.. ..	Bribie Is., April, 1915; Bajool, April, 1915.
* *Centropyxis aculeata*, Stein.	.. ..	Chelmer, July, 1914; Bribie Is., April, 1915.
* *Centropyxis ecornis*, Leidy.	.. ..	Bajool, April, 1915.
* *Difflugia acuminata*, Ehrb.	.. ..	Darra, July, 1914.
* *Difflugia globulosa*, Leidy.	.. ..	Bribie Is., April, 1915.; Darra, July, 1914; Bajool, April, 1915.
* *Difflugia lobostoma*, Leidy.	.. ..	Darra, July, 1914.
* *Difflugia oblonga*, Ehrb.	.. ..	Darra, July, 1914; Chelmer, July, 1914; Bajool, April, 1915.
* *Euglypha alveolata*, Duj.	.. ..	Darra, July, 1914.
* *Euglypha cristata*, Leidy.	.. ..	Bribie Is., April, 1915.
* *Trinema enchelys*, Leidy.	.. ..	Sandgate, June, 1915; Bribie Is., April, 1915; Darra, July, 1914.

SPECIES.	RECORDER.	LOCALITY.
SUB-CLASS HELIOZOA. Order Aphrothoraca.		
Actinophrys eichornii ..	Colledge (2)	
* *Actinophrys sol*, Ehrb. ..	.. ..	Sandgate, June, 1915.
Actinosphaerium, sp. ..	Johnston (3)	Caloundra, 1914.
Order Desmothoraca.		
* *Clathrulina elegans*, Cien.	.. ..	Bribie Is., April, 1915: Sandgate, June, 1915.
CLASS MASTIGOPHORA. SUB-CLASS FLAGELLATA.		
Anthophysa vegetans (O. F. Müll.)	Schewiakoff (1)	Brisbane, Dec., 1889.
Chilomonas paramoecium, Ehrb.	Schewiakoff (1)	Brisbane, Dec., 1889.
Chlamydomonas ..	Wasteneys (4)	Enoggera.
Cryptomonas	Wasteneys (4)	Enoggera.
Dinobryon	Wasteneys (4)	Enoggera.
Euglena	Wasteneys (4)	Enoggera.
* *Euglena viridis*, Ehrb.	... ..	Chelmer, July, 1914.
Mallomonas	Wasteneys (4)	Enoggera.
Phacus	Wasteneys (4)	Enoggera.
Trachelomonas volvocini, Ehrb.	Schewiakoff (1)	Brisbane, Dec., 1889.
SUB-CLASS DINOFLAGELLATA.		
Ceratium	Wasteneys (4)	Enoggera.
Ceratium, sp.	Johnston (3)	Enoggera, 1914.
Peridinium	Wasteneys (4)	Enoggera.
Peridinium, sp.	Johnston (3)	Enoggera, 1914.
CLASS INFUSORIA. SUB-CLASS CILIATA. Order Holotricha.		
Cinetochilium margaritaceum, (Ehrb.) ..	Schewiakoff (1)	Brisbane, Dec., 1889.
Coleps hirtus, Ehrb. ..	Schewiakoff (1)	Brisbane, Dec., 1889.
Coleps	Wasteneys (4)	Enoggera.
Cyclidium glaucoma (O. F. Müll.) ..	Schewiakoff (1)	Brisbane, Dec., 1889.
Enchelys	Wasteneys (4)	Enoggera.
Nassula aurea, Ehrb. ..	Schewiakoff (1)	Brisbane, Dec., 1889.
Nassula	Wasteneys (4)	Enoggera.
Paramoecium bursarea, (Ehrb.)	Schewiakoff (1)	Brisbane, Dec., 1889.
Paramoecium	Wasteneys (4)	Enoggera.

SPECIES.	RECORDER.	LOCALITY.
Order Heterotricha.		
Stentor polymorphus, Ehrb.	Schewiakoff (1)	Brisbane, Dec., 1889.
Stentors	Colledge (5)	Northgate, Aug., 1910.
Order Peritricha.		
Epistylis	Colledge (2)	
Vorticella	Colledge (2)	
	Wasteneys (4)	Enoggera.

My thanks are due to Dr. T. Harvey Johnston for material and valuable suggestions.

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NOTES ON AN EXHIBIT OF A SMALL ABORIGINAL "CAMP" COLLECTION FROM NEAR BUNDABERG.

By R. Hamlyn-Harris, D.Sc.

(*Exhibited before the Royal Society of Queensland. November 15th*, 1915.)

It has long been felt that our knowledge of the Stone Implements of the Queensland Aboriginals is very meagre, and we have almost made ourselves believe that, beyond the proverbial stone axe, stone knife, stone millers and things of that kind and an occasional chipped flake, there is little to be found in our day, especially in those places where the natives have died out. Mr. A. S. Kenyon, of Melbourne, has, with his unique opportunities as a civil engineer, assisted by Messrs. D. J. Mahoney and S. F. Mann, subjected some of the most important places in his districts to a thorough scrutiny, and many interesting stone implements have as a consequence been brought to light. No one has as yet attempted a similar, thorough and systematic investigation of the camping-grounds in Queensland, and as a consequence many have thought that some of these crude implements found in the south are non-existent here, but from various cursory examinations of such places whenever an opportunity for field work has presented itself, I am convinced that there is yet an enormous field for investigation right throughout Queensland. Only a short time ago, through the kindness of Mr. Lionel C. Ball, of the Queensland Geological Survey, I had an opportunity of examining a number of flakes and chips collected by him in the sand dunes to the south-east of Sand Hills, near

Bundaberg. One, if not two, of these, made of jasperoid, show unmistakable secondary chipping. Snatching the opportunity of a visit to Bundaberg almost immediately after, I made a special visit to Sand Hills in company with Alderman L. H. Maynard as guide. Less than half a mile from the railway station, officially termed Bargara, we came across our first feeding-ground. The sand dunes rise immediately behind the beach and within a hundred yards reach elevations of 30 to 50 feet. They are backed by low swampy ground, and this locality, judging by the many aboriginal relics of a similar rock which have been picked up from time to time and shown to me, appears to have been a favourite camping-ground. The flakes, chips, and other cutting implements found, were almost without exception accompanied by large quantities of molluscs. Through the kindness of Dr. Shirley, who indentified the specimens for me, I am able to state that these heaps of shell fish consisted of the following species :—*Brachyodontes hirsutus* Lamk, *Meleagrina vulgaris* Schn., *Nerita chameleon* L., and a species of oyster. So that the camp collection which we made on the spot consisted of these shells, together with one blank (unfinished) axe of silicified sandstone, two primitive stone tools also made of the same material, a large quantity of flakes, chips, scrapers, drills and gouges made of silicified sandstone, jasperoid. petrified wood, quartz, etc., and a basalt hammer. The latter implement has most distinct finger marks, and although it was made of basalt, an unusual material for an implement of this kind, a definite weathered surface of that portion used in hammering testifies, I think, to its one time use. The country rock here is of vesicular basalt which, as Mr. Ball has pointed out, was evidently considered unsuitable for tool making. He considers that the Burrum coal measures presumably underlie the basalt, but they do not appear on the surface in this locality, so we may presume that the silicified rocks used by the aboriginals as here decsribed, had evidently been brought some distance by them for this purpose.

PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND

FOR 1915.

VOL. XXVII.—PART II.

—— Edited by ——
A. B. WALKOM, B.Sc.

The Authors of Papers are alone responsible for the statements made and the opinions expressed therein.

PRINTED FOR THE SOCIETY
BY
ANTHONY JAMES CUMMING, GOVERNMENT PRINTER, BRISBANE,
AND
H. POLE & CO., PRINTERS, ELIZABETH STREET, BRISBANE.

1916.

Price: Five Shillings.

CONTENTS.

VOLUME XXVII.—PART II.

THE VOLCANIC ROCKS OF SOUTH-EASTERN QUEENSLAND.*

By H. C. Richards, D.Sc.
Department of Geology, The University of Queensland.

(Read before the Royal Society of Queensland, November 15th, 1915.)

CONTENTS.

I. INTRODUCTION.

During the last forty years, there have been numerous publications dealing with different portions of the volcanic area of south-eastern Queensland, or with some representatives of the volcanic rocks, but hitherto there has been no attempt to deal with the volcanic area as a whole from a petrological standpoint.

Many divergent views have been put forward as to

* The Council of the Royal Society of Queensland desires to acknowledge its gratitude to the Queensland Government for their generosity in printing this paper.

the age of the volcanic activity, and the field occurrences of the rocks in a few of the localities have been described. Dr. H. I. Jensen has thoroughly dealt with the alkaline representatives, and as a result they have gained a rather undue prominence, for it is found that they form quite a minor portion of the extensive development of volcanic rocks in the area.

The calcic or sub-alkaline rocks have received scant attention, and microscopic and chemical investigations have been, with the exception of the Main Range district, restricted almost entirely to the alkaline rocks.

The area under investigation covers about 4,000 square miles, and is in the extreme south-eastern corner of Queensland. It is bounded by the Pacific Coast on the east, by MacPherson's Range on the south, by the Main Range on the south-west and west, and on the north by an east and west line from Toowoomba to the coast. In addition to this main area, the strip of country between the coast and the D'Aguilar Range as far north as the Glass House Mountains, and the Brisbane River Valley as far north as Esk, are added.

During the last five years the author has travelled extensively over this area, more particularly, however, in the southern portion which is the least known geologically. All the important localities have been investigated. Altogether twenty-five complete analyses[1] of volcanic rocks of this area have been recently made in the laboratory of the Agricultural Chemist, and these analyses, together with nine published by Dr. Jensen,[2] furnish analyses of all the important rocks. Thus it is possible to enter upon a correlation of the various types on chemical lines.

Owing to the absence of any important development of fossiliferous rocks since late Mesozoic times, physiographical considerations must be availed of in elucidating the Cainozoic history of this area.

The physical features are so largely connected with the origin and structures of the volcanic rocks that an

[1] Ann. Rept. Agric. Chem., Q'land, 1912, 1913, 1914.

[2] Proc. Linn. Soc., N.S.W., xxxi.-xxxiv. (1906-1909).

investigation of the latter is essential before anything definite can be arrived at with regard to the history since late Mesozoic times.

As has been pointed out by E. O. Marks,[3] the problem of the geological ages of volcanic activity affects extensive areas of coal measures, for by far the greater portion of this area is made up of the Mesozoic coal-bearing sediments.

A great portion of the area dealt with is still covered with its dense virgin scrub, and this, coupled with the size of the area and the extreme ruggedness of a great deal of it, has rendered it impossible to prepare anything other than a geological sketch-map, roughly showing the distribution and extent of the various rocks.

The accompanying sketch-map, however, in a general way, indicates the areas which are at present occupied by volcanic rocks and, taken in conjunction with the various sketch-sections, affords a reasonable idea of the extent, distribution, and stratigraphic relationships of the rocks of the area.

The main questions which the author has set out to determine are:—

A—The relationships of the volcanic rocks—

(*a*) to one another;

(*b*) to the sedimentary and metamorphic rocks.

B—The geological period at which these rocks have been extruded.

II. PREVIOUS LITERATURE.

E. O. Marks, in his paper[4] "Notes on the Geological Age of Volcanic Activity in south-east Queensland," has summarised the various views put forward, up to that time, as to the age of the volcanic activity, and he also gave a list of publications particularly bearing on the volcanic area.

Since then, however, there have been one or two further contributions; and as it is proposed to discuss in

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[3] Proc. Roy. Soc., Q'land, vol. xxiii., pt. 2 (1912), p. 139.

[4] Proc. Roy. Soc., Q'land, vol. xxiii., pt. 2 (1912).

this paper many of the views put forward by previous writers as to the extent and age of the volcanic rocks, a résumé of the conclusions drawn by the several investigators is desirable.

A. C. Gregory, in 1875 and 1879, referred the basaltic rocks in this area to a very recent date in the Tertiary era. W. H. Rands, in 1887 and 1889, placed the Brisbane tuffs at the base of the Trias-Jura; the Woodhill trachyte as contemporaneous with what are now called the Walloon or uppermost Trias-Jura measures; and the Tamborine Plateau and MacPherson's Range basalts and andesites as older than the Desert Sandstone (Upper Cretaceous). Rands regarded a certain deposit at the head of the Nerang River as being of Desert Sandstone age, but this, as shown further on, the author believes to be really rhyolitic pyroclastic material which has been found extensively developed in that area, and resting usually upon underlying basalt flows. In 1902, Dr. Jack was of the opinion that the basalts of the Main Range at Toowoomba, and also the Ipswich basalt, were contemporaneous with the Trias-Jura rocks in each of these places, but that the basalts at Clifton on the Darling Downs were younger than the Trias-Jura.

In 1898, S. B. J. Skertchly referred to the Toowoomba basalts as Tertiary in age. H. I. Jensen, in several papers in the Proceedings of the Linnean Society of New South Wales and elsewhere during the period 1906-1909, dealt fully with the alkaline rocks of the Glass House Mountains, and the Mount Flinders-Fassifern areas. He showed that the alkaline trachytes &c., intruded the Upper Trias-Jura, and, on account of their similarity with the Warrumbungle rocks, he set the Queensland rocks down as early Tertiary —Eocene or Lower Miocene. He also considered the South Queensland basalts Pliocene in age.

E. C. Andrews, in 1903, set down the (?) trachytes and basalts of MacPherson's Range district as Trias-Jura in age, but he has subsequently withdrawn this, and is now inclined to view them as Tertiary in age.

Wearne and Woolnough,[5] in 1911, described the occurrence of the rhyolites, trachytes, andesites and basalts

[5] Proc. Roy. Soc., N.S.W., xlv., p. 137.

in the south-western portion of the area, and determined the volcanic sequence as—i. Trachytes, ii. Andesites and dacites, iii. Rhyolites, iv. Basalts; while they believed the ages of the volcanic eruptions to belong (i.) to the Walloon stage of the Trias-Jura Coal Measures &c., (ii.) to the Tertiary Era.

E. O. Marks, in 1910 and 1911, in referring more particularly to the basaltic types of south-east Moreton, set down one series, composed particularly of the andesites and basalts of MacPherson's Range and the Tamborine Plateau, as Trias-Jura, and another series, exemplified by the basalts near Brisbane, as late or post-Tertiary. The same writer in 1912[6] strongly favoured a Trias-Jura age for the trachytic rocks in the Esk district.

In 1913,[7] R. A. Wearne gave further evidence for the Trias-Jura age of a portion of the volcanic rocks of the area.

Microscopic investigations have not been carried out previously on the sub-alkaline rocks, except on a few rocks by Dr. Woolnough from the locality of Cunningham's Gap, and a few by Dr. Jensen; while chemical investigations have been, hitherto, almost entirely restricted to the alkaline rocks.

With respect to the time at which these volcanic rocks have been extruded, we find Rands, Jack, Wearne, and Marks have advocated a Trias-Jura age for either all or a part of the volcanic series, whereas A. C. Gregory, Skertchly, Jensen, and also Andrews of recent years have advocated a Tertiary age for the rocks they have particularly described.

No previous record has been made by any of the writers on this area of the threefold development of upper, middle, and lower divisions of volcanic rocks which the author has found developed extensively over a great part of the area.

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[6] Queensland Govt. Min. Jour., xiii. (1912).

[7] A.A.A.S., xiv., Melb. 1913.

III. PHYSICAL FEATURES.

A general examination of the map of the area concerned shows certain marked features with regard to the drainage (*see* Plate X.).

It is noticeable that MacPherson's Range on the south, and the Main Range on the south-west and west, form very definite water-divides. With respect to MacPherson's Range, on the Queensland side all the drainage is to the north and north-east, there being a marked parallelism of the valleys. In fact, the characteristic feature is the northerly trend of the drainage until the wider valleys in the volcanic-rock-free portions of the Mesozoic measures are reached, when there is a marked easterly trend.

The main factor governing this northerly trend is the general north and south direction of the ranges forming the divide between the streams. An investigation of these ranges leaves little doubt as to their being residuals, except, perhaps, in the case of some of those in the western part of the area. They are either at present capped with volcanic rock, or show signs of having been covered at one time, and one is inclined to the belief that the pre-volcanic drainage system had a general north and south direction and that the north and south ranges of to-day mark the sites of the former valleys, or else that, as a result of folding movements, there was formed a series of depressions extending in a general north and south direction. The field evidence is very much against the latter.

Wearne and Woolnough[8] have shown that in Cainozoic times the divide which is now constituted by the Main Range was considerably to the east of its present position, and that there are traces of several stream channels along which the streams flowed in a westerly direction.

The only evidence of extensive faulting is in the western part of the area, and the same authors have shown the influence of this which has resulted mainly in the steep escarpment along the eastern slope of the Main Range.

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[8] Proc. Roy. Soc., N.S.W., xlv.

The most prominent features of the area are, perhaps, the plateaux capped with basic volcanic rocks in the south. One finds there the extensive plateaux known as Lamington, Roberts, Springbrook and Tamborine Plateaux. While slightly undulating on the surface, the first three plateaux rise gradually to the south, and on the border the culminating peaks are approximately 3,500 feet high, while Tamborine plateau is only 2,000 feet high. There is little doubt that they were at one time all connected. They are, however, very much dissected by the head waters of the Logan, Albert and Nerang Rivers and in the upper portions of the streams great canyons with almost precipitous sides and nearly 2,000 feet deep in some places occur.

All along the south-west and west parts of the area, one finds the basalt-capped plateau which constitutes the eastern edge of the Darling Downs, and at a height of approximately 2,500 feet. The main portion of the area is occupied by the slightly undulating Mesozoic plains which are traversed by sandstone ridges in a north and south direction. These are now either capped with volcanic rocks, or show signs of having been covered at one time. The valleys are wide and very deeply filled with alluvial material derived from the volcanic-capped plateaux at the heads of the streams. The outstanding masses of acid and sub-acid rocks form a conspicuous feature, and a close similarity of appearance characterises these masses, *e.g.*, Mounts Lindsay, Barney, Maroon, Edwards, Greville, Flinders &c., and the various peaks of the Glass House Mountains. These masses range from 4,600 feet above sea-level in the case of Mount Barney, to small hillocks. The contrast between these peaks of rhyolitic and trachytic rocks, and the plateaux of andesitic and basaltic rocks, is most marked. The western part of the area is bounded by a basalt-capped plateau at a height of about 2,500 feet above sea-level, but which has along it several peaks about 4,000 feet high—namely, Mounts Wilson, Roberts, Huntley, Spicer, Mitchell, Cordeaux, Castle &c. On the eastern side, along the coast, there is a broad coastal plain only a few feet above sea-level, extending from near Point Danger to well north of Southport. This is here and there dotted by inliers of Palæozoic schists, while at Currumbin and Burleigh Heads there are ridges of Palæozoic rocks, in some cases capped by basaltic rocks, dividing the plain.

The drainage of the various plateaux in the south usually descends over precipitous cliffs, often 500 feet or more in height. These falls are very frequent, and the head of each creek generally has its falls several hundreds of feet high. The course of the stream is then usually through a canyon-like valley with precipitous cliffs, in some cases 2,000 feet high, on either side; and the valley itself may be only half a mile wide. This young valley usually merges suddenly into a mature and well-rounded valley immediately the plateau is traversed and the Mesozoic sediments without a capping of volcanic rocks are entered upon. The contrast between the valleys dissecting the plateaux of volcanic rocks, and the valleys in the denuded Mesozoic areas, is very pronounced, and is, no doubt, almost entirely due to the differential rates at which the rocks are worn down.

The streams flowing over the Mesozoic portion of the area are very similar in nature, and their maturity is very evident. If one views a valley such as the Reynolds' Creek Valley from Mount Greville or the Canungra Creek Valley from Tamborine Plateau, the serpentine-like line made by the dark vegetation which grows on the banks of the streams is very definite. The average fall of the streams when once they have left the plateau area is approximately 5 feet per mile.

The steep cliffs which frequently form impassable precipices around the plateaux are due in many cases to the undercutting of the loosely-aggregated acid volcanic agglomerate and tuff. This acid fragmental rock is usually near the lower level of the cliffs, and owing to its ease in wearing away, it leaves no support for the overlying hard basic volcanic rocks which consequently fall away leaving steep inaccessible cliffs.

All of the plateaux are of the same structure. They are made up of a lower series of sub-basic and basic rocks resting on either Palæozoic or Mesozoic sediments; on top of this, one finds either acid tuff, agglomerate, or lava, and resting on this, numerous flows of sub-basic and basic rocks. The upper series may contain twenty or more different flows, and individual flows may attain a thickness of 100-120 feet, though usually they are much less than this. These separate flows result in a series of ledges being formed along the cliff faces.

In the south-eastern part of the area, even in the areas free from volcanic rocks, the topography is very young and this is especially so in the upper parts of Little Nerang Creek, Mudgeeraba Creek, and Currumbin Creek. The youth of the valleys results from the resistant character of the Palæozoic schists, and is contrasted very sharply with the mature valleys of the streams in the areas of Mesozoic sediments.

The relationship between the vegetation and the rocks is a very striking one. The volcanic rocks are usually clothed with scrub, the sub-basic and basic rocks being thickly coated with true scrub, and the acid and sub-acid rocks with either bastard-scrub or forest timber. The Mesozoic and Palæozoic rocks are clothed with the normal forest timber. The value of selections on rhyolitic country is not nearly as high as that of selections on andesitic or basaltic country, although all other conditions may be similar. The part which the volcanic rocks have played in the production of the soils of the rich valleys of this area is, of course, very great, and a close relationship between the fertility of the soil and the rock is observable.

IV. EARTH MOVEMENTS.

Dr. Jensen[9] has discussed the faulting near Mount Flinders and west of Ipswich, while Wearne[10] and Woolnough have shown the extensive faulting which has gone on in the western and north-western portions of the area. The author has obtained evidence which is in general accord with the conclusions arrived at by these investigators. Just to the north of Brisbane near Albion, a fault line in a north and south direction is known, but this is of no great importance.

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[9] Proc. Linn. Soc., N.S.W., xxxiv., p. 68.

[10] Op. cit., pp. 140, 141.

Apart from the above instances, no important fault movements are known to have occurred.

Folding movements of only a very gentle nature have taken place since the Palæozoic era.

The earth movements might then be regarded as being of a vertical nature, and the important ones have taken place in the western and north-western parts of the area, along lines having a general north and south direction.

These movements took place in Cainozoic time and the last great movement occurred after the volcanic activity had ceased for some time.

V. VOLCANIC ROCKS.

(I.) General Petrology.

The maximum thickness of volcanic rocks in any one area is approximately 3,000 feet, and this is seen to be made up in general of three main divisions, the lower basaltic members, the middle rhyolitic and trachytic members, and the upper basaltic and andesitic members. The upper division has the greatest development and the lower division the least.

This maximum thickness of 3,000 feet does not occur only in isolated places, but is general along MacPherson's Range, and in parts along the Main Range. The southern plateaux have an average elevation of approximately 2,500 feet, with volcanic deposits about 2,000 feet thick.

Tamborine Plateau, however, has an average thickness of about 800 feet of volcanic rock; Springbrook Plateau has about the same but rising to a thickness of 1,000 feet at least at its southern termination.

Lava flows exist at all levels from the sea-level at Lytton, Wellington Point, Point Danger &c., to over 4,000 feet in the south and west. An examination of the map shows that the present-day development is particularly in the south and the west, but there is very strong evidence of the development having been very much more extensive both to the north and east of the present main masses. In all probability there was a connection between the Tamborine Plateau and MacPherson's Range, and also a general extension in a westerly direction to Mount Lindsay. The length of time over which the volcanic activity resulting in these deposits extended must have been considerable, for in many cases the formation of soil on the surface of the flows has taken place, and in others river gravels and lacustrine deposits have been formed before the succeeding flow has been poured out.

There seems to have been a decided lapse of time between the extrusion of the lower and middle divisions of rocks, for in the Lamington area the acid agglomerate belonging to the middle division rests on extremely weathered basaltic material, and incorporated in the acid agglomerate are lumps of underlying soil. The same holds good between the middle and upper divisions.

In the Upper Chinghee Creek area, a deposit of river gravel several feet thick, containing well-rounded pebbles of the underlying basalts and rhyolites, occurs between the rhyolite and the overlying basalts. The upper division is made up of a large number of flows, and there are abundant instances in many localities of the production of surface soils before the succeeding flow took place. In some cases there are stems and roots associated with the soil, and in other places deposits of diatomaceous earth, between successive flows of lava, as at Mount Meerschaum, Beech Mountain, Point Danger, &c.

The total amount of denudation which has gone on since volcanic activity ceased has been very large, and valleys have been carved out to a depth of 2,500 feet—*e.g.*, the Christmas Creek Valley—through the volcanic rocks. In other places, as in Canungra Valley, there has been a cutting down through 1,000 feet of volcanic rocks, and through 700 feet of Mesozoic sediments, giving to-day a stream with a very meandering nature. At Cunningham's Gap also, the volcanic rocks had been denuded at least 1,500 feet, giving a well-rounded valley before the faulting along a north and south direction, which resulted in the so-called air-gap, took place. It is thus quite clear that the volcanic activity extended over a lengthy period, and also that there has been considerable time since the last volcanic outburst.

The extrusions appear to have been poured out under sub-aërial conditions, for nowhere in the area is there any evidence of marine deposits, but on the other hand, one has the occurrence between the flows, of soils *in situ,* of river gravels, of deposits of diatomaceous earth, and of the lacustrine Oxley beds which directly underlie the basalts at Cooper's Plains, and the trachytic rocks at Redbank Plains. The volcanic rocks show great variation in types, and they range from rhyolites to basalts. Rhyolites, trachytes, andesites and basalts are all abundantly represented though rhyolites and basalts seem to have the greatest development. Pitchstones and obsidians are associated with the rhyolites. In addition to the normal lavas, there are tremendous accumulations of pyroclastic material.

In considering the alkaline or sub-alkaline nature of the rocks it is found that there is a definite series having alkaline characteristics, but the great majority are definitely sub-alkaline. The terms alkaline and sub-alkaline are used all through as the equivalents of the terms "atlantic" and "pacific" as used by Harker. In addition to these two series, a third series which has characteristics intermediate between those of the alkaline and sub-alkaline series is developed to a minor extent.

Deposits of fragmental material are common in many parts of the area, but the greatest development of these is in association with the acid members. In the Lamington Plateau area in particular, basaltic agglomerate is associated with the lower basic rocks, while on the Main Range at Spicer's Peak, and in particular at Toowoomba, there are fragmental deposits associated with the basic rocks. At the latter place the development of basic tuff exceeds that of any other part of the area. While fragmental rocks among the lower and upper basaltic series are localised, there is a widespread distribution of acid and sub-acid fragmental material, especially of the former, over an area of 300 square miles right in the south.

Apart from the fragmental material, however, very extensive deposits of lavas of basic, intermediate and acid natures occur. The most widespread distribution of lavas is with the andesites and basalts belonging to the upper division.

The lower division, made up of basic and sub-basic rocks, is very widespread, being found over almost the whole area in the south and south-west, which is at present covered with volcanic rocks. The greatest development is at Mount Lindsay where it has a thickness of at least 1,500 feet, but usually it is less than 100 feet thick.

The middle division is made up of rhyolites and trachytes together with their glassy and fragmental representatives. As far as extensive development is concerned, the rhyolites are confined to the southern portion extending over an area bounded on the south by MacPherson's Range, while the trachytes occur in the south-west, generally along the line of the Main Range. However, trachyte is found in the southern area at Cainbable Creek, and rhyolite in the south-western area at Mount Alford. A remarkable similarity exists between the fragmental deposits all over the southern area, and not only is this confined to the actual nature of the material and its included fragments, but also to the manner in which it occurs and weathers. The acid lava is found either above or below the volcanic agglomerate, though on the Springbrook Plateau, where there is a widespread distribution of both lava and fragmental material, the lava occurs with agglomerate both above and below. In the Main Range area at Spicer's Gap, the agglomeratic and tuffaceous trachytic material appears to be above the trachytic lava.

The thickness of this middle division may be 1,000 feet, as is the case at the Springbrook Plateau. At this place the rock is rhyolitic and not more than 200 feet is fragmental.

The upper division, of sub-basic and basic rocks, is made up of a very large number of separate flows amongst which, in the same locality, there may be considerable variation.

One may have, as at Tamborine Plateau, fine-grained basalts, olivine-basalts and porphyritic andesites resting on one another, or at Lamington Plateau, a series of about twenty different flows of basalt. The individual flows vary greatly in thickness, in vesicular nature and in texture; in addition to this, they do not seem to be very persistent, but rather to overlap one another. The maximum thickness of the upper division is approximately 2,000 feet.

Pyroclastic material does not occur in this upper division throughout the southern plateaux, but on the Main Range one finds it on top of Mount Spicer in the form of agglomerate, and at Toowoomba there is a most extensive development of tuff. Basalt is much more widespread than andesite, and the greatest development of the andesitic type occurs in the east and south-eastern portions of the area, while the southern and western portions are almost entirely basaltic and usually rich in olivine; this is particularly the case at Toowoomba.

Nature of Extrusions and Sequence of Flows.

All three divisions are widespread, and there is a good deal of variation in the thickness in different localities. The acid and sub-acid members occur in the middle division; the lower and middle divisions are characterised by abundant pyroclastic material; while the upper division, except in one or two isolated and widely distant localities, has no development of pyroclastic material, but is built up of a large series of flows none of which attain any very great thickness. It is clear that the upper division at least was characterised by a tranquil welling out, such as characterises fissure-eruptions, and preceding this period, during which such a tremendous amount of volcanic material was quietly effused, there was one of violent outburst giving the large accumulations of acid volcanic agglomerate and tuff. This period of explosive violence must have been a fairly extensive one or else it was most prolific in the production of material. There is a remarkable similarity throughout the whole of the southern area, where the acid agglomerate is particularly developed, in this pyroclastic material; and the uniformity of nature and the widespread distribution incline one to the view that there must have been a large number of volcanic vents from which the material was showered forth at the same time. One of the characteristic included fragments in the agglomerate is a black pitchstone containing abundant white felspar phenocrysts, and it is an exception to find any occurrence of the agglomerate without fragments of this material. The only source of this pitchstone actually encountered was Mount Lindsay, yet it characterises agglomerates at least 36 miles away. Associated with the acid agglomerate, extensive flows of rhyolite are found particularly in the south-eastern portion of the area. The highly-fluxioned lithoidal rhyolite of the Springbrook Plateau and Tamborine Plateau differs from the porphyritic rhyolite met at Upper Chinghee Creek and the less porphyritic but more glassy type near Mount Lindsay, so that one does not find the same similarity of lavas as of pyroclastic material. The Chinghee Creek and Mount Lindsay material can each be reasonably ascribed to two closely adjacent volcanic vents, while the fine-grained more fluxioned and more extensive acid flows in the south-east of the area are most likely derived from a fissure or series of fissures with a general north and south extension.

Associated with the trachytes of the Main Range, as at Mount Roberts and near Spicer's Gap, there is fragmental material, and while there has been a quiet welling out along a north and south set of fissures of the trachytic material, as well as explosive outbursts, there is a series of plugs characteristic of the central type of eruption in a general north-east and south-west direction from the Main Range to Mount Flinders. It is probable that also during this period the rhyolitic and trachytic rocks were formed in the Esk and Glass House Mountains districts.

The material of the lower division appears to have resulted rather from fissure eruptions than from central vents, for although there is at Christmas Creek a development of agglomerate, the general uniformity of the lava and its widespread distribution taken into conjunction with its comparative thinness point towards a series of fissures forming the channels for the effusion.

It is a somewhat difficult matter to determine the sequence of the various volcanic products over the whole area, but in a general way the order can be established. Volcanic activity seems to have been ushered in with the extrusion from fissures of a normal basalt; this was succeeded by olivine-basalt. The latter portion of the period was characterised by explosive action in certain isolated localities, and may have been due to the choking of the fissures. This ended the first period of activity. After some time the intensely explosive action marking the second period developed and large deposits of rhyolitic agglomerate containing fragments of rhyolite and pitchstone were hurled out, to be succeeded in certain centres by lava flows of an acid nature, these being succeeded by the volcanic agglomerate again. The ashy material in some few localities was deposited in water and tuff resulted, but the occurrence of bedded ashy material is very limited. While the acid material was being extruded in the southern portion of the area, sub-acid ashes and lavas were being extruded in the south-west and generally along a north-east and south-west line to Mount Flinders. Dr. Jensen,[11] in dealing with the Mount Flinders and Fassifern areas, pointed out this probability. Most of the material during this period was extruded through vents of the central type, though the trachytes along the Main Range were probably the result of fissure eruptions.

Succeeding this period of activity, which was characterised by such prolonged and intense explosive action, there was the third period during which a vast accumulation of basic and sub-basic rocks was poured out. Generally speaking, the operations of this period seem to have been of a tranquil nature, and the material to have been extruded through a large number of fissures. Olivine-rich basalts are the predominant lavas of this period, but there is in the south-eastern portions of the main area, and also in the south-eastern coastal area, a development of andesitic rocks. These seem to have been extruded at an early time in this third period, but in almost all cases basalts or olivine basalts were first poured out. The final extrusions were almost all of a rather basic nature, and olivine basalt is characteristic of the uppermost flows. The

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[11] Proc. Linn. Soc., N.S.W., xxxiv. (1909), p. 72.

explosive element seems to have become more pronounced towards the end, and the extrusions were apparently carried out through vents of the central type, and accompanied by moderate explosive action except at Toowoomba, where it seems to have been particularly violent. The sequence from below upwards might then be stated as follows:—Normal sub-alkaline basalts followed by olivine-basalts, then the normal rhyolites, trachytes and the various alkaline lavas; these in turn were succeeded by olivine-basalt, andesite, andesitic basalt and olivine-basalt, generally speaking in that order.

Comparison with Cainozoic Volcanic Rocks of New South Wales and Victoria.

When one compares the threefold development of volcanic rocks in this area with the Cainozoic volcanic rocks of New South Wales and Victoria, a most interesting correlation is seen. In New South Wales there is a considerable development of older sub-alkaline basalts which rest upon leaf beds which are considered to be of early Cainozoic age, and these older basalts are especially developed in the New England district. A series of alkaline lavas and tuffs occurring in the Canoblas, Warrumbungle, and Nandewar regions is, in part at least, ascribed to the Upper Miocene,[12] and the remarkable similarities between many of these lavas and those of south-eastern Queensland have been pointed out by Dr. Jensen. In addition to these two developments, there is a series of newer sub-alkaline basalts at Ben Lomond, Gulgong, Inverell &c., which are regarded as probably Pliocene.

In Victoria [13] an older and a newer series of sub-alkaline basalts, belonging to the Lower and Upper Cainozoic respectively, occur, and also a development of alkaline lavas which are mainly trachytic and in many respects very similar to the alkaline types from this area. This alkaline series is believed to be of Middle Cainozoic age. and is certainly older than the newer series of sub-alkaline basalts.

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[12] T. W. E. David, N.S.W. Handbook, B.A.A.S., 1914.

[13] E. W. Skeats, A.A.A.S., vol. xii., 1909.

A tabulated comparison is given in the next chapter.

It is interesting also to note that J. A. Douglas,[14] in a paper on "Geological Sections through the Andes of Peru and Bolivia," points out that after the intense folding and elevation which took place in Middle Tertiary times, resulting in the raising of the Andes, volcanic activity continued and vast sheets of rhyolitic lavas and tuffs were poured out, and these were succeeded by the trachytic lavas which build up Mount Taapaca and the andesites and basalts of Mount Tacora and Chupiquiña.

(II.) Age of Effusive Rocks.

The acid pyroclastic material near Brisbane known as the Brisbane Tuff[15] is unquestionably at the base of the Ipswich Series of Coal Measures, and there is no doubt as to its early Trias-Jura age. Apart from this minor occurrence, however, the most recent opinions expressed by writers, namely E. O. Marks and R. A. Wearne, on the volcanic rocks of this area have been certainly in favour of a late Trias-Jura age for at least a considerable portion of the extruded material. The author, after a most careful investigation into all the evidence adduced in favour of these opinions, is unable to accept them, but, on the other hand, is convinced of a post-Walloon age for the whole development. If the Walloon measures represent the uppermost Trias-Jura deposits, then the whole volcanic development is post-Trias-Jura. All the direct and indirect evidence appears undoubtedly to point in this direction, and Messrs. Marks and Wearne, who have been the most ardent advocates of an Upper Trias-Jura age for a great deal of the volcanic material, have accepted the author's interpretations of the sections and occurrences which had formerly chiefly led them to their conclusions.

The volcanic rocks are found resting on top of the Trias-Jura sediments in all parts of the area, except in the south-east, where they rest on the Palæozoic schists. In no

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[14] Q.J.G.S., vol. lxx. (1914), pp. 47, 48.

[15] W. H. Rands, Q'land Geol. Surv., Pub. 34.

locality is there any interbedding of the volcanic flows or pyroclastic material with the Mesozoic sediments, but on the other hand there is abundant evidence of inclusions of the Mesozoic sediments in the overlying volcanic rocks. Rhyolitic pitchstone, trachytic and basaltic dykes and sills intrude the Walloon Coal Measures in different localities.

In several places, deposits of diatomaceous earth a few feet thick occur between successive flows of basalt in the upper division of volcanic roks. These deposits occur at Mount Meerschaum, Beech Mountain, Tweed Heads, near Rosewood &c. In some cases the diatomaceous material has been altered into common opal,[16] but where it is unaltered frequent traces of plant-remains are found. These remains are imperfectly preserved and not capable of precise determination, but amongst them remains of dicotyledonous plants can be recognised; this places these basaltic flows as post-Trias-Jura at least. In the middle division of acid and sub-acid rocks abundant fragments of the Mesozoic sediments occur. The most notable example is in a small cliff section in Upper Christmas Creek, between portions 62v and 72v. Here, a mass of shale many feet in diameter is included in volcanic agglomerate. The shale is standing with its bedding approximately vertical and it contains not only a highly carbonaceous band, but also fossiliferous shale bands containing *Cladophlebis* which characterises the Upper Trias-Jura measures of this locality.

An examination of this section leaves no doubt whatever as to the included nature of the mass of shale, and it furnishes definite evidence of a post-Walloon age for this volcanic material. The compactness and nature of the material in the shale-block indicate that a considerable period of time had elapsed between its formation and the disruption from the bedded position.

The basalts of Cooper's Plains and the trachytic material at Redbank Plains both overlie the Oxley beds as shown by Marks[17] and Cameron. The Oxley beds which

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[16] Q'land Mineral Index, Q'land Geol. Surv., Pub. 241, p. 961; E. W. Skeats, Proc. Roy. Soc., Q'land, xxvi. (1914).

[17] Q'land Geol. Surv., Pub. 225 (1910), p. 53.

contain remains of dicotyledonous plants, fish, and reptiles are most probably Tertiary, though they may be Cretaceous. In any case these occurrences of volcanic rocks are certainly post-Trias-Jura and most likely Cainozoic in age. There seems to be a definite connection between the trachytic material of the Redbank Plains and that along the line of eruption from Mount Flinders to the Main Range, so that there is additional evidence of a post-Trias-Jura age for the middle and upper divisions of the volcanic rocks at least. It will be noticed that all the direct evidence as to age is based on fossil leaves with the exception of the Oxley beds which in addition to dicotyledonous plants contain fish and reptilian remains. As to the latter beds, the question of age is merely one between the Cretaceous and Cainozoic. The direct evidence is thus seen to point to a Cainozoic age for the whole development.

The indirect evidence, obtained from a correlation of these rocks with similar ones in New South Wales and Victoria, is seen to be in accord with the above, and the following table shows an interesting comparison between the developments in the three States.

Cainozoic Volcanic Rocks of New South Wales.[1]		Cainozoic Volcanic Rocks of Victoria.[2]		Cainozoic Volcanic Rocks of South-east Queensland.	
—	Age.	—	Age.	—	Age.
Basalts of Ben Lomond, Inverell, Gulgong &c.	Probably Pliocene	Newer basalts	Upper Cainozoic	Upper division of basaltic rocks	? Upper Cainozoic
Alkali lavas and tuffs of the Canoblas and Warrumbungle Mountains and Nandewar Ranges	Upper Miocene	Alkali series of Central and Western Victoria	? Middle Cainozoic	Middle division of acid and sub-acid rocks, including the alkaline series of the Main Range, Fassifern, Mount Flinders, and Glass House Mountains	? Middle Cainozoic
Older basalts typically developed in New England District	Oligocene to Eocene	Older basalts	Lower Cainozoic	Lower division of basaltic rocks	? Lower Cainozoic

(1) T. W. E. David, N.S.W. Handbook, B.A.A.S. 1914, p. 603.

(2) E. W. Skeats, A.A.A.S. xii., 1909, pp. 199 et seq.

As E. O. Marks and R. A. Wearne, the most recent writers on the age of the volcanic activity resulting in these rocks, have so definitely advocated a Trias-Jura age for at least a considerable portion of them, the author has found it necessary to deal with this matter rather fully. Marks writes[18] :—

> "The present writer in examining the coal-measures south of Brisbane came to the conclusion that the volcanic rocks met with, almost entirely of the basaltic type, belong to two ages, Trias-Jura and late or post-Tertiary. In a flying visit to the coal-seams outcropping on the Upper Logan district, a site was pointed out by Mr. Buchanan, where an outcrop of carbonaceous shale or weathered coal had been covered by a recent slip in the bank of Christmas Creek. Mr. Buchanan remarked on the outcrop being perpendicular, and the writer observed that the sandstone in juxtaposition with the fallen ground was also perpendicular, and that this sandstone contained rounded pebbles of basalt similar macroscopically to the andesitic basalt of the neighbourhood. Some distance further down the creek, a similar sandstone is seen resting on the basalt. Owing to circumstances, a detailed examination could not be made then, but the section thoroughly convinced the writer of the Trias-Jura age of the basalt in that locality. . . . The sandstone and included basalt is presumably on the same horizon as that observed by Mr. Rands, and ascribed by him to the Desert Sandstone. . . . It is more than probable, there being no evidence to the contrary, that the sandstone observed by Mr. Rands is of Trias-Jura age, like the remainder of the sandstone in the neighbourhood."

It was the above that mainly led Marks to a Trias-Jura age for most of the basaltic rock, more especially for that in the eastern portion of MacPherson's Range. The cliff section pointed out by Mr. Marks was the one already described by the author earlier in this paper (*see*

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[18] Proc. Roy. Soc., Q'land, xxiii., pt. 2, p. 142.

page 123), and there is no doubt that the "sandstone" in juxtaposition to the fallen ground which contained pebbles of andesitic basalt is in reality the acid pyroclastic material which occurs developed to such an extent in that area. There is absolutely no trace of included fragments of volcanic rock in the mass of included shale, but the volcanic fragmental rock which surrounds it is thickly strewn with both rhyolitic and basaltic fragments, some of which attain several inches in diameter. The so-called "similar sandstone" further down the creek is also the acid pyroclastic material. I have communicated with Mr. Marks who is now in Dublin, and he quite accepts my interpretation, indicating also that he did not have a proper opportunity of thoroughly investigating the section. He writes: "The fact that the upturned strata are only part of a comparatively small mass enclosed in the tuff is an unexpected explanation of the section which I could only explain by contemporaneous action. It is very interesting and of course accepted, and removes the only definite evidence I saw of contemporaneous vulcanicity."

The material called desert sandstone by the late Mr. Rands,[19] and which forms the summit of the ranges between Nixon's Creek and Back Creek, is also the acid pyroclastic rock.

It is somewhat remarkable that both Rands and Marks should have regarded this material as sandstone, but the author of this paper is quite convinced of the real nature of the material as he has had repeated opportunities of investigations in innumerable cliffs, distributed over a large area, and has also investigated micro-sections (*see* Plate XIII., fig. 3) of the more compact material.

It is thus clear that Mr. Rands' pre-Cretaceous age for the basalt underlying the acid agglomerate and acid tuff at Nixon's Creek and Nerang Creek is not borne out on the evidence.

Mr. Rands described the Woodhill trachyte as a flow interbedded with the Walloon measures, but the true relationship is masked by faulting, and one needs to assume

[19] Q'land Geol. Surv., Pub. 51 (1889).

less in interpreting it as a sill than as an interbedded flow. The material is very much weathered and is probably a sill connected with the trachytic mass at Mount Flinders.

The evidence put forward by Wearne[20] for a Trias-Jura age for some of the volcanic rocks is here summarised and is as follows:—

(1) Occurrence of waterworn volcanic pebbles in beds of conglomerate, near the top of the Walloon series. These pebbles have been found near Mount Flinders, near Mount Alford, in Blenheim Creek and near Esk.

(2) Occurrence of a piece of volcanic tuff containing imprints of Trias-Jura plants and associated with basalts at the Hip Roof Range, south of Laidley.

(3) Occurrence near Esk of volcanic tuff containing imprints of Trias-Jura plants.

(4) Interbedded alkaline trachyte with shales containing fossil plants of Mesozoic age, 5 miles north of Esk.

With respect to (1) the author has carefully examined many similar conglomerate beds, and most of those mentioned by Wearne, and there is no doubt about the presence of trachytic, rhyolitic and basic-porphyry waterworn pebbles in these beds which are apparently of Walloon age. The pebbles, however, are not quite comparable with the trachytes and rhyolites which have been described as volcanic lavas &c., but they are indistinguishable from the rhyolitic and trachytic material which occurs as intrusive dykes through the Palæozoic rocks of this area. These dykes are particularly well seen in the Taylor Range area, and have been described by Bryan.[21] There is no doubt that these dyke rocks, which represent the hypabyssal phase following the deep-seated intrusions of grano-diorite material occurring along the D'Aguilar Range, are older than the Trias-Jura sediments, as one never finds the intru-

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[20] Proc. Roy. Soc., N.S.W., xlv.; A.A.A.S., xiv., Melbourne, 1913.
[21] Proc. Roy. Soc., Q'land, xxvi. (1914).

sions passing from the Palæozoic schists to the Mesozoic sediments, but on the other hand they stop at the junction.

One can thus easily account for the presence of these pebbles, and it is clear that there need be no relationship at all between these waterworn pebbles and the volcanic rocks which are found resting on the Walloon sediments, and in fact the evidence is against it. The author knows of no basalt pebbles, although melanocratic porphyritic rocks which have some resemblance to porphyritic basalt are sometimes met with, but these also occur as pre-Trias-Jura hypabyssal material.

(2.) The piece of "volcanic tuff" containing fossil plant-remains such as *Tæniopteris daintreei* was about 3 or 4 cubic feet in volume, and was found by Messrs. Wearne and Zerner. They also found another smaller piece. The author investigated this locality with Mr. Zerner, and although the same track was traversed to the top of the range, and diligent search made, no further traces of "volcanic tuff" were found, but on the other hand many small boulders of sandstone and quartzite were met with. This particular range is made up of quartzites, sandstones, conglomerates and shales, to a height of 1,500 feet above sea-level, and it is capped by about 600 feet of olivine basalt. Messrs. Wearne and Zerner found their plant-bearing fragments at heights 1,350 feet and 1,700 feet respectively.

Between the heights of 1,150 feet and 1,750 feet nothing other than basalt is met, except the occasional sandstone and quartzite boulders lying on the surface. In many other areas one finds these xenoliths included in the basic flows, and it is most probable that these quartzite and sandstone boulders which are indistinguishable from the underlying quartzites and sandstones have been caught up by the basalt, also that the "volcanic tuff," which to the author seems a light-coloured shale, simply represents underlying Mesozoic sedimentary material caught up in the basalt and brought along with it. There is no development at all of trachytic rocks in this district, and this has been pointed out by Wearne in his report to the Melbourne meeting of the A.A.A.S. in 1913.

(3.) Near Esk, one finds in the coal measures a great amount of felspathic material in the shales and sandstones. This is derived from the weathered grano-diorite which occurs a few miles to the north-east, and an examination shows all stages of the material, from thoroughly broken-down particles right up to fresh grano-diorite pebbles which are abundantly distributed through the beds.

The felspathic particles in the shales are often quite large, and bear a very close resemblance to the other weathered felspars on the surface of the included pebbles. The assumption that this material is trachytic tuff does not seem at all justified, and the author interprets it merely as felspathic sandstone and shale which are made up of material largely derived from weathered grano-diorite. A micro-section of the so-called "trachyte-tuff" which contains fossil plants was shown to the author by Mr. Wearne and it is best described as a fine-grained argillaceous sediment through which are distributed abundant angular grains of quartz. There is nothing of the microscopic characters of a tuff associated with this rock, and it bears no resemblance to the undoubted tuffs which are found in other parts of the area.

(4.) This occurrence of trachytic material is between portions 155 and 157, parish of Esk, and is encountered on the roadside as one ascends the ridge towards Ottaba Station from Esk. Instead of being alkaline trachyte interbedded with shales, the author regards it as a dyke of trachy-andesite. This material is very much weathered, but a somewhat similar rock which has been analysed occurs at portion 51, parish of Esk, and the latter is one of the series of rocks which are regarded as belonging to an intermediate series between the normal alkaline and sub-alkaline series. The strike of the sedimentary rocks is 320° east of north, and of the dyke 340° east of north, and the material cuts across the beds, so that it is a dyke and not an interbedded flow. The strata are fairly highly tilted here, and are made up largely of felspathic sandstones and shales, containing abundant Mesozoic plant-remains. Quite close in the railway cutting, large dykes of augite-andesite have definitely intruded and baked the

Mesozoic sediments. These sedimentary rocks are tentatively regarded as belonging to the Walloon stage of the Trias-Jura, so that the evidence here is certainly not in favour of a contemporaneous age for the trachytic rocks and the Walloon stage of the Trias-Jura, as has been advocated.

This question of age has been discussed at some length and all the important pieces of evidence which have been adduced in favour of a Trias-Jura age have been discussed. The author is unable to accept the evidence for a Trias-Jura age, but is firmly of the opinion that these rocks have all been extruded during the Cainozoic era.

The direct evidence as well as the indirect evidence leads one to this conclusion, and the correlation with similar extrusive material of Cainozoic age in New South Wales and Victoria is strong confirmative evidence.

The volcanic activity which resulted in the widespread distribution of these volcanic rocks probably began in the Lower Cainozoic and continued until the Upper Cainozoic.

(III.) Rhyolitic Rocks.

These occur as lava flows, plugs, dykes and pyroclastic accumulations. They were all formed during the second great period of activity, and although they are represented in nearly all parts of the field where volcanic rocks are encountered, the greatest development is in the southern portion.

Wearne and Woolnough[22] made reference to the rhyolites of Mount Barney, Mount Maroon, Mount Alford and Glennie's Pulpit. Jensen[23] also referred to these rhyolites, but hitherto there has been no treatment of the big development of the rhyolitic rocks in the southern and south-eastern portions of the area.

These rocks have resulted from central eruptions for the most part, and setting aside the pyroclastic material they usually occur more or less as isolated masses along

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[22] Op. cit.

[23] Proc. Linn. Soc., N.S.W., xxxiv., p. 72.

somewhat definite lines. In the Springbrook and Tamborine areas however, fissure eruptions were most probably responsible for the extensive development of lithoidal rhyolite which is found there. All stages from holocrystalline to thoroughly glassy rocks are represented, and there is a great diversity of types. In the lava flows both the porphyritic and lithoidal varieties occur, though the latter are the more abundant.

Definite flows are found building up portions of Tamborine Plateau, Springbrook Plateau and MacPherson's Range from Mount Cougal on the east nearly to Mount Wilson on the west. Along the Coomera River there are also extensive lava flows. A general idea of the thickness of these flows has already been given.

Large masses which seem to represent plugs associated with central vents occur at Mount Lindsay, Mount Barney, Mount Maroon, the Maroon Range, Knapp's Peak, Mount Moon, Mount Alford, in the Esk district, particularly at Glen Rock, and in the Glass House Mountains district. Dykes are not frequently met with, but in the Cunningham's Gap area there are several. In Johnston's Creek below Mount Matheson there is a rhyolitic dyke striking in a north-west and south-east direction; its width cannot be determined as it passes under alluvium on the east side, but it is at least 50 feet wide and its western margin is a dark pitchstone. This pitchstone margin is several feet in thickness, and is somewhat porphyritic. Near Mount Alford, both pitchstone and rhyolitic dykes occur, and just near the Moogerah School an excellent pitchstone dyke is seen.

On the Upper Logan River between Mounts Lindsay and Barney, there are rhyolitic dykes intruding the Walloon sandstones and shales, and at the Yellow Pinch reserve, just to the east of Mount Barney, there is a rhyolitic dyke about 15 feet wide, which has severely baked the intruded sandstones and shales.

Heat metamorphism of the intruded coal-measures seems to have been more pronounced in connection with the Mount Barney mass than in any other locality examined.

Microscopical and chemical considerations show that there are two well-defined series of acid volcanics, namely the alkaline and sub-alkaline, but in addition there are representatives of a series intermediate between these two.

Sub-alkaline Acid Rocks.

Among the sub-alkaline rhyolites we find both porphyritic and non-porphyritic varieties. The porphyritic rhyolites may be white, yellowish, or reddish in colour, and have phenocrysts of quartz and felspar. The phenocrysts of quartz are always transparent, and in the case of felspars which may be orthoclase, sanidine, or anorthoclase, they are typically colourless and glassy and not white. The relative proportions of phenocrysts and groundmass do not vary very much, and the phenocrysts always play a very subordinate part.

The groundmass varies from holocrystalline to holohyaline, as in the case of the pitchstones, and all intervening stages are represented in the various types.

The lithoidal varieties have a characteristic colour ranging from light grey to lavender. Occasionally one may see in the hand-specimen short, stout, lath-shaped crystals of orthoclase. Fluxion structure is very pronounced and is particularly evident on the weathered surface.

As described by Harker,[24] the banding of the rhyolites is seen on microscopic examination to be the result of slight differences in the nature and texture of the groundmass. While spherulitic structure on a microscopic scale is generally present in the rhyolites from this field, in one place only has it been found sufficiently coarse to be easily seen in the hand-specimen. This occurrence is on the banks of the Coomera River west of the Gin's Leap, and there one finds coarsely spherulitic rhyolite with spherulites averaging perhaps half an inch in diameter but ranging up to 1½ inches. The rock is very much altered and chalcedony occurs abundantly between the spherulites

The microscopic characters may be summarised thus:—

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[24] Tertiary Igneous Rocks of Skye.

Texture.—The crystallinity varies from holocrystalline to hypocrystalline, the grain-size is always very fine, less than ·01 mm., and there is a great variety of fabrics. The fabric may be consertal as in the Chinghee Creek and Glennie's Pulpit rocks (*see* Plate XIII., fig 1), or micrographic as in the Mount Barney rock, but it is generally microspherulitic and often shows an axiolitic nature. In the porphyritic varieties, a strong fluxional arrangement of the groundmass may be noticed, while in the lithoidal varieties there is usually a strong development of banding shown.

The porphyritic crystals vary in size up to 4 mm. in diameter, but they have an average diameter of 2 mm. In many cases they are rounded and embayed.

Minerals Present.—The phenocrysts are usually quartz, and orthoclase or sanidine, though anorthoclase is present in some rocks. It frequently happens in those rhyolites with a hypohyaline groundmass that the quartz phenocrysts have curved cracks and the cleavage traces in the felspar are stained by a film of iron oxide. There is a marked absence of ferro-magnesian minerals, though in some cases greenish granules which may represent altered ferro-magnesian minerals occur. The groundmass invariably consists of quartz and orthoclase, and in some cases the quartz seems to be of a secondary nature. Apatite, zircon and magnetite are seen occasionally, particularly in the Mount Barney rock.

Specimen 98.[25]—Locality: Portion 58v, parish of Telemon, Upper Chinghee Creek. The rock occurs as a flow, yellowish white to grey in colour, and somewhat decomposed. It is porphyritic, being perpatic, and has phenocrysts of quartz, sanidine and anorthoclase averaging 2 mm. in diameter set in a very fine consertal groundmass of quartz and orthoclase. Ferro-magnesian minerals are absent although small greenish-brown granules throughout the slide may be altered augite. The specific gravity is 2·37. Name: *Rhyolite.*

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[25] These numbers refer to the micro-slide numbers in the University of Queensland collection.

This rock is very similar to the rhyolite at Glennie's Pulpit, Mount Alford.

Specimen 54C.—Locality: South-east of Tamborine Plateau. This specimen is greyish white in colour, and is seen to be hypocrystalline. It consists of small grains of quartz and felspar set in a micro-spherulitic groundmass of quartz and orthoclase. (*See* Plate XII., fig. 6.) Fluxion structure is common and thin veins of secondary quartz are numerous. Name: *Rhyolite.*

Specimen 134.—Locality: Glass Cutting, 4 miles north of Springbrook. This is a pale lavender in colour, and is lithoidal in character. In the hand-specimen it shows magnificent banding. The rock is cryptocrystalline, and apart from a very characteristic micro-spherulitic structure little else is seen. The slight variations in texture of the different bands through the rock, together with different degrees of pale staining, account for the rather pronounced banding which this rock shows. The fluxion structure shown by the rock mass is very fine, and at its base is developed an excellent perlite. This rock is characteristic of all the rhyolite lava on the Springbrook Plateau. Specific gravity 2·38. Name: *Lithoidal Rhyolite.*

Specimen 223.—This rock was obtained from the base of the upper dome of Mount Lindsay, at an elevation of 3,600 feet. The dome is made up of pitchstone and rhyolite agglomerate, and has a very rough columnar structure. The specimen described occurred as a large boulder in the agglomerate. In colour it is a deep brownish black passing into red in patches. It has a dull lustre and a conchoidal fracture, while the phenocrysts of quartz and felspar are particularly glassy. Under the microcope the groundmass is seen to be cryptocrystalline, and to have a very definite fluxion structure. Micro-spherulitic structure is well developed. The phenocrysts are quartz, sanidine and possibly anorthoclase. It is dopatic and phenocrysts which are frequently corroded and embayed are traversed by curved cracks. The perlitic cracks in many cases run right through the phenocryst and into the groundmass. These cracks are stained with limonite. (*See* Plate XII., fig. 4.)

This rock represents an intermediate stage between the black pitchstone, with which it is associated, and the more crystalline rhyolite which has been poured out from the vent which has been plugged up by this material. All through the south-eastern area of acid pyroclastic material this rock is found, and is, together with the black pitchstone, the most constant inclusion. Name: *Rhyolite.*

Specimen 229.—Locality: 78v, parish of Palen, Tylerville. This material represents lava which has been poured out from Mount Lindsay. It is a light grey in colour, is perpatic, and has phenocrysts of quartz and sanidine set in a hypohyaline groundmass which contains quartz and orthoclase. Micro-spherulitic structure is common, and an axiolitic arrangement is frequent. Name: *Rhyolite.*

Specimen 220.—Locality: Mount Barney. This forms the main plug of Mount Barney and it is somewhat different from the other rhyolites, as it is much coarser. It is greyish white in colour and in patches is stained brown by the limonite resulting from the altered magnetite in the rock. This rock contains phenocrysts of felspar, a good deal of which is possibly anorthoclase, and quartz, the felspar being the more abundant. In many cases the felspars are subidiomorphic, whereas the quartz is allotriomorphic. The groundmass consists of a micrographic intergrowth of quartz and orthoclase, which is developed to a great perfection. (*See* Plate XII., fig. 5.) The intergrowth forms a framework around the phenocryst which in some cases has been embayed. Frequently one sees the intergrowth radiating off from a particular point or line and there is apparently no nucleus of felspar or quartz. Distributed through the rock are abundant small granules of magnetite which are frequently being altered into limonite. Minute grains of apatite and zircon occur as inclusions in the phenocrysts. Specific gravity 2·50. Name: *Micrographic Rhyolite.*

Specimen 102.—This light-grey rock occurs as a dyke through the Walloon measures on Johnston's Creek near Cunningham's Gap, portion 62v, parish of Clumber. It has a fine development of black pitchstone, containing porphyritic felspars, on its margin. The rock is holocrystalline and porphyritic. The rock is perpatic, and phenocrysts consist of quartz, sanidine and an acid plagioclase somewhat sparingly developed; these are set in a very fine consertal groundmass. Micrographic intergrowths of quartz and orthoclase are very common. This rock is very similar to the rhyolite of Glennie's Pulpit at Mount Alford, which is a few miles to the south. Name: *Quartz Porphyry.*

Glassy Varieties.

Perlite.—This is of rather limited occurrence and is found at the Glass Cutting on the Springbrook Plateau, between portions 117 and 121, parish of Numinbah. It is found at the base of the rhyolite flow, and is many feet thick. It can be seen grading off into the rhyolite and it exhibits beautiful fluxion structure and perlitic cracks. (*See* Plate XII., fig. 2.) Perlites are abundantly developed and the rock in many places is seen to be composed entirely of them. In colour it is a bluish grey when fresh, but it becomes brown on alteration. The rock has a specific gravity of 2·33.

Under the microscope, the holohyaline nature of the rock is very evident and the perlitic cracks are abundant. Trichites, cumulites and margarites are present in great abundance, and the cumulites are seen arranged in bands. It is noticeable that the trichites and margarites are arranged along parallel lines, and these intersect the bands of cumulites at an angle of 40°.

Pitchstones.—These occur as dykes and as inclusions in the acid pyroclastic material in the southern portion of the area. The dyke occurrences are near Cunningham's Gap. Near the Moogerah School at the foot of Mount Alford, there is a green pitchstone dyke through the Walloon measures. There are very occasional phenocrysts of sanidine up to 1·5 mm. long, but apart from this the rock is a glass in which are occasional lath-shaped felspars ·05 mm. in length. Trichites are common and spherulites are very abundant and they tend to have an axiolitic arrangement, parallel to the fluxion bands. (*See* Plate XII., fig. 3.) A number of micro-slides of this rock were prepared for class purposes, and in one section, a phenocryst of micrographic intergrowth of quartz and orthoclase round a kernel of sanidine is seen. The phenocryst is 2 mm. long. and the dyke is no doubt associated with the "granophyre" which Dr. Woolnough[26] has described from the northern base of Mount Alford.

The most characteristic pitchstone, however, is the one which occurs over the whole of the southern area, as inclusions in the acid pyroclastic material. It is remarkably uniform in nature and occurs in boulders of all sizes. It is found in great abundance at Mount Lindsay and forms the major portion of the agglomerate which makes up the top dome of Mount Lindsay. The pitchstone itself occurs in tremendous blocks many tons in weight, and when fresh has a beautiful glassy black appearance. It has a conchoidal fracture, and the white felspar phenocrysts which occur abundantly through it show up well. In thin sections it is seen to be made up of a light-brown glass and it has phenocrysts of sanidine, anorthoclase, quartz and occasionally augite. These phenocrysts are usually corroded and embayed and often the glass is seen entering along the cleavage cracks. (*See* Plate XII., fig. 1.) The glassy groundmass shows perfect fluxion structure and it is traversed by perlitic cracks. In several places through the sections small angular fragments of felspar may be seen, and these have apparently resulted from the disruption of the phenocrysts while the groundmass was still in a mobile state. Around these fragments the fluxion structure is particularly pronounced, and their sharp angles are in great contrast to the rounded corners of the larger phenocrysts which have remained intact. The specific gravity is 2·39.

Cracks occur abundantly in the phenocrysts and are of interest as they are seen to have the same characters as those described in a perlitic pitchstone from the Tweed River by Smeeth.[27]

The cracks are much more abundant in the quartz than in the felspar, and in some cases they pass continuously from the matrix into the quartz crystals and also into the felspar cystals. One does not, however, see the

[26] Proc. Roy. Soc., N.S.W., xlv., p. 150.

[27] Proc. Roy. Soc., N.S.W., for 1894 (xxvii.).

completion of the matrix perlite in the quartz, nor perlites formed in the quartz and completed in the matrix as described by Watts.[28] Sometimes, however, perlitic cracks surround the crystals.

In the hand-specimen this pitchstone bears a very close resemblance to one described by Harker[29] from Glas Bheinn Mhor in Skye, and it is a matter of difficulty to distinguish between them.

When the analysis is recalculated to 100 per cent. after removing the water and is compared with the recalculated analysis of the Mount Barney rhyolite a very close resemblance is seen, so that they in all probability have a common source. (*See* Table VII.) This is of interest as the rocks are so different in texture and in addition are separated by several miles.

Rhyolites intermediate between the sub-alkaline and alkaline varieties.

Specimen 233.—Locality: Portion 28v, parish of Biarra. This light-grey rock forms a hill on the west side of the railway line, just near the Ottaba railway station. It is a lithoidal variety, but has occasional phenocrysts of anorthoclase set in a hypohyaline groundmass which contains very fine equigranular quartz and orthoclase. Good fluxional arrangement is shown through the rock in places, and the weathered surface often shows a ropelike structure owing to the twisting of the viscous magma when extruded. Through the rock, one sees under the microscope indefinite green granules which are difficult to determine. This rock is much richer in soda than potash. The specific gravity is 2·61. Name: *Rhyolite.*

Specimen 234.—Locality: Glen Rock, Esk. This is a light brown in colour, and it forms the large mass of Glen Rock. It is remarkably free from phenocrysts although occasionally one sees crystals of sanidine which are slightly larger than the rest of the mass. The rock is hypohyaline, and the grain-size is very fine being about ·075 mm. The fabric shows a very poor fluxional arrangement, and there is a tendency for the felspar laths to

[28] Q.J.G.S., l. (1894).

[29] Skye Memoir, p. 408.

group themselves into stellate masses. (*See* Plate XIII., fig. 2.) The minerals present are quartz, anorthoclase and sanidine. The zeolite, stilbite, occurs in cracks through the rock. The specific gravity is 2·61. Name: *Rhyolite*.

Alkaline Rocks.

These rocks have been fully described by Jensen,[30] and it is worthy of note that there is a very great difference both macroscopically and microscopically between these rocks and the rhyolites already described in this paper.

We may group these rocks under two headings:

(*a*) Pantellerites;

(*b*) Comendites.

Pantellerites.—One finds these in the Glass House Mountains district, at Mount Ngun-Ngun and the Trachyte Range, and also in the neighbourhood of Mount Flinders. They are usually greyish to bluish-green in colour and often show in the hand-specimen dendritic and mossy aggregates of ægirine. The fabric may be trachytic, hyalopilitic, pilotaxitic or orthophyric, and the minerals are quartz, sanidine, anorthoclase, riebeckite, arfvedsonite as well as rarer minerals.

Comendites.—These are usually lighter in colour than the above, and occur at Mounts Conowrin, Tibrogargan, Beerburrum and Ewin in the Glass House Mountains area, and also at Mount French. Jensen[31] records them from Spicer's Peak and Mount Mitchell, but the author has failed to find them there. The fabric is microgranitic or orthophyric, and the minerals, quartz, sanidine, soda-sanidine, ægirine, riebeckite and arfvedsonite.

These special alkaline types are very limited in their occurrence and their total volume is insignificant when compared with that of the more normal rhyolites in the southern portion.

Chemical Composition of Rhyolitic Rocks.

(*a*) *Sub-alkaline and intermediate types.*—An examination of the analyses shows that there is a close

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[30] Proc. Linn. Soc., N.S.W., 1906-1909.

[31] A.A.A.S., xii., Brisbane, 1909, p 253.

similarity amongst these rocks, and that they are all of a decidedly acid nature. The alumina value is a little lower and the total iron-oxides value a little higher than is usual in these rocks.

This deficiency in alumina and richness in iron-oxides is a characteristic of the rocks of the area as a whole, but is much more pronounced in the basic representatives. The lime value is normal, and is to be contrasted with the much lower percentages in the alkaline types. The alkali contents are a little above normal, and it is noticeable that in the two rocks from the Esk district the soda is in excess of the potash. These two rocks seem to be midway between the sub-alkaline and alkaline types.

Two analyses have been inserted in the table for comparison, and a somewhat close relationship exists between the Chinghee Creek rhyolite and the perlite from Yellowstone National Park; while between the Springbrook rhyolite and a biotite-rhyolite from Sugarloaf Hill, San Francisco, especially close chemical relationship exists.

The exact locality of the pitchstone in Column IV. from MacPherson's Range is unknown, but Mr. G. W. Card of the Mining Museum, Sydney, kindly sent me the analysis, and it is evident that it is very similar to the Mount Lindsay pitchstone, and in fact it may be from the same locality.

The analysis of the perlitic pitchstone from Tweed River is not a complete one, but it is richer in alumina and poorer in alkalies than the other rocks. This analysis, which was originally published by Smeeth,[32] and which is undoubtedly an analysis of the perlitic pitchstone from Tweed River, has been published in a subsequent paper by E. C. Andrews[33] as the analysis of the Mount Lindsay rock, but there is obviously a mistake in locality. The analysis in Column IV., with which Mr. Card of the Mining Museum, Sydney, kindly furnished me, seems rather to be an analysis of the Mount Lindsay rock.

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[32] Op. cit., p. 311.

[33] Rec. Geol. Surv., N.S.W., vol. vii., p. 240.

TABLE I.—RHYOLITES, PITCHSTONES &c.

—	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
SiO_2	74·28	73·84	72·35	71·98	74·10	73·10	74·02	72·73	72·02	75·51
Al_2O_3	11·27	12·47	10·96	12·02	12·08	13·09	13·20	13·57	12·60	14·30
Fe_2O_3	1·93	0·32	2·60	1·20	2·02	1·19	0·50	0·69	0·32	1·01
FeO	0·58	0·90	1·50	1·08	0·86	1·43	0·52	1·43	3·29	
MgO	0·44	0·25	0·17	0·16	0·64	0·43	0·06	0·42	0·55	0·24
CaO	1·15	1·08	1·03	0·64	1·10	0·87	0·56	1·00	1·95	1·81
Na_2O	2·74	2·88	3·26	3·04	3·32	4·03	4·18	4·98	4·84	1·21
K_2O	4·77	5·38	4·87	5·07	4·98	4·92	4·82	3·74	2·82	2·89
H_2O+	1·01	2·76	3·50	3·86	0·81	0·54	1·86	0·95	0·20	2·84
H_2O-	0·70		0·35	1·02	0·34	nil	..	0·50	0·30	
CO_2	..	..	..	0·01	..	..	..	..	..	..
TiO_2	0·25	..	nil	0·13	0·21	0·39	0·02	tr.	0·69	..
P_2O_5	0·07	..	0·09	0·02	0·07	0·11	..	0·07	0·11	..
MnO	0·02	tr.	0·03	0·06	0·05	nil	tr.	0·04	0·04	..
				&c. 0·19						
Total ..	99·21	99·88	100·71	100·48	100·58	100·10	99·76	100·12	99·73	99·81
Spec. Grav...	2·37	..	2·39	2·347	2·50	2·38	..	2·43	2·61	2·47

Norm.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
Quartz ..	37·38	32·9	32·94	32·7	33·06	28·56	29·70	26·64	27·36	..
Orthoclase ..	28·36	32·2	28·91	30·0	29·47	28·91	28·36	21·68	16·68	..
Albite	23·06	24·6	27·77	25·1	27·77	34·06	35·63	41·92	40·87	..
Anorthite ..	4·45	4·7	0·83	2·8	3·61	3·06	2·78	3·89	4·45	..
Corundum ..	..	..	..	1·4	..	..	..	..	..	..
Diopside ..	0·22	0·8	2·10	..	0·86	..	..	..	3·81	..
Hypersthene ..	1·00	1·5	..	1·3	1·20	2·02	0·56	3·11	4·34	..
Wollastonite ..	..	..	0·35	..	..	..	..	..	..	..
Magnetite ..	1·16	0·5	3·71	1·9	2·09	1·86	0·70	0·93	0·46	..
Hæmatite ..	1·12	..	..	..	0·64	..	..	..	..	..
Ilmenite ..	0·46	..	..	..	0·46	0·76	..	..	1·37	..
Apatite ..	0·31	..	0·34	..	0·34	0·34	..	0·34	0·34	..

I.—Rhyolite, I. 3.2.3. Tehamose, Chinghee Ck., por. 58v, parish Telemon.[1]

II.—Rhyolite-Perlite, I. 4.2.3. Toscanose, Midway Geyser Basin, Yellowstone Park.*

III.—Pitchstone, I. 4(3).1.3. Liparose, Mt. Lindsay.[2]

IV.—Pitchstone, I. 4(3).1.3. Liparose, MacPherson's Range.†

V.—Rhyolite, I. 4.1.3. Liparose, Mt. Barney.[2]

VI.—Rhyolite, I. 4(3).1.3. Liparose, Springbrook Plateau, por. 89, parish Numinbah.[2]

VII.—Biotite-Rhyolite, I. 4.1.3. Liparose, Sugarloaf Hill, San Francisco.‡

VIII.—Rhyolite, I. 4.1.4. Kallerudose, Glen Rock, Esk.[2]

IX.—Rhyolite, I. 4.2(1).4. Lassenose, Ottaba, por. 28v, parish Biarra, Esk District.[2]

X.—Perlitic-Obsidian, Tweed River, New South Wales.§

[1] Ann. Rept. Agric. Chem., Q'land., for 1913. Slight alterations have been made subsequent to publication by Agric. Chem.

[2] Ann. Rept. Agric. Chem., Q'land, for 1914.

* Iddings, Igneous Rocks, vol. ii., p. 127.

† From Mr. G. W. Card, Mining Museum, Sydney ; Analyst, Mr. Mingaye.

‡ U.S.G.S. Prof. Paper 76, p. 104.

§ W. F. Smeeth, Roy. Soc. N.S.W. for 1894, vol. xxvii.

TABLE II.—ALKALINE RHYOLITES.

—	I.	II.	III.	IV.
SiO_2	74·20	72·38	71·56	74·88
Al_2O_3	11·75	12·21	11·94	11·34
Fe_2O_3	1·92	3·36	4·68	2·80
FeO	1·30	0·69	0·46	0·95
MgO	0·30	0·17	0·32	0·35
CaO	0·19	0·18	0·28	0·21
Na_2O	4·25	3·52	4·88	4·20
K_2O	5·00	5·20	5·03	4·98
H_2O+	0·27	0·86	0·40	..
H_2O-	0·06	0·69	0·33	..
CO_2	0·01	..	..	..
TiO_2	0·13	0·25	0·17	0·19
P_2O_5	abs.	tr.	tr.	0·02
MnO	0·20	0·70	tr.	0·08
NiO	0·03	0·04	0·01	..
ZrO_2	0·38	..	..	..
F	0·02	..	..	..
Cl	0·17	0·01	..	..
Total ..	100·12	100·26	100·06	100·00
Spec. Grav. ..	2·62	2.47 (vesicular)	2·71	..
Norm.				
Quartz	34·74	31·68	25·08	..
Orthoclase	29·47	30·58	29·47	..
Albite	25·15	29·34	33·54	..
Anorthite	..	1·11	..	..
Sodalite	4·85	..	..	..
Diopside	0·68	..	1·08	..
Corundum	..	0·51	..	..
Hypersthene	0·99	1·72	0·30	..
Acmite	0·46	..	6·93	..
Magnetite	2·55	1·39	0·93	..
Hæmatite	..	3·21	1·60	..
Ilmenite	0·15	·061	0·46	..
Fluorspar	0·08	..	..	..
Zircon	0·37	..	..	..
Pyrite	0·18	..	..	..
&c.	·33	..	·73	..

I.—Comendite, I. 3.1.3. Alaskose, Mt. Conowrin, Glass House Mountains.[1]
II.—Pantellerite, I. 4.1.3. Liparose, Mt. Ngun-Ngun, Glass House Mountains.[1]
III.—Pantellerite, I. 4.1.3. Liparose, Trachyte Range, Glass House Mountains.[1]
IV.—Average analysis of six Comendites.[2]

[1] Jensen, Proc. Linn. Soc. N.S.W., xxxi. (for 1906).
[2] Daly, Igneous Rocks, p. 20.

The rhyolite from Ottaba, which is relatively low in alkali contents, has an excess of soda over potash, also the lime content is considerably higher than in any of the other rhyolitic rocks.

(*b*) *Alkaline Rhyolites.*—These are all very acid rocks, and they differ from the sub-alkaline types in having a slightly lower alumina, higher total iron-oxides, much lower lime, and much higher total alkalies. The rocks are all sodipotassic with potash in excess of the soda. It is also noticed that normative acmite exists in two of the rocks.

The average of 6 comendites given in Column IV. agrees remarkably well with the Mount Conowrin rock.

Acid Pyroclastic Rocks.

These occur as breccias, agglomerates and tuffs, and as previously indicated have an extensive development in the southern portion of the area. Quite apart from the main development which is probably of Middle Cainozoic age, there are the Brisbane tuffs. These were first determined as made up of volcanic ash by W. H. Rands[34] in 1887. He gave a good account of their occurrence and also showed them to be at the base of the Ipswich formation, so that they are of early Trias-Jura age. The Brisbane tuff is really a rhyolite-tuff and it consists of very fine-grained felspathic matrix with blebs of quartz, orthoclase and plagioclase. It has been very much silicified in most places, and it has undergone a great deal of alteration.

Under crossed nicols the base seems to be made up of very fine-grained particles of felspar and quartz, but in ordinary light the original shapes of the particles which were originally glass but are now quite altered and crystallised are seen, and show the characteristic drawn-out shapes with frequent concave faces. Inclusions are numerous, and one finds fragments of the underlying schist and also carbonised wood. In certain places, but particularly on the northern side of the Brisbane River,

[34] Q'land Geol. Surv., Pub. 34, 1887.

there is a hardened band up to 2 feet thick right at the base of the tuff. This band is more compact than the overlying material and in many respects it suggests a rhyolite flow. It is noticeable, however, that this band is best developed where the overlying tuff is most silicified, and it is highly probable that it represents a layer of tuff at the bottom which has received an extra amount of silicification owing to the percolating solutions being held up by the impervious underlying shale band.

The greatest development of acid pyroclastic material occurs along MacPherson's Range and the ridges running off it in a northerly direction. It is distributed over an area of about 300 square miles, and was in all probability almost continuous. In general appearance, it is remarkably uniform as far as the matrix is concerned, but there is considerable variation in the size and abundance of the included fragments.

Occurrences of tuff are only occasional and the most typical development showing definite bedded structure was met with on the northern banks of the Coomera River, a few miles west of the Gin's Leap. The tuff has in places been much silicified and made very compact, although it is usually in a rather loose state of aggregation. The matrix is usually very fine-grained and a dirty yellow in colour, though it may be white or a bright green in patches. The greenish colour seems to be due to the presence of chloritic material.

The included fragments consist for the most part of rhyolite, but near the base there are large rounded boulders of basalt very similar to the underlying basaltic flows. The rhyolite inclusions range from holocrystalline and porphyritic varieties to pitchstones, and a black glassy pitchstone is a very widespread and characteristic inclusion. These inclusions often show a definite brecciated or welded structure.

On portion 136, parish of Telemon, at Mr. P. Burnett's selection on Chinghee Creek, a silicified tree trunk about 12 inches in diameter and 4 feet long was found included in the agglomerate. Thin veins of silicified ash material were seen along what had apparently been cracks in the log. As described earlier, at Upper Christmas Creek, a large included mass of coal-bearing shale was found included in the agglomerate. The cliffs of compact pyroclastic material which occur frequently on the valley sides all through the southern area are very characteristic, and when examined are seen to have an imperfect columnar structure and to be weathered out into caves. These caves are often several feet in diameter, and on the weathered surface, the angular and subangular included fragments of rhyolite &c., generally a few inches in diameter, stand out as a result of their superior weathering properties.

(iv.) Trachytic Rocks.

These are found occurring in much the same way as the rhyolitic rocks, but they have a much more limited occurrence. The most extensive development is along the Main Range from Wilson's Peak to near Mount Castle, and they seem to have resulted from a fissure eruption. Along a line from Mount Greville to Redbank Plains they occur at Mount Greville, Mount Edwards, Mount French, Mount Flinders, and at Redbank Plains. Isolated peaks occur in the Esk and Glass House Mountains districts, and there are also areas of trachytic rocks at Woodhill and Cainbable Creek. All these occurrences have probably resulted from central eruptions.

The trachytic rocks have been dealt with at length by Dr. Jensen in several papers, but he has given them a more widespread distribution than they really have. He states[35] that he has "good reason to believe that the whole of the Little Liverpool Range from Wilson's Peak to the Rosewood District is mainly trachytic"; also, that "the culminating peaks of the range like Spicer's Peak, Mount Mitchell, Mount Cordeaux, Mount Huntley, Mount Roberts, &c., are apparently of trachytic composition." Jensen also states[36] that "At Spring Bluff, between Helidon and Toowoomba, trachytes underlie basalts, but not having examined sections, I cannot say whether they are very alkaline or not."

[35] Jensen, Proc. Linn. Soc., N.S.W., xxxiv., p. 73.
[36] Jensen, Proc. Linn. Soc., N.S.W., xxxiii., p. 576.

As Wearne[37] has pointed out, Jensen has called the southern portion of the Main Range the Little Liverpool Range. However, while trachytic rocks are found along the Main Range as far north as Mount Castle, they do not extend from there on to the Rosewood district, also the top of the Main Range and the culminating peaks such as Mount Roberts, Mount Huntley, Spicer's Peak, Mount Mitchell, Mount Cordeaux and Mount Castle, consist of basaltic rocks, for the most part olivine-basalt.

At Spring Bluff, there seems to be no evidence of trachytic rocks at all, but on the other hand, the basalt is found resting on the Walloon shales and sandstones. The map and sketch-section on page 74 of Jensen's paper on the Geology of Mount Flinders and Fassifern Districts are rather misleading in showing the extent of the trachytic rocks on the Main Range, and also of the rhyolitic rocks in the south-west portion of the area. The sketch-section also seems to the author incorrect, in showing Cretaceous rocks underlying the basalt of the Darling Downs. There is no record of such being the case, but on the other hand, where the basalt flows have been worn down by the streams to the underlying rocks, these are seen to be, in all cases, the so-called Trias-Jura sediments. Also in the section through Mount Tamborine no indication is given of the rhyolitic rocks which occur on the eastern side.

The trachytic rocks in the Fassifern and Mount Flinders districts have been dealt with by Jensen in several papers, and also by Wearne and Woolnough, but hitherto the Esk, Woodhill and Cainbable Creek material has not been really described.

The Cainbable trachyte is apparently the base of a worn-down plug, and the Woodhill trachyte has apparently come up as a sill. The Esk trachytes occupy an intermediate position between the alkaline and sub-alkaline series; this is best illustrated by the variation diagrams. (*See* Plates VI.-VIII.) The Cainbable Creek trachyte is sub-alkaline, but the other trachytes are all of a definite alkaline nature.

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[37] Proc. Roy. Soc., N.S.W., xlv., p. 137.

These trachytes are represented by the leucocratic and melanocratic varieties, though the light-coloured varieties are the more abundant. The leucocratic varieties are light grey to bluish grey in colour, and range from holocrystalline to holohyaline; while the fabric may be trachytic, micro-granitic, or orthophyric. There are little or no soda-lime-felspars, but one finds sanidine, soda-sanidine and anorthoclase. The matrix minerals are ægirine, riebeckite, arfvedsonite; olivine and biotite do not occur. The melanocratic varieties are dark grey or brown in colour, and are usually less porphyritic than the leucocratic types.

The texture varies from holocrystalline to holohyaline, and the fabric may be almost pilotaxitic, although generally it is trachytic. The felspars are orthoclase, anorthoclase, microperthite and lime-soda-felspars. The matrix minerals are ægirine, augite, magnetite and ilmenite.

Glassy varieties of the trachytic rocks are not so abundant as those of the rhyolitic rocks, but at Mount Flinders there is a very fine trachytic glass which Jensen has described, also at Cainbable Creek there is a dull green trachytic pitchstone associated with the trachyte.

Specimen 128.—Locality: Cainbable Creek, portion 12, parish of Nindooimbah. This is a greyish rock in the hand-specimen. It is holocrystalline and slightly porphyritic. The phenocrysts, which are frequently anorthoclase, occur as sub-idiomorphic crystals up to 1·5 mm. in diameter. The groundmass is orthophyric and is made up of short stout prisms of sanidine and occasional crystals of pale augite. Abundant granules of magnetite occur all through the section. The rock has been considerably altered, and limonite and chlorite are abundant. The chlorite and some of the limonite are the result of alteration of the granules of pyroxene which are distributed through the rock; some of the limonite is also derived from the magnetite. Small patches of a secondary carbonate, probably calcite, occur through the rock. The specific gravity is 2·40, and this low value is no doubt due to the somewhat cavernous nature of the rock. Name: *Orthophyric Trachyte.*

Specimen 129.—This is from the same locality as the previous rock, and is a somewhat mottled greenish-grey rock, with a dull lustre, but showing very evident signs of fluxion. It is made up almost entirely of glassy material, but it has occasional phenocrysts of sanidine, and possibly anorthoclase. These phenocrysts are rounded and they occur up to 1·5 mm. in diameter. The rock is obviously a more quickly cooled portion of the same material which produced the above rock, as one can see intermediate stages between the two. The groundmass shows strong fluxion structure and it is partly microfelsitic. The glassy portion of the rock is corroded with aggregates of microlites which take up a variety of shapes, many of them radiating, but feathery and allied forms are common. Microspherulitic structure occurs here and there. There are no perlitic cracks. Name: *Trachytic Pitchstone.*

Specimen 131.—Locality: Woodhill, portion 122, parish of Logan. This rock is in a very altered condition, and it is a matter of great difficulty to obtain a specimen fresh enough for sectioning. It is found, however, to be holocrystalline, and to be made up of sanidine, ? oligoclase and chlorite, magnetite and limonite being also abundant. The rock is really too altered to determine exactly, but it is in many respects similar to the Cainbable Creek trachyte, although the presence of the acid plagioclase is rather a variation from that. Name: *Trachyte.*

Specimen 230.—Locality: Portion 136A, parish of Esk. This rock occurs to the west of Esk, and has been referred to by E. O. Marks. He stated[38] that the trachyte on the summit of the ridge where it occurs is covered with sandstone, but such does not appear to be the case. The rock is very weathered, and much resembles a brown sandstone in appearance and also in the manner of weathering. It is a matter of great difficulty to obtain fresh samples, but in portion 136A there is a bluff of material which is weathered out into a cavernous structure and the freshest material obtainable was at the base of the bluff. Fluxion structure is shown very clearly in the massive rock.

This rock is very much like the brown Helidon sandstone in general appearance and it is slightly porphyritic. The porphyritic crystals are nearly all short, stout lath-

[38] Q'land Govt. Min. Jour., xiii., July, 1912.

shaped, and show broad lamellar twinning as well as simple twinning; in addition to these, somewhat longer crystals of sanidine are seen. The phenocrysts vary from ·75 to 1 mm. in length, and the groundmass is made up of an equigranular mass of felspar and secondary quartz, the granules of which are about ·1 mm. in diameter.

The groundmass is somewhat difficult to determine, but it seems to be constituted of sanidine and albite, through which is distributed abundant quartz which seems to be almost entirely secondary. Limonite is very abundantly distributed all through the rock. The specific gravity is 2·49. Name: *Trachyte.*

Specimen 51.—Locality: Portion 51, parish of Esk. This is an altered rock and somewhat difficult to determine. Apart from the fact that it intrudes the Walloon coal-measures, one has little indication as to its actual age. In the hand-specimen this is a greenish-grey rock, fine-grained and containing occasional phenocrysts of a flesh-coloured felspar. Microscopically, it is seen to be holocrystalline and to be made up almost entirely of felspar. There are occasional stout idiomorphic plagioclase phenocrysts, 1·5 mm. in length, set in stout idiomorphic felspars with an average length of ·75 mm., while all through the rock are allotriomorphic patches of quartz.

There are very occasional sub-idiomorphic crystals of augite ·6 mm. in diameter which show twinning. All through the rock one finds patches of chlorite, and this has almost certainly been derived from altered augite granules. The plagioclase is very largely albite, as it has an extinction angle of 15° on the (010) face, and a refractive index lower than quartz. Andesine, with a composition Ab_3An_2, occurs frequently. Magnetite and ilmenite are abundant, and occasional crystals of apatite are seen.

Secondary minerals, such as calcite, chlorite and serpentine, occur also; possibly some of the quartz is secondary. This rock in many respects appears to be a more acid representative of the material which occurs in the same district as augite-andesite, and which is described later. The specific gravity is 2·69. Name: *Quartz-trachyte.*

Trachytic Tuffs, Breccias &c.

These are of limited development and the chief occurrences are on the Main Range near Spicer's Gap and Mount Matheson, also near Mount Flinders. The intense explosive action producing these accumulations seems to have taken place after the trachytic rocks had been extruded, and on the Main Range after the fissure had been almost plugged up so that one got eruptions of the central type. Jensen[39] has described this material and the author has no new developments to add.

There is a very characteristic breccia developed near Mount Matheson, and it may pass into a coarse agglomerate with trachyte boulders several tons in weight, or into trachytic tuff with a beautiful fragmentary glass as a base. The breccia has been considerably altered and chalcedony is abundant all through it; also a ferruginous cement is common.

The tuff is well developed just below the elbow on the Warwick coach road through Spicer's Gap. It is seen to be a typical tuff, and has a fragmental glass groundmass which shows the curious drawn-out fragments with concave surfaces. The groundmass has not undergone very much alteration and is much better preserved than in the Brisbane tuff. All through the rock are crystals of sanidine, anorthoclase and plagioclase, also abundant inclusions of rock-fragments. These rock-fragments are trachyte, andesite, basalt and shale.

At Ivory's Knob near Mount Flinders there is also a very good trachyte tuff.

Chemical Composition of Trachytes.

Most of these rocks are seen to be rather acid in nature, and they are either sodi-potassic or dosodic, with soda in

[39] Proc. Linn. Soc., N.S.W., for 1909, vol. xxxiv.

excess of potash except in the case of the trachyte from the summit of Mount Flinders.

The Esk trachyte shows a very low value for alumina, but this rock is rather altered, and shows a very high ferric oxide value; this is no doubt due, to some extent, to the limonite present.

The Cainbable Creek trachyte is seen to differ considerably from the other rocks; it has a low alumina and high iron-oxides value, the magnesia is comparatively high, while the lime is much higher than in any of the others.

The soda trachyte from the Main Range is a melanocratic one, and it is seen to have a very high soda value. It is chiefly remarkable for the high titanium oxide, and Jensen has indicated that there is probably a mineral belonging to the lavenite group, which accounts largely for this.

The trachyte from portion 51, parish of Esk, is rather an altered one, and it is noticeable for the low alumina and the comparatively high magnesia and lime, also the soda preponderates over potash very much.

TABLE III.—TRACHYTES.

—	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
SiO_2	69·32	66·40	65·31	65·09	64·58	60·58	56·78	60·00
Al_2O_3	16·06	12·03	12·08	14·43	17·52	18·06	14·47	10·58
Fe_2O_3	1·42	8·23	5·12	3·21	2·56	3·05	2·80	6·18
FeO	0·88	0·64	3·07	0·13	0·96	1·38	6·05	4·72
MgO	0·06	0·40	0·96	0·10	0·22	0·23	0·34	1·97
CaO	0·31	0·62	2·50	1·18	0·39	1·74	2·47	2·88
Na_2O	6·01	5·26	4·91	7·26	6·41	5·01	8·67	6·58
K_2O	4·23	3·26	4·72	3·24	6·23	6·87	4·51	2·20
H_2O+	1·09	1·85	0·57	2·42	0·30	0·90	1·70	1·65
H_2O-		0·50	0·47		0·11	0·99	0·56	0·65
CO_2	..	..	..	..	0·08	..	..	..
TiO_2	0·62	0·82	0·49	2·50	0·13	0·83	2·00	1·56
P_2O_5	..	0·23	0·14	..	tr.	..	..	0·44
MnO	..	0·05	0·11	..	0·08	0·04	tr.	0·18
					&c. 0·40	&c. 0·07	&c. 0·05	
Total	100·00	100·29	100·45	99·56	99·97	99·75	100·40	99·59
Spec. Grav.	..	2·49	2·40	..	2·62	..	..	2·69

Norm.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Quartz	17·58	21·84	15·00	10·32	2·76	1·50	..	11·79
Orthoclase	25·02	19·46	27·80	18·90	36·69	40·59	26·69	42·91
Albite	50·83	44·01	36·15	56·07	53·97	42·44	35·11	42·44
Anorthite	1·35	..	..	..	0·83	6·39	..	..
Nepheline	..	..	..	..	..	..	7·67	..
Corundum	1·12	..	..	..	..	..	..	..
Diopside	..	1·73	9·25	..	0·46	1·58	11·00	9·83
Hypersthene	..	0·20	..	0·20	0·40	..	..	..
Acmite	..	..	4·62	5·08	..	..	8·32	11·55
Olivine	..	..	..	..	..	..	2·74	..
Magnetite	1·16	..	5·10	..	2·78	2·09	..	3·25
Hæmatite	0·64	8·16	..	1·44	0·64	1·60	..	..
Ilmenite	1·22	1·37	0·91	0·15	0·15	1·52	3·80	3·04
Apatite	..	0·34	0·34	..	..	..	..	1·01
Zircon	..	..	..	..	0·32	..	..	..
Titanite	..	..	..	4·12	..	..	..	..
Pyrite	..	..	..	..	0·12	..	..	..
Soda-metasilicate	..	..	..	..	..	..	3·42	..

I.—Porphyritic Soda-Trachyte, I. 4.1.4. Kallerudose, Mt. Flinders.[1]
II.—Trachyte, I. 4.1.4. Kallerudose, por. 136a, parish Esk.[3]
III.—Trachyte, II. 4.1.3. Grorudose, Cainbable Ck., por. 12, parish Nindooimbah.[3]
IV.—Soda-Trachyte, I. 5.1.4. Nordmarkose, 2,000 ft. level, Coach road, Spicer's Gap, Main Range.[1]
V.—Trachyte, I. 5.1.3(4). Phlegrose, Mt. Beerwah, Glass House Mountains.[2]
VI.—Trachyte, I. 5.2.3. Pulaskose, Summit, Mt. Flinders.[1]
VII.—Phonolitic Ægirine Trachyte, II. 5.1.4. Umptekose, foot of Mt. Flinders.[1]
VIII.—Trachyte, II. 4.1.4. Pantellerose, por. 51, parish Esk.[3]

[1] Jensen, Proc. Linn. Soc., N.S.W., xxxiv. [2] Jensen, Proc. Linn. Soc., N.S.W., xxxi. [3] Ann. Rept. Agric. Chem., Qland, for 1914.

(v.) Dacites.

Andesites are fairly common through the area, but in only one or two localities do dacites occur. These localities are near Bankfoot House in the Glass House Mountains district, and at Mount Alford.

The Glass House Mountains dacite which Jensen has fully described and analysed is certainly younger than the trachytic rocks with which it is associated, for it contains frequent inclusions of trachytic material which bears a close resemblance to the adjacent trachytic rocks. It is a variable rock, and in some microscopic sections appears to be a normal andesite while in the others it has abundant corroded quartz crystals. Chemically the rock is very similar to the dacite of Devonian age from the Macedon area in Victoria and more particularly the rock from the Willimigongong Creek near "Cheniston," "Upper Macedon."[40] The Macedon dacite is rather low in alkalies, particularly soda, but otherwise the resemblance is very close. Microscopically, however, there is a great difference, as not only is there a big difference in texture, but also in mineralogical composition. The Glass House Mountains rock covers an area of a few square miles, but it is apparently a thin flow.

Microscopically it is seen to be holocrystalline. It is perpatic having occasional rounded phenocrysts of plagioclase set in a groundmass with an average grain-size of ·15 mm. The groundmass is pilotaxitic and ophitic structure is common. The felspar present frequently shows zoning, and also simple and lamellar twinning; it ranges from labradorite to andesine, and occasional lath-shaped crystals of orthoclase are present. A feature of the plagioclase phenocrysts is the abundance of bright-green glass inclusions. Violet-coloured augite is frequent through the groundmass, and in some sections brown hornblende is seen, but augite is more abundant. Magnetite is abundant, and greenish chloritic alteration products are also plentiful. Quartz, when present, occurs as corroded phenocrysts. The Mount Alford material is somewhat similar to the Glass House Mountains material, but while the latter follows the trachytes the former precedes the rhyolite, for the rhyolite plugs at Glennie's Pulpit &c., on Mount Alford, intrude right through the andesites and dacites.

[40] Geol. Surv., Vic., Bull. 24, pp. 17, 18.

TABLE IV.—DACITES.

—	I.	II.	III.
SiO_2	62·15	62·56	61·3
Al_2O_3	16·73	16·60	..
Fe_2O_3	2·90	1·02	..
FeO	3·22	5·98	..
MgO	2·70	2·70	..
CaO	3·98	4·30	3·2
Na_2O	3·58	2·98	6·0
K_2O	2·81	2·57	
H_2O+	1·06	0·68	..
H_2O-	0·14	0·18	..
CO_2	0·04	nil	..
TiO_2	0·83	1·10	..
P_2O_5	p.n.d.	0·17	..
MnO	0·12	tr.	..
NiO	0·08	..	..
S (FeS_2)	0·11	nil	..
Total	100·45	100·85	..
Spec. Grav.	2·61	2·773	..
Norm.			
Quartz	16·56	18·84	..
Orthoclase	16·68	15·01	..
Albite	30·39	25·15	..
Anorthite	19·74	20·57	..
Corundum	0·51	1·43	..
Diopside	..	..	..
Hypersthene	8·78	15·12	..
Magnetite	4·17	1·39	..
Ilmenite	1·52	2·13	..
Pyrite	0·12	..	..
Apatite	..	0·31	..

I.—Dacite, II. 4.3.4. Tonalose, near Bankfoot House, Glass House Mountains.[1]

II.—Dacite, II. 4.3.4. Tonalose, Willimigongong Ck., Upper Macedon, Victoria.[2]

III.—Dacite (partial analysis), Mt. Alford.[3]

[1] Jensen, Proc. Linn. Soc., N.S.W., xxxi., p. 169.

[2] Geol. Survey, Victoria, Bull. 24, pp. 17, 18.

[3] Govt. Analyst, Brisbane.

Chemical Composition.

The Glass House Mountains dacite is seen to be a normal dacite, and certainly sub-alkaline in nature. This is interesting, as it is found in the closest association with the very alkaline rocks such as the comendite of Mount Conowrin. The partial analysis of the Mount Alford rock shows that in a general way it is similar chemically to the Glass House Mountains dacite.

(VI.) Andesites.

These have been recognised in several parts of the area, but in no place is there any very extensive development. It is a somewhat difficult matter to distinguish between the andesites and the andesitic basalts, as there are all gradations from andesites to olivine-basalts. The presence or otherwise of olivine, the relative amounts of augite and plagioclase, and the nature and habit of these have been taken as the main considerations in determining whether a flow is an andesite or not. Andesites were poured out during the first period of activity, but apparently towards the end of it. They are much more abundant in the last period of eruption, however, and in some places seem to have followed upon the trachytes; this is particularly the case in the most typical ones, as at the Main Range. On the other hand, andesite occurs at Mount Meerschaum in the upper division, forming one of the most recent flows and resting on considerably more basic flows.

The Esk andesites really stand apart from the others as they are definitely of a porphyritic type and seem to be more basic representatives of the material which produced the rhyolites and trachytes occurring there; all of the other andesites, on the other hand, seem to be rather the acid representatives of the material which resulted in the extensive basaltic flows in their respective areas. The Esk andesites differ somewhat in their mode of occurrence also, for they occur as large intrusions through the ? Walloon coal-measures; the other occurrences are either as definite lava flows or sills. Apart from the Esk district, one finds andesites at the Main Range in the neighbourhood of Spicer's Gap, on the eastern side of the range; at Mount Alford forming the base of the mountain; at Tamborine Plateau where there is an extensive and well-defined flow near the top of the plateau, and seen particularly well at the south-west end; at the summit of Mount Meerschaum; at the Lookout on MacPherson's Range where the Springbrook Plateau terminates; and at One Tree Hill near Point Danger. Just over the State border fence from One Tree Hill, similar material forms Observation Hill, and this, although in New South Wales, will be dealt with here.

It is found advisable to treat these rocks in two divisions, one embracing the augite-andesites from the Esk district, and the other the more normal sub-alkaline andesites.

Augite-Andesites.

These occur near the Ottaba railway station, and also along the railway line towards Esk. Sections are seen where they intrude through the Walloon shales. At a cutting 42 miles 62 chains distant from Ipswich there is an excellent section showing an intrusion of andesite which has had a severe baking effect on the intruded shales. There are several intrusions seen along the line, and in the cutting immediately to the south of Ottaba there is a very large one, several hundreds of feet in width. The freshest material found was in portion 28v, parish of Biarra, and its description will serve for all this material. An analysis has been made of the andesite from portion 134, parish of Esk, and the sample was collected from the railway cutting. In the hand-specimen the rock is a light grey with abundant phenocrysts of augite which have a length of 2 or 3 mm.; around these there are accumulations of small granules of augite and this gives the rock a rather mottled appearance. In addition to the augite phenocrysts, there are plagioclase phenocrysts up to 2 mm. long. Microscopically the groundmass is seen to be hyalopilitic and to contain plagioclase, augite and magnetite. Here and there are rounded patches up to ·75 mm. in diameter and these are made up of small granules of augite. The augite phenocrysts frequently show twinning and are usually surrounded by a fringe of augite granules which have resulted from corrosion by the magma. (*See* Plate XIII., fig. 4.) It is noticeable that when an augite phenocryst impinges on another augite crystal or on a plagioclase phenocryst, the fringe does not exist, but occurs only along the junction of the augite with the groundmass. The fringe of granules is optically continuous with the crystal so that it is a resorption border.

The plagioclase phenocrysts are crystals of basic andesine, $Ab_{55}An_{45}$ for the most part, although some of them show zoning with more acid shells; these phenocrysts are idiomorphic and have not been corroded. Magnetite occurs as inclusions in the augite, and also through the groundmass as very fine granules. The specific gravity of this rock is 2·75.

Normal Andesites.

These are all compact dark-coloured rocks and range from porphyritic to non-porphyritic. They are perpatic, and the phenocrysts are plagioclase, augite, and in some cases hypersthene, the latter occurring sparingly and having strongly marked resorption borders.

The plagioclase phenocrysts range from medium andesine, Ab_3An_2, to medium labradorite, Ab_2An_3, and do not, as a rule, show zoning. They show carlsbad, albite and pericline twinning, and are usually sub-idiomorphic or allotriomorphic; in size they range from 2 mm. to ·4 mm. in length.

In several flows, particularly the Tamborine, Observation Hill, One Tree Hill and Mount Meerschaum flows, the plagioclase phenocrysts appear to be medium andesine, Ab_3An_2, which is crowded with regularly arranged inclusions. These inclusions are frequently studded all through the crystal with the exception of a narrow band at the edge, which is quite clear. The inclusions in most cases consist of an opaque material, but in others they are small granules of augite. Both kinds of inclusion occur in the same crystal however, and this peculiar character of the plagioclase phenocrysts has also been noticed in some of the andesitic basalts. A great deal of variation exists in the relative amount and size of the inclusions, but in the andesites from near Point Danger, in some cases, the phenocrysts seem almost wholly composed of very fine opaque inclusions.

The groundmass is in all cases hyalopilitic, and in some of the lavas it shows a definite fluxion structure. The crystals in the groundmass are plagioclase, augite, magnetite and ilmenite. The plagioclase usually shows simple twinning only, though in some, lamellar twinning is present. It is slightly more acid in the groundmass than in the phenocrysts, and ranges from medium andesine, $Ab_{65}An_{35}$, to basic andesine, $Ab_{55}An_{45}$. In size the laths range from ·05 mm. to ·15 mm. in length. Augite occurs in two generations in several rocks, but it is usually in very small grains in the groundmass.

The iron ores may occur as small granules or rod-like fragments ·3 mm. long. The amount of glass in the groundmass varies greatly but it never exceeds the crystals in amount. It is usually a light brown in colour and crowded with trichites &c. Ophitic structure is not seen in any of the sections.

A few of the more representative rocks are here described.

Specimen 136.—Locality: Lookout, Springbrook Plateau, portion 84, parish of Numinbah. This andesite occurs as a flow and forms the summit of MacPherson's Range at the southern termination of the Springbrook Plateau. The rock is perpatic and has phenocrysts of medium andesine ranging up to 2 mm. long, and violet-coloured sub-idiomorphic augite crystals up to ·75 mm. in diameter, set in a hyalopilitic groundmass showing good fluxion structure.

The plagioclase in the groundmass ranges from ·05 mm. to ·3 mm. in length, and the augite is present in very fine granules. Very small granules occur abundantly through the section. The plagioclase phenocrysts show zoning in some cases, and twinning of the augite phenocrysts is seen occasionally. The specific gravity is 2·79. Name: *Andesite.*

An andesite similar to the above occurs on the old Warwick coach road on the east side of the Main Range.

Specimen 7.—Locality: One Tree Hill, near Point Danger. This occurs as a flow about 30 feet thick, capping the Palæozoic schists. Parts of it seem somewhat agglomeratic, and rounded fragments of finer-grained, almost glassy, andesite are seen in it. One frequently finds quartzite and sandstone fragments which have been caught up in the flow. This material is apparently part of the same flow which occurs at Observation Hill or Razorback on the New South Wales side of the border. They are only separated by a few hundred yards and are at the same level, have the same thickness and general relationships, and are indistinguishable either in the hand-specimen or microscopically. The analysis of the Observation Hill rock may thus be regarded as holding for this rock. In the hand-specimen the rock is a very fine-grained, compact dark material which has occasional phenocrysts through it. Microscopically it shows a hyalopilitic groundmass with occasional phenocrysts of medium andesine, Ab_3An_2, augite and hypersthene. This is the only rock in which hypersthene has been definitely recognised, and it occurs in long crystals reaching 1·5 mm. in length, showing marked pleochroism and having a strong resorption border. The plagioclase phenocrysts which are sub-idiomorphic and range up to 1 mm. in length are remarkable for the numerous regularly arranged inclusions; in some cases the inclusions seem to form the major portion of the crystal. (*See* Plate XIII., fig. 6.) In almost all cases there is a narrow outside fringe of felspar clear of inclusions, but as a rule the rest of the crystal contains them, except occasionally the central portion. The arrangement is in many cases zonal but this is not universal. The exact nature of the inclusions is difficult to determine, but in these felspars they seem to be small patches of glassy matrix. The groundmass contains a large amount of brown glass which is not very evenly distributed, and here and there there are small patches free from augite and plagioclase. The felspar shows lamellar twinning only as a rule, and it is a medium andesine, the laths of which have an average length of ·15 mm. The augite granules are very fine and distributed evenly.

Iron-ore granules are not very abundant and they seem irregular in outline. The glass is a pale-brown colour and in some cases is thickly crowded with trichites &c., but in others it is comparatively free from them. The specific gravity is 2·57.

Specimen 123.—Locality: Portion 18, parish of Witherin. This flow forms a prominent cliff on the south-west end of Tamborine Plateau, and is well seen in a cliff in front of Mr. D. Lahey's house. The flow is more than 100 feet thick and gives rise to a precipice along the edge of the plateau. The rock is dark grey with large phenocrysts of a dark plagioclase. Microscopically it is seen to be hyalopilitic although the amount of glassy material is very small. The rock is perpatic and the phenocrysts are plagioclase and augite. The plagioclase is medium andesine, $Ab_{55}An_{45}$, and similar plagioclase containing inclusions as described in the andesine from near Point Danger occurs. The crystals containing the inclusions are not so abundant in this rock, and augite is frequently seen as the included material along with the glass. (*See* Plate XIII., fig. 5.) The augite phenocrysts are pale brown in colour and occur in allotriomorphic crystals up to 1 mm. in diameter. The groundmass is made up principally of small lath-shaped plagioclases showing lamellar twinning and having an extinction angle agreeing with medium andesine, Ab_3An_2. Abundant irregularly-shaped patches and rods of iron ores occur through the rock. The specific gravity is 2·64.

TABLE V.—ANDESITES.

——	I.	II.	III.	IV.	V.
SiO_2	61·24	57·62	54·10	56·52	59·59
Al_2O_3	14·33	13·63	13·42	17·55	17·31
Fe_2O_3	1·81	5·41	4·06	3·14	3·33
FeO	6·09	5·15	7·43	4·86	3·13
MgO	3·45	2·86	4·43	2·51	2·75
CaO	5·07	5·57	7·97	5·50	5·80
Na_2O	3·75	3·38	3·81	4·82	3·58
K_2O	3·13	3·07	1·15	1·90	2·04
H_2O+	0·28	1·54	0·88	2·45	1·26
H_2O-	0·17	nil	nil	0·25	
CO_2	..	..	..	..	..
TiO_2	0·52	1·75	2·35	tr.	0·77
P_2O_5	0·51	0·40	0·46	0·22	0·26
MnO	tr.	0·26	0·30	0·13	0·18
Total	100·35	100·64	100·36	99·85	100·00
Spec. Grav.	2·57	2·64	2·79	2·75	..

Norm.

	I.	II.	III.	IV.	V.
Quartz	10·74	12·42	6·78	4·68	..
Orthoclase	18·35	18·35	6·67	11·12	..
Albite	31·96	28·82	31·96	40·35	..
Anorthite	12·79	12·51	16·12	20·85	..
Diopside	7·47	9·89	16·45	4·61	..
Hypersthene	13·93	4·82	9·87	10·48	..
Magnetite	2·55	7·89	6·03	4·41	..
Ilmenite	0·91	3·34	4·41	..	..
Apatite	1·34	1·01	1·34	0·34	..

I.—Andesite, II. 4.2.4. Dacose, Observation Hill, Tweed Heads.[1]

II.—Andesite, II. 4.2.3(2). Adamellose, por. 18, parish Witherin, Tamborine Plateau.[1]

III.—Andesite, III.(II.) 5.3.4. Camptonose, Lookout, Springbrook Plateau.[1]

IV.—Augite-Andesite, II. 5.3.4. Andose, Ottaba, por. 124, parish Esk.[1]

V.—Average analysis of 87 Andesites.[2]

[1] Ann. Report Agric. Chem., Q'land, for 191

[2] Daly, Igneous Rocks, p. 26.

Specimen 125.—Uppermost flow, Mount Meerschaum. This is a very fine-grained dark-grey rock which is almost free from phenocrysts. Microscopically it shows a typical hyalopilitic groundmass with very occasional corroded phenocrysts of plagioclase containing glass inclusions. The groundmass is extremely fine-grained, and contains a rather larger amount of small granules of the iron ores than usual.

Chemical Composition.

In the case of the three normal andesites there is a lack of alumina, but a corresponding richness in the iron-oxides, particularly ferrous oxide. The total of alumina and iron-oxides gives a normal value. The only other respect in which they are at all abnormal is in the slightly higher value for potash in the Tamborine Plateau and Observation Hill rocks than is usual for the andesites; the Springbrook rock seems to be more normal in that respect.

In the augite-andesite from Ottaba the alumina value is normal, but this rock is characterised by a relatively high soda value.

(VII.) BASALTS.

These are the most abundant rocks and they form the bulk of the material extruded in both the first and last periods of eruption.

The accumulated thickness of the flows of basalt in some cases reaches 1,500 feet and it is made up of a number of small flows one on top of the other. The flows vary a great deal in thickness, and 120 feet is the maximum thickness noted for any one flow, but 20 feet or 30 feet is a very common thickness.

The bulk of the material is believed to have been poured out as surface flows, not intruded as sills; close observations were made in the field, and only sills of a very minor nature were encountered. Microscopic evidence does not help one in this direction, as there is great variation in the texture, and ophitic structure is developed to a large extent in undoubted lava flows. It is impossible to distinguish between the basalts of the lower and upper divisions, as they do not differ chemically, macroscopically or microscopically to a sufficient extent to enable one to do so. Also macroscopical investigations fail to distinguish between the andesites and basalts, except possibly by specific gravity determinations. The basalts range from 2·74 to 2·92 in specific gravity, while the andesites range from 2·57 to 2·79; so that in many cases it would be possible to judge whether the rock was an andesite or a basalt.

It has been, however, found impossible to distinguish them in the field, and the whole series of andesites and basalts have been coloured the same on the sketch-map; also in many cases it is found that successive flows pass from one to the other.

At Spicer's Peak there occurs an oligoclase-basalt which is very different from any other known basaltic rock in the area. It is similar chemically, mineralogically and in its appearance and weathering, to the mugearite described by Harker[41] from Druim na Crìche in Skye.

While one finds in certain areas great developments of olivine-basalts and basalts, there is also an extensive development of andesitic-basalts. The andesitic-basalts have the texture of andesites with a certain percentage of glassy base while the olivine-basalts are holocrystalline.

These rocks are distributed over the whole of the area, and they are found at all levels from 4,100 feet above sea-level down to sea-level.

Many of the lavas are amygdaloidal, and in the case of several flows on the Main Range in particular, they have abundant zeolites filling the cavities. The zeolite chabazite is the most abundant; several other minerals occur in the cavities, but are of minor importance when compared with chabazite. The rock containing these cavities in most cases appears perfectly fresh, and these minerals have apparently been formed during the cooling period of the rock, and they do not represent ordinary secondary minerals. Analcite also has been noticed.

Generally speaking, the flows are not porphyritic, although very porphyritic flows do occasionally occur, and

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[41] Op. cit., pp. 264, 265.

in these latter flows plagioclase phenocrysts up to half an inch in length may occur. Olivine also occurs as phenocrysts in some of the lavas, and in particular at Toowoomba and Spring Bluff.

In crystallinity the rocks are either holocrystalline or hypocrystalline. As far as the grain-size is concerned, in the groundmass it varies from extremely fine to medium, although a fine groundmass averaging ·1 mm. in diameter is the most common, and in the phenocrysts there are plagioclase crystals ranging up to 14 or 15 mm. long, although the average length of plagioclase phenocrysts is 2 mm. The groundmass is either pilotaxitic or hyalopilitic; fluxion structure may be well developed, but ophitic structure is very common and indicates that in most cases the lavas had come to rest before the augite crystallised out. The minerals present as phenocrysts are plagioclase and olivine; the former shows simple and broad lamellar twinning as a rule and ranges from medium andesine, Ab_3An_2, to acid labradorite, $Ab_{45}An_{55}$, although basic andesine is the most common. Zoning is seen rarely but it has been noticed in some of the large phenocrysts in an olivine-basalt from Lamington Plateau. Olivine occurs frequently as phenocrysts and it may occur up to 2 mm. in length. It is usually sub-idiomorphic to rounded and alters in several different ways; the alteration to the red lamellar mineral iddingsite is very well seen in some of the Lamington basalts. The minerals of the groundmass are plagioclase, augite, olivine and iron ores. The plagioclase crystals usually show albite twinning, though only simple twinning is seen in very fine lath-shaped crystals.

Usually the groundmass felspar is more acid than the phenocrysts, and ranges from acid andesine, Ab_7An_3, which is fairly common, to medium labradorite, Ab_2An_3; the most abundant plagioclase is andesine.

The augite appears either colourless in thin sections or as the violet-tinted titaniferous variety. It occurs in granules, sub-ophitic patches, or as definite ophitic patches. It is frequently a matter of great difficulty to distinguish between the colourless augite and olivine in the granules. Hypersthene has not been seen in any of the basalts.

Olivine is very abundant in many of the rocks and occurs as rounded granules; this mineral occurs in two generations quite frequently. Augite has not been found in two generations in the basalts, nor has it been found in them showing twinning. Olivine may occur sparingly in the andesitic basalts, but augite is extremely abundant.

Both magnetite and ilmenite occur in great abundance, as small granules or crystals in the groundmass, and frequently as inclusions in all the other minerals. In some of the finer-grained basalts there is a great abundance of small granules of either ilmenite or magnetite, but it is not easy to determine which of them. The Mount Lindsay basalt is particularly rich in iron ore, and in all probability it is mostly ilmenite as it contains 12·15 per cent. FeO, 1·78 per cent. Fe_2O_3, and 3·08 per cent. TiO_2. The iron ore occurs frequently as inclusions in olivine, augite and plagioclase, and while many of the crystals are undoubtedly magnetite from their shape, it is usual to find them quite allotriomorphic, and frequently in long thin rods sometimes ·75 mm. long and cut through by felspar laths. Apatite is not often seen although it is undoubtedly present in all the rocks to a small extent. The order of crystallisation is always the same: iron-ore, olivine if present, felspar, augite.

A very large number of micro-sections have been examined, and descriptions of a few of the more typical ones are given below.

Specimen 86.—Lamington Plateau. This is a compact porphyritic basalt in which phenocrysts of plagioclase and olivine may be seen. Microscopically it is perpatic with phenocrysts of acid labradorite showing carlsbad and broad lamellar twinning.

These phenocrysts are idiomorphic, do not appear to have been corroded at all, and range up to 2 mm. in length. Olivine phenocrysts which are roughly idiomorphic in outline and up to 1 mm. in length are abundant. They are altering into the red lamellar mineral iddingsite, and in all cases have a thin red band around them where the alteration has gone on. (*See* Plate XIV., fig. 2.) The groundmass is holocrystalline and shows good fluxion structure; the augite is distributed abundantly through the section as sub-ophitic patches approximately ·2 mm. in diameter. Small olivine granules which have been altered occur sparingly through the section. Plagioclase occurs in lath-shaped crystals averaging ·3 mm. in length, and it is either acid labradorite or basic andesine. The iron-ore minerals occur both as small granules about ·04 mm. in diameter, and as thin rods about 2 mm. long.

The above rock is typical of most of the basalts on Lamington Plateau, although there is a great variation in the amount of olivine present, and also fluxion structure is not always present.

Phenocrysts of olivine with large crystals of plagioclase moulded on them are seen in some sections of these rocks.

Specimen 94.—Locality: Chinghee Creek, portion 69, parish of Telemon. This is one of the flows from the first eruption, and it is found below the rhyolite agglomerate. In the hand-specimen it is a compact rock, which shows occasional plagioclase phenocrysts. When examined microscopically it is seen to be holocrystalline with very occasional plagioclase phenocrysts set in a groundmass with plagioclase averaging ·5 mm. in length, and showing a rough fluxion structure. The plagioclase is both medium and basic andesine, but the latter is the more abundant. (*See* Plate XIV., fig 3.) Ophitic structure is very well developed, and the enclosing augite by its violet colour is apparently the titaniferous variety.

Olivine granules which are altering into serpentine are abundant, and they have an average size of ·25 mm. in diameter. Allotriomorphic grains and rods of iron-ore are plentiful. The specific gravity of this rock is 2·76 and an analysis is given. Name: *Basalt.*

Specimen 92.—Chinghee Creek, portion 67v, parish of Telemon. This is one of the flows from the third period of eruption, and rests on top of the rhyolite agglomerate. It comes from Lahey's Cutting. The flow is very much weathered, and it is a matter of difficulty to get a fresh specimen. This rock is rather finer-grained than the previous one and contains more olivine, being particularly noted for the abundant and large phenocrysts of this mineral. These are usually sub-idiomorphic and have an average diameter of 1 mm.

The plagioclase, which occurs only in the groundmass is basic andesine, $Ab_{55}An_{45}$. An analysis of this rock is given. The specific gravity is 2·87. Name: *Olivine Basalt.*

Specimen 221.—Locality: 3,000 feet level, south-east side of Mount Lindsay. This represents the uppermost flow of the lower division of basic rocks and lies directly underneath the pitchstone and rhyolite dome of Mount Lindsay. In the hand-specimen it is seen to be extremely fine-grained. It has a hyalopilitic groundmass showing a very good fluxion structure. (*See* Plate XIV., fig. 6.) It has small porphyritic crystals of plagioclase and olivine about 1 mm. long, but these phenocrysts are not plentiful. The groundmass consists of felspar microlites, very small granules of augite, and a great abundance of very fine granules of iron-ore. This is probably largely ilmenite as the norm shows 5·93 per cent. of ilmenite and 2·55 per cent. magnetite. Occasional rectangular patches of magnetite ·05 mm. in diameter are seen. A very similar rock to this is met among the lower basalts on Christmas Creek, near Burge's Crossing, and on the western termination of Buchanan's tramline. The specific gravity is 2·79. Name: *Basalt.*

Specimen 225.—Locality: 2,400 feet level, south-east side of Mount Lindsay. This flow is one of the lower division, and occurs somewhat below the rock just described. It differs considerably, however, in being holocrystalline and it does not exhibit the same fluxion structure. The olivine is nearly all altered and the augite, which is titaniferous, occurs in definite ophitic patches. Name: *Basalt.*

Specimen 112.—Locality: Coulson's Creek, portion 51v, parish of Clumber. This occurs as a dyke, 2 feet wide, cutting through a coal-seam which it has coked on either side. It is indistinguishable in the hand-specimen from many of the surface flows.

It is holocrystalline, and is made up of very abundant thin lath-shaped plagioclase and augite crystals up to ·5 mm. long, set in a pilotaxitic groundmass of augite, plagioclase, olivine and iron-ore.

The plagioclase shows lamellar twinning and is acid labradorite, $Ab_{45}An_{55}$, while the augite is seen to have a marked violet tint. The iron-ore which is very abundant and more or less aggregated into patches is seen to consist largely of octahedral crystals, so that it is largely magnetite. The olivine occurs as rounded granules averaging ·15 mm. in diameter. It is noticeable that ophitic structure is entirely absent, also the "granulitic" structure which one finds in some of the flows and which indicates movement after crystallisation. Name: *Dolerite.*

Specimen 124.—Locality: Canungra Creek, portion 21, parish of Sarabah. This is a flow which belongs to the first division of basic rocks, and is the only one of this division in which columnar structure has been seen. The rock in the hand-specimen is seen to contain abundant phenocrysts of plagioclase and occasional crystals of olivine. Microscopically it is hypocrystalline and consists of sub-idiomorphic crystals of medium labradorite, Ab_2An_3, in size up to 3 mm. long but averaging 1·5 mm., and rounded and corroded phenocrysts of olivine averaging 1 mm. in diameter, set in a groundmass of plagioclase, olivine, augite, iron-ore and a brown glass. The augite does not appear in two generations like olivine does. The plagioclase phenocrysts in many cases are very well zoned, and the outer fringes are rather acid andesine. The plagioclase in the groundmass averages ·3 mm. in length and is fairly basic andesine.

The brown glass is very cloudy and seems crowded with small dots of iron-ore. The latter occurs as rounded patches and as rods up to ·2 mm. in length. This rock is mainly characterised by the zoning of the plagioclase phenocrysts. Name: *Andesitic basalt.*

Specimen 116.—Summit Spicer's Peak. This rock is a very compact dark-greenish one, and shows very occasional phenocrysts of olivine. Microscopically it has a cryptocrystalline groundmass which seems to be mainly felspar, although granules of augite can be seen. (*See*

Plate XIV., fig. 5.) Iron-ore is abundant and occurs both as allotriomorphic granules and as minute octahedra. Olivine occurs as phenocrysts and is largely altered to serpentine. These phenocrysts range in size up to 1 mm. in length. This rock is somewhat peculiar chemically, and although its felspar is indeterminable, it is probably oligoclase.

Another micro-section of the same flow shows somewhat more crystalline characters, and the microlites can be determined as oligoclase. Dr. Woolnough[42] described this rock and determined it as a porphyritic olivine-basalt. The author has seen sections of the same material that he dealt with, and while agreeing with his description, would prefer to call this rock oligoclase-basalt. The rock has a few phenocrysts of acid labradorite up to 2 mm. long, and olivine largely altered to serpentine set in a pilotaxitic groundmass of oligoclase, granules of augite, granules of iron-ore and small patches of olivine and serpentine. Small needles of apatite are abundant.

This rock is rather different from any of the others in the area, and it has certain similarities to the mugearites described by Harker.[43] In its mode of weathering, fissile character and specific gravity of 2·74, it is similar. Chemically it is characterised by low magnesia and low lime, by high alkalies, both soda and potash; also it has the characteristic high value for phosphoric pentoxide.

This rock may be regarded as much allied to the mugearites described by Harker and probably it is best described as oligoclase-basalt.

Specimen 139.—Municipal Quarries, Toowoomba. This rock shows magnificent columnar structure, and it is very fine-grained, breaking with a conchoidal fracture. Phenocrysts of olivine are frequently seen in the hand-specimen, and in some cases "pockets" are found, several inches in diameter. These are accumulated masses of small olivines which are eagerly sought for gem purposes. Microscopically the rock shows abundant phenocrysts of

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[42] Proc. Roy. Soc., N.S.W., xlv., p. 158.

[43] Skye Memoir.

olivine which are usually rounded, but occasionally sub-idiomorphic. These range from about 4 mm. down to very small granules, although occasionally individual phenocrysts may be nearly half an inch in length. The groundmass is pilotaxitic and is composed of augite, plagioclase, olivine, magnetite and ilmenite.

Plagioclase is much less abundant, and olivine much more abundant in this rock than in any other rock examined. The plagioclase is difficult of determination, but is possibly an acid andesine; it occurs as lath-shaped crystals averaging 0·4 mm. in length. The specific gravity is 2·88. Name: *Olivine-basalt.*

The olivine-basalt at Picnic Point, Toowoomba, is very similar to this rock.

Specimen 218.—Locality: Summit of Hip Roof Range, south of Laidley. This rock in many respects is similar to the Toowoomba basalt, and has an abundance of olivine, both as phenocrysts and granules in the groundmass. It is coarser-grained than the Toowoomba rock, and the olivine is seen decomposing into iddingsite.

Titaniferous augite is also fairly abundant through the groundmass. This rock differs considerably from one at a lower level in the same locality at Deep Creek. The Deep Creek rock is mineralogically the same, but has well-developed ophitic structure. Name: *Olivine-basalt.*

Specimen 11.—Locality: Point Danger. This occurs as the top flow, which is about 60 feet thick. It has been extensively quarried and used for forming the river walls along the Tweed River.

In the hand-specimen, large phenocrysts of a dark coloured plagioclase showing both carlsbad and lamellar twinning are abundant.

Microscopically the rock is seen to have a holocrystalline groundmass of plagioclase, augite and magnetite in which are set the phenocrysts of acid labradorite, $Ab_{45}\,An_{55}$. (*See* Plate XIV., fig. 1.) The phenocrysts range up to 10 mm. in length and have somewhat broken edges. In some of them, regularly arrayed inclusions of a brown colour are seen. The plagioclases in the groundmass are lath-shaped, average 0·4 mm. in length, and have an extinction angle which indicates acid andesine.

The augite occurs in ophitic patches about 1 mm. in diameter. The iron-ore occurs in granules and in rods, the latter averaging ·4 mm. in length. Olivine is not present.

Underlying this rock there is another flow, which rests on Palæozoic rocks. Between the two flows there are lenticular patches of common black opal [44] which represents altered diatomaceous earth. Also, in the lower part of the flow, casts of trees several feet in length and up to a foot in diameter are seen; these are always horizontal. The lower flow is somewhat similar in the hand-specimen, but it has fewer phenocrysts of felspar and microscopically it is very different, as it is hyalopilitic and much finer-grained. This latter basalt is in many respects similar to the basalt at Fingal Point, which is about a mile away and at the same level.

Specimen 4.—Locality: Burleigh Heads. This forms a capping on the Palæozoic schists, and supports a subtropical vegetation. It is typical of the basalt rocks in this locality and is characterised by magnificent columnar structure. The columns are about 4 feet in diameter, and in many cases are 40 feet long.

In the hand-specimen occasional phenocrysts, about half an inch long, of very clear plagioclase are seen. Under the microscope the rock is seen to be hyalopilitic with a fluxional arrangement of the felspars.

The plagioclase laths are about ·05 mm. in length, and are of two varieties, acid labradorite which is most abundant, and acid andesine which occurs less frequently and in somewhat square prisms.

Augite occurs in sub-ophitic rounded patches but occasionally in long patches 1 mm. in length. Iron-ore is abundant, and occurs mainly as irregular granules. An analysis of this rock is given. Specific gravity 2.87. Name: *Andesitic Basalt.*

[44] E. W. Skeats, Proc. Roy. Soc., Q'land, xxvi. (1914).

The basalt at Cut Hill near Coolangatta is very similar indeed to this rock.

Specimen 237.—Quarries, Bundamba. This represents one of the most recent flows in the whole of the area, and is largely quarried for road-making purposes.

It is a compact non-porphyritic basalt, and under the microscope it is seen to be holocrystalline. The brown glass which is studded with rod-shaped crystals of iron-ore is not very abundant. (*See* Plate XIV., fig. 4.) The rock is rather coarse in texture, the plagioclase laths averaging 0·6 mm. in length, and the augite which occurs in ophitic patches well developed may extend to 1·5 mm. in length.

Olivine is abundant, and occurs in rounded crystals up to 1 mm. in diameter. The plagioclase is an acid labradorite.

This rock is certainly a flow, and it shows ophitic structure better developed than in any other rock examined. Specific gravity 2·92. Name: *Basalt.*

Basaltic Tuffs and Agglomerates.

These do not occur to any great extent, and are really of very limited occurrence. At Christmas Creek, between Lamington and Lamington Glen, basaltic agglomerate which is made up of rounded boulders and scoriaceous fragments occurs immediately beneath the acid agglomerates of the area. There is no great thickness and it represents the surface of the lower basic rocks. The surface material at Spicer's Peak, on its extreme eastern end, is also agglomeratic in nature, and represents in that locality the most recent material which is preserved, of the upper division of the basic rocks. It is probable that the explosive element resulting in the agglomerate developed here and also at Christmas Creek when the fissures which had served as the extruding channels became choked up.

Near Toowoomba there are very large accumulations of basaltic tuff, and numerous sections through it are seen along the railway cuttings, between Harlaxton and Spring Bluff. It is well bedded, loosely aggregated, and in a very weathered condition.

In the Municipal Quarries at Toowoomba, distinct evidence of central vents is present, and it is in this district only that evidence of prolonged and important extrusions of basic material from eruptions of the central type is found.

Chemical Composition.

The analysis of the oligoclase-basalt from Spicer's Peak is seen to be very similar to the mugearite analysis. It is richer in silica and poorer in ferric oxide, but the lime, magnesia, total alkalies, titania and phosphorus pentoxide are very similar. The Spicer's Peak rock is poorer in soda but correspondingly richer in potash. There is a close similarity between the basalt from Cooper's Plains and the lower basalt in portion 69 at Chinghee Creek. This similarity is interesting as the Cooper's Plains basalt represents one of the most recent flows of the area, and the Chinghee Creek flow one of the earliest, as it belongs to the lower division.

The basalts from Pittsworth and Mount Lindsay are also very similar. Chemical distinctions cannot be made between the rocks of the lower and upper divisions, nor can they be distinguished microscopically.

TABLE VI.—BASALTS.

—	I.	II.	III.	IV.	V.(a)	VI.	VII.	VIII.(a)	IX.	X.(a)	XI.	XII.(a)	XIII.	XIV.
SiO_2	52·95	49·24	52·24	51·80	51·86	51·69	50·78	50·27	50·24	49·90	49·32	48·96	48·55	47·50
Al_2O_3	15·56	15·84	16·52	16·63	18·56	13·16	15·16	12·50	16·59	15·79	18·11	16·58	12·45	14·19
Fe_2O_3	2·62	6·09	4·52	2·72	0·38	3·99	2·36	2·44	2·72	4·52	2·51	1·95	3·60	1·78
FeO	7·29	7·18	6·61	7·91	10·69	8·65	10·01	8·18	8·35	6·25	4·86	8·62	10·43	12·15
MgO	2·89	3·02	3·55	5·34	3·72	6·84	4·43	10·25	5·14	5·77	8·05	7·97	7·64	5·06
CaO	4·92	5·26	8·20	8·38	5·77	8·41	6·46	7·52	8·70	9·12	8·90	8·75	7·58	7·47
Na_2O	4·46	5·21	3·28	3·89	3·30	2·76	3·54	3·29	3·54	3·24	1·90	3·08	3·20	3·85
K_2O	2·94	2·10	1·48	0·29	2·10	0·45	2·20	1·42	0·40	0·89	3·30	0·91	1·75	1·58
H_2O+	2·18	1·61	0·65	0·88	0·56	1·00	1·32	1·14	1·84	1·36	1·80	1·18	1·66	1·59
H_2O-	0·75	1·08	0·58	1·10	0·24	0·55	0·75	0·46	1·02	1·28	0·28	0·66	0·34	0·33
CO_2	..	..	..	..	..	..	0·01	..	..	..	..	..	..	..
TiO_2	1·84	1·84	1·44	0·82	0·70	1·70	2·60	2·26	0·72	1·98	0·60	0·81	1·34	3·08
P_2O_5	1·15	1·47	0·80	0·26	1·44	0·28	0·34	0·60	0·41	0·43	0·27	0·34	0·61	0·79
MnO	0·14	0·29 &c. 0·23	tr.	0·23	0·18	0·14	0·14 &c. 0·30	0·18	0·29	0·12	0·47	0·14	0·25	0·20
Total	99·69	100·46	99·87	100·25	99·50	99·62	100·40	100·51	99·96	100·65	100·37	99·95	99·40	99·57
Spec. Grav.	2·74	2·79	2·87	..	..	2·92	..	2·88	2·81	2·76	2·89	2·87	..	2·79

(a) Slight alterations in MnO and TiO_2 have subsequently been made by Agric. Chemist.

Norm.

—	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Quartz	0·96	..	6·06	0·42	2·22	5·82	..	..	0·06	2·10	..	..	..	..
Orthoclase	17·24	12·23	8·90	1·67	12·23	2·22	12·79	8·34	2·22	5·56	19·46	5·56	10·01	9·45
Albite	37·73	43·49	27·77	33·01	27·77	23·58	29·87	27·77	29·87	27·25	16·24	26·20	27·25	32·49
Anorthite	13·90	13·62	25·85	26·97	20·29	22·24	19·18	15·29	28·36	25·85	30·86	28·36	14·46	16·68
Nepheline	..	0·28	..	..	..	..	..	..	..	..	..	..	..	..
Corundum	..	..	..	..	3·47	..	..	..	..	..	..	..	..	..
Diopside	2·25	2·72	7·94	10·73	..	14·46	9·22	14·95	10·08	13·56	9·36	10·88	16·35	..
Hypersthene	13·76	..	11·09	19·38	27·65	19·96	15·15	11·90	20·23	12·40	3·12	6·97	7·54	7·86
Olivine	..	8·74	..	..	..	..	5·38	11·52	..	..	13·89	15·00	13·15	15·04
Akermanite	..	..	..	..	..	..	..	..	..	..	..	..	..	5·66
Magnetite	3·71	8·82	6·50	3·94	0·70	5·80	3·48	3·48	3·94	6·50	3·71	2·78	5·34	2·55
Ilmenite	3·50	3·50	2·74	1·52	1·37	3·19	5·02	4·41	1·44	3·80	1·22	1·52	2·43	5·93
Apatite	2·69	3·70	2·02	0·67	3·36	0·67	0·67	1·34	1·01	1·01	0·67	0·67	1·34	2·02

I.—Oligoclase-Basalt, II. 5.2.4. Akerose, Spicer's Peak, Main Range.[3]
II.—Mugearite, II. 5.2.4. Akerose, Druim na Crìche, I. of Skye.[5]
III.—Andesitic-Basalt, II. 5.3.4. Andose, Burleigh Heads.[3]
IV.—Basalt, II. 5(4). 5. Beerbachose, por. 25/26, par. Purga.[1]
V.—Basalt, II. 5.3.4. Andose, por. 124, par. Purga.[1]
VI.—Basalt, III. 5.3.5. Ornose, Bundamba.[3]
VII.—Olivine-Basalt, III. 5.3.4. Camptonose, Fingal Pt., Tweed Hds.[4]
VIII.—Olivine-Basalt, III. 5.3.4. Camptonose, Municipal Quarries, Toowoomba.[1]

IX.—Basalt, III.(II.) 5.3(4).5 Auvergnose-Ornose, Walkeden's Quarries, Cooper's Plains.[1]
X.—Basalt, III.(II.) 5.3.4. Camptonose, Chinghee Creek, por. 69, par. Telemon.[2]
XI.—Basalt, II. 5(3).4.3 Shoshonose-Hessose, Red Hill, Ipswich.[1]
XII.—Olivine-Basalt, III.(II.) 5.4(3).4. Auvergnose, Chinghee Creek, por. 67v, par. Telemon.[2]
XIII.—Basalt, III. 5.3.4. Camptonose, Pittsworth.[1]
XIV.—Basalt, III. 5.3.4. Camptonose, 3,000′ level, Mt. Lindsay.[3]

[1] Ann. Rep. Agric. Chem., Q'land, 1912.
[2] Ann. Rep. Agric. Chem., Q'land, 1913
[3] Ann. Rep. Agric. Chem., Q'land, 1914.
[4] Rec. Geol. Surv., N.S.W., vol. 7, p. 304.
[5] Tertiary Igneous Rocks of Skye, p. 263.

VI. RELATIONSHIPS OF THE VOLCANIC ROCKS TO ONE ANOTHER.

Thirty-five complete chemical analyses of the volcanic rocks are available. These, which may be regarded as representative of the extruded material, have all been tabulated earlier in this paper. For purposes of better comparison, however, the accompanying table has been drawn up, and all the analyses have been recalculated to 100 per cent. after the subtraction of the water &c.

In the list of rocks analysed, there are representatives of the upper, middle and lower divisions, and also of the alkaline and sub-alkaline types. An examination of the table shows that the rocks range from acid to basic, and the order followed is simply one of silica percentage in the recalculated analyses. The numbers which the rocks are here given are those used for the rocks in the variation diagrams.

Owing to the great extent of volcanic rocks, their stratigraphical relationship to one another, the denudation which has gone on, and the great difficulty of mapping-in boundaries owing to the ruggedness of the country, it is a matter of difficulty to accurately estimate the relative volumes of the different outpourings. But as the important masses are all known and the average thicknesses of the various divisions can be determined it is possible to make an estimate as to the general ratios of the volumes of the extrusions.

This estimate used in conjunction with the chemical analyses enables one to make an approximation to the mean average composition of the extruded material.

It is believed that all the volcanic rocks of the area are magmatically related, and that the parent magma from which they have been derived had the composition of a nearly normal andesite.

Average Composition of the Volcanic Rocks of the Upper Division.

Fourteen analyses of lavas known definitely to belong to this division have been used. The rocks analysed are representatives of all parts of the area, and it is notable that there are no representatives, belonging to this division, of the definitely alkaline series. The author is of the opinion that a combination of the analyses in equal proportions furnishes the most reliable basis for a determination of the mean average composition of the lavas. The analyses used were those of lavas numbered 18, 20, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34.

Average Composition of the Volcanic Rocks of the Middle Division.

This estimation is rather more complex than the above, and seventeen analyses were used.

The rhyolitic rocks in the southern part of the area, the rocks of the Esk district, and the alkaline rocks from the Glass House Mountains, Mount Flinders and Main Range areas, constitute the representatives of this division.

It is estimated that rocks of this division in the Main Range, the Esk, the Glass House Mountains and the Mount Flinders areas are of nearly equal importance. Consequently the analysis of the soda trachyte from the Main Range was combined equally with each of the three averages derived from (*a*) the five Esk rocks, (*b*) the four Glass House Mountains rocks, and (*c*) the three Mount Flinders rocks.

The above rocks together total approximately one quarter of the extensive development of middle division rocks in the southern and south-eastern portions of the areas.

The Chinghee Creek, Mount Lindsay, Mount Barney, and Springbrook rocks are all very similar and are representative of the southern and south-eastern material.

Consequently the average obtained by taking each of these latter four rocks and the above average in equal proportions is regarded as being approximately representative of the extruded material of the middle division.

The analyses used were those of the rocks numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 19, 21.

TABLE VII.

—	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
SiO_2 ..	74·28	74·20	72·35	74·10	72·73	73·10	72·38	72·02	71·56	69·32	66·40	65·09	65·31	64·58	62·15	60·58	60·00	61·24
Al_2O_3 ..	11·27	11·75	16·96	12·08	13·57	13·69	12·21	12·60	11·94	16·06	12·03	14·43	12·08	17·52	16·73	18·06	10·58	14·33
Fe_2O_3 ..	1·93	1·92	2·60	2·02	0·69	1·19	3·36	0·32	4·68	1·42	8·23	3·21	5·12	2·56	2·90	3·05	6·18	1·81
FeO ..	0·58	1·30	1·50	0·86	1·43	1·43	0·69	3·29	0·46	0·88	0·64	0·13	3·07	0·96	3·22	1·38	4·72	6·09
MgO ..	0·44	0·30	0·17	0·64	0·42	0·43	0·17	0·55	0·32	0·06	0·40	0·10	0·96	0·22	2·70	0·23	1·97	3·45
CaO ..	1·15	0·19	1·03	1·10	1·00	0·87	0·18	1·95	0·28	0·31	0·62	1·18	2·50	0·39	3·98	1·74	2·88	5·07
Na_2O ..	2·74	4·25	3·26	3·32	4·98	4·03	3·52	4·84	4·88	6·01	5·26	7·26	4·91	6·41	3·58	5·01	6·58	3·75
K_2O ..	4·77	5·00	4·87	4·98	3·74	4·92	5·20	2·82	5·03	4·23	3·26	3·24	4·72	6·23	2·81	6·87	2·20	3·13
H_2O+ ..	1·01	0·27	3·50	0·81	0·95	0·54	0·86	0·20	0·40	} 1·09	{ 1·85	} 2·42	{ 0·57	0·30	1·06	0·90	1·65	0·28
H_2O- ..	0·70	0·06	0·35	0·34	0·50	..	0·69	0·30	0·33		0·50		0·47	0·11	0·14	0·99	0·65	0·17
CO_2 ..	..	0·01	..	..	..	..	..	..	..	..	..	..	..	0·08	0·04	..	..	..
TiO_2 ..	0·25	0·13	nil	0·21	tr.	0·39	0·25	0·69	0·17	0·62	0·82	2·50	0·49	0·13	0·83	0·83	1·56	0·52
P_2O_5 ..	0·07	abs.	0·09	0·07	0·07	0·11	tr.	0·11	tr.	..	0·23	..	0·14	tr.	p.n.d.	..	0·44	0·51
MnO ..	0·02	0·20	0·03	0·05	0·04	nil	0·70	0·04	tr.	..	0·05	..	0·11	0·08	0·12	0·04	0·18	tr.
&c. ..	..	0·60*a*	..	..	..	..	0·05*b*	..	·01*c*	..	..	..	..	0·40*d*	0·19*e*	0·07*f*	..	..
Total ..	99·21	100·12	100·71	100·58	100·12	100·10	100·26	99·73	100·06	100·00	100·29	99·56	100·45	99·97	100·45	99·75	99·59	100·35
Sp. Grav.	2·37	2·62	2·39	2·50	2·43	2·38	2·47	2·61	2·71	..	2·49	..	2·40	2·62	2·61	..	2·69	2·57
SiO_2 ..	76·19	74·78	74·68	74·53	73·72	73·42	73·37	72·59	72·07	70·08	67·82	67·02	65·70	65·18	62·76	61·94	61·72	61·30
Al_2O_3 ..	11·56	11·84	11·33	12·15	13·76	13·15	12·38	12·70	12·02	16·24	12·29	14·85	12·15	17·68	16·90	18·48	10·88	14·35
Fe_2O_3 ..	1·98	1·94	2·68	2·03	0·70	1·20	3·40	0·32	4·71	1·44	8·40	3·30	5·15	2·59	2·93	3·12	6·35	1·81
FeO ..	0·59	1·31	1·55	0·06	1·45	1·44	0·70	3·31	0·46	0·89	0·65	0·13	3·09	0·97	3·25	1·40	4·86	6·10
MgO ..	0·45	0·30	0·17	0·64	0·42	0·43	0·17	0·55	0·32	0·06	0·41	0·10	0·97	0·22	2·73	0·23	2·02	3·45
CaO ..	1·18	0·19	1·06	1·11	1·01	0·87	0·18	1·97	0·28	0·31	0·63	1·21	2·52	0·39	4·02	1·78	2·96	5·08
Na_2O ..	2·81	4·28	3·37	3·34	5·04	4·05	3·57	4·88	4·91	6·08	5·36	7·47	4·94	6·47	3·61	5·13	6·75	3·75
K_2O ..	4·89	5·03	5·04	5·01	3·79	4·94	5·27	2·84	5·06	4·28	3·32	3·34	4·74	6·29	2·84	7·03	2·26	3·13
TiO_2 ..	0·26	0·13	nil	0·21	..	0·39	0·25	0·69	0·17	0·62	0·84	2·58	0·49	0·13	0·84	0·85	1·58	0·52
P_2O_5 ..	0·07	abs.	0·09	0·07	0·07	0·11	tr.	0·11	tr.	..	0·23	..	0·14	tr.	p.n.d.	..	0·44	0·51
MnO ..	0·02	0·20	0·03	0·05	0·04	nil	0·70	0·04	tr.	..	0·05	..	0·11	0·08	0·12	0·04	0·18	tr.
Total ..	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

(*a*) NiO 0·03; ZrO_2 0·38; F 0·02; Cl 0·17

(*b*) NiO 0·04; Cl 0·01

(*c*) NiO 0·01

(*d*) ZrO_2 0·21; NiO 0·03; Cl 0·08; S (FeS_2) 0·08

(*e*) NiO 0·08; S (FeS_2) 0·11

(*f*) NiO } CoO } 0·07

TABLE VII.—*continued.*

—	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.
SiO_2	56·52	57·62	56·78	52·95	54·10	52·24	51·80	51·69	51·86	50·78	50·24	49·90	50·27	49·32	48·96	48·55	47·50
Al_2O_3	17·55	13·63	14·47	15·56	13·42	16·52	16·63	13·16	18·56	15·16	16·59	15·79	12·50	18·11	16·58	12·45	14·19
Fe_2O_3	3·14	5·41	2·80	2·62	4·06	4·52	2·72	3·99	0·38	2·36	2·72	4·52	2·44	2·51	1·95	3·60	1·78
FeO	4·86	5·15	6·05	7·29	7·43	6·61	7·91	8·65	10·69	10·01	8·35	6·25	8·18	4·86	8·62	10·43	12·15
MgO	2·51	2·86	0·34	2·89	4·43	3·55	5·34	6·84	3·72	4·43	5·14	5·77	10·25	8·05	7·97	7·64	5·06
CaO	5·50	5·57	2·47	4·92	7·97	8·20	8·38	8·41	5·77	6·46	8·70	9·12	7·52	8·90	8·75	7·58	7·47
Na_2O	4·82	3·38	8·67	4·46	3·81	3·28	3·89	2·76	3·30	3·54	3·54	3·24	3·29	1·90	3·08	3·20	3·85
K_2O	1·90	3·07	4·51	2·94	1·15	1·48	0·29	0·45	2·10	2·20	0·40	0·89	1·42	3·30	0·91	1·75	1·58
H_2O+	2·45	1·54	1·70	2·18	0·88	0·65	0·88	1·00	0·56	1·32	1·84	1·36	1·14	1·80	1·18	1·66	1·59
H_2O-	0·25	nil	0·56	0·75	nil	0·58	1·10	0·55	0·24	0·75	1·02	1·28	0·46	0·28	0·66	0·34	0·33
CO_2	..	..	..	..	..	..	..	..	..	0·01	..	..	..	..	..	..	..
TiO_2	tr.	1·75	2·00	1·84	2·35	1·44	0·82	1·70	0·70	2·60	0·72	1·98	2·26	0·60	0·81	1·34	3·08
P_2O_5	0·22	0·40	..	1·15	0·46	0·80	0·26	0·28	1·44	0·34	0·41	0·43	0·60	0·27	0·34	0·61	0·79
MnO	0·13	0·26	tr.	0·14	0·30	tr.	0·23	0·14	0·18	0·14	0·29	0·12	0·18	0·47	0·14	0·25	0·20
&c.	..	..	0·05*g*	..	..	..	..	..	..	0·30*h*	..	..	..	..	..	..	..
Total	99·85	100·64	100·40	99·69	100·36	99·87	100·25	99·62	99·50	100·40	99·96	100·65	100·51	100·37	99·95	99·40	99·57
Sp. Grav. ..	2·75	2·64	..	2·74	2·79	2·87	..	2·92	..	..	2·81	2·76	2·88	2·89	2·87	..	2·79
SiO_2	58·15	58·15	57·88	54·72	54·38	52·96	52·73	52·69	52·55	51·81	51·72	50·92	50·83	50·20	49·91	49·87	48·58
Al_2O_3	18·09	13·75	14·77	16·09	13·50	16·74	16·92	13·45	18·82	15·47	17·07	16·12	12·65	18·43	16·89	12·79	14·55
Fe_2O_3	3·23	5·46	2·86	2·70	4·08	4·60	2·77	4·07	0·38	2·41	2·81	4·61	2·46	2·55	1·99	3·69	1·83
FeO	5·01	5·20	6·17	7·53	7·47	6·71	8·05	8·81	10·83	10·22	8·59	6·37	8·27	4·94	8·78	10·71	12·46
MgO	2·58	2·89	0·34	3·00	4·45	3·59	5·42	6·98	3·76	4·52	5·30	5·89	10·36	8·19	8·13	7·84	5·19
CaO	5·66	5·62	2·51	5·09	8·01	8·31	8·52	8·57	5·84	6·59	8·97	9·30	7·60	9·05	8·92	7·78	7·66
Na_2O	4·97	3·41	8·83	4·60	3·83	3·34	3·96	2·81	3·34	3·61	3·65	3·30	3·32	1·93	3·14	3·28	3·95
K_2O	1·96	3·10	4·60	3·05	1·16	1·50	0·30	0·46	2·13	2·24	0·41	0·91	1·44	3·35	0·93	1·80	1·62
TiO_2	tr.	1·76	2·04	1·90	2·36	1·46	0·84	1·74	0·71	2·65	0·75	2·02	2·28	0·61	0·83	1·37	3·15
P_2O_5	0·22	0·40	..	1·18	0·46	0·81	0·26	0·28	1·46	0·34	0·43	0·44	0·61	0·27	0·34	0·62	0·81
MnO	0·13	0·26	tr.	0·14	0·30	tr	0·23	0·14	0·18	0·14	0·30	0·12	0·18	0·48	0·14	0·25	0·20
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

(*g*) NiO 0·05. (*h*) SO_3 0·15; Cl 0·02; NiO.CoO 0·05; BaO 0·05; V_2O_5 0·02; CuO 0·01.

1. Rhyolite—3½ miles south of Lamington, por. 58v, par. Telemon.
2. Comendite—Mount Conowrin, Glass House Mountains.
3. Pitchstone—Mount Lindsay.
4. Rhyolite—Mount Barney.
5. Rhyolite—Glen Rock, Esk.
6. Rhyolite—Springbrook Plateau, por. 89, par. Numinbah.
7. Pantellerite—Mount Ngun-Ngun, Glass House Mountains.
8. Rhyolite—Ottaba, por. 28v, par. Biarra, Esk District.
9. Pantellerite—Trachyte Range, Glass House Mountains.
10. Porphyritic Soda-Trachyte—Mount Flinders.
11. Trachyte—Portion 136A, par. Esk.
12. Soda-Trachyte—2,000 feet level, Warwick coach road, Main Range.
13. Trachyte—Cainbable Creek, por. 12, par. Numinbah.
14. Trachyte—Mount Beerwah, Glass House Mountains.
15. Dacite—Near Bankfoot House, Glass House Mountains.
16. Trachyte—Summit, Mount Flinders.
17. Trachyte—Portion 51, par. Esk.
18. Andesite—Observation Hill, Tweed Heads.
19. Augite-Andesite—Portion 134, par. Esk.
20. Andesite—Tamborine Plateau, por. 18, par. Witherin.
21. Phonolitic-Ægirine-Trachyte—Foot of Mount Flinders.
22. Oligoclase-Basalt—Summit of Spicer's Peak.
23. Andesite—Springbrook Plateau, por. 84, par. Numinbah.
24. Andesitic-Basalt—Burleigh Heads.
25. Basalt—South of Ipswich, por. 25/26, par. Purga.
26. Basalt—Quarries, Bundamba.
27. Basalt—South of Ipswich, por. 124, par. Purga.
28. Olivine-Basalt—Fingal Point, Tweed Heads.
29. Basalt—Walkeden's Quarry, Cooper's Plains.
30. Basalt—Two miles south of Lamington, por. 69, par. Telemon.
31. Basalt—Quarries, Toowoomba.
32. Basalt—Red Hill, Ipswich.
33. Basalt—Four miles south of Lamington, por. 67v, par. Telemon.
34. Basalt—Pittsworth, Queensland.
35. Basalt—3,000 feet level, south-east side, Mount Lindsay.

Average Composition of the Volcanic Rocks of the Lower Division.

This is of much less importance than the other two divisions and two analyses only were used here. They were combined equally in making the determination, and the analyses used were those of rocks numbered 30, 35.

Mean Average Composition of the Volcanic Rocks of the Area.

All three divisions are represented in each of the important accumulations of extruded material, and the average thicknesses are 1,000, 500 and 100 feet respectively for the upper, middle and lower divisions.

The actual areal distribution of each division is approximately the same, as they are all piled one on top of the other, so that a general ratio of 10 : 5 : 1 is arrived at for the respective volumes of the upper, middle and lower divisions.

By combining the averages for each of these divisions of rocks in these proportions, the following average composition as shown in Table VIII. of the whole of the volcanic rocks of the area is obtained. For the purposes of these calculations, all the rocks were assumed to have the same density, as the roughness of the mapping did not warrant one taking differences of density into account. The average analysis is seen to be close to the average andesite given by Daly,[45] and also to the andesite from the southern end of Tamborine Plateau. It differs from the average andesite analysis mainly in alumina and iron-oxide value, though on totalling these a close approximation is obtained. The magnesia is rather higher, the lime slightly lower, and the potash a little higher than in the average andesite analysis.

In comparing the average obtained with the Tamborine andesite it is seen that the former is about 1 per cent. higher in silica, the ferric oxide is considerably lower, the magnesia is rather higher, and the potash and also the titania a little lower.

[45] Igneous Rocks and their Origin, p. 26.

This estimated average composition for the whole of the volcanic rocks of the area is based on rough general calculations, but it may be regarded as approximately correct.

TABLE VIII.—AVERAGE COMPOSITIONS.

——	I.	II.	III.	IV.	V.	VI.
SiO_2 ..	52·45	71·73	48·63	58·24	59·59	57·25
Al_2O_3 ..	15·05	12·30	14·97	14·19	17·31	13·54
Fe_2O_3 ..	2·80	2·16	3·14	2·62	3·33	5·38
FeO ..	7·89	1·21	9·19	5·89	3·13	5·12
MgO ..	5·48	0·42	5·41	3·89	2·75	2·84
CaO ..	7·32	1·09	8·28	5·43	5·80	5·53
Na_2O ..	3·38	3·85	3·53	3·54	3·58	3·36
K_2O ..	1·76	4·74	1·23	2·66	2·04	3·05
H_2O+ ..	1·21	1·55	1·47	1·33	1·26	1·53
H_2O- ..	0·49	0·42	0·86	0·49		
TiO_2 ..	1·40	0·40	2·52	1·16	0·77	1·74
P_2O_5 ..	0·56	0·09	0·61	0·42	0·26	0·40
MnO ..	0·19	0·04	0·16	0·14	0·18	0·26
Total ..	100·00	100·00	100·00	100·00	100·00	100·00

Calculated as Water-Free.

	I.	II.	III.	IV.	V.	VI.
SiO_2 ..	53·37	73·17	49·88	59·34	60·35	58·15
Al_2O_3 ..	15·31	12·58	15·32	14·46	17·54	13·75
Fe_2O_3 ..	2·85	2·20	3·22	2·67	3·37	5·46
FeO ..	8·03	1·23	9·31	5·99	3·17	5·20
MgO ..	5·58	0·43	5·53	3·97	2·78	2·89
CaO ..	7·44	1·11	8·47	5·53	5·87	5·62
Na_2O ..	3·43	3·93	3·61	3·59	3·63	3·41
K_2O ..	1·80	4·82	1·25	2·71	2·07	3·10
TiO_2 ..	1·43	0·40	2·63	1·18	0·78	1·76
P_2O_5 ..	0·57	0·09	0·62	0·42	0·26	0·40
MnO ..	0·19	0·04	0·16	0·14	0·18	0·26
Total ..	100·00	100·00	100·00	100·00	100·00	100·00

I.—Average composition of Volcanic Rocks of Upper Division.

II.—Average composition of Volcanic Rocks of Middle Division.

III.—Average composition of Volcanic Rocks of Lower Division.

IV.—Average composition of Volcanic Rocks of all three Divisions.

V.—Average composition of 87 Andesites. (*a*)

VI.—Composition of Andesite from Tamborine Plateau, por. 18, parish Witherin.

(*a*) Daly. Igneous Rocks.

All the analyses available were used with the exception of that of the Glass House Mountains dacite and the Cainbable Creek trachyte. These are both of very minor importance, and would not really affect the determinations carried out above.

Magmatic Relationships.

In order to see whether the volcanic rocks were magmatically related, the recalculated analyses, in percentages by weight, were plotted with the different oxides against the silica in the usual way in the constitution of variation diagrams. It is quite obvious that the rocks as a whole do not conform to one particular curve for each oxide, and investigation shows that it is necessary to have at least three curves. The rocks which are definitely alkaline conform closely to one series of curves having all the characteristics of curves for alkaline rocks, while the rocks definitely sub-alkaline conform closely to one series of curves which have all the characteristics of curves for sub-alkaline rocks. There are, however, nine rocks whose somewhat intermediate character had been detected already microscopically, and these are all found to conform fairly well with a series of curves which take up, as a rule, an intermediate position between the alkaline and sub-alkaline curves.

An examination of all the diagrams (*see* Plates VI.-IX.) shows that generally speaking there is a close conformity of the three series of rocks to their respective curves in each diagram.

While in general the term "alkaline" as applied to rocks may be satisfactory the author felt that he wanted some specific information for the correct determination of the character of certain rocks, particularly the acid ones.

A fine series of generalised variation diagrams which Harker shows on pages 150 and 151 of "The Natural History of Igneous Rocks" proved of very great value in this direction and the author adapted them for the purpose mentioned above. By drawing up the variation diagrams, each with its three curves, and also plotting Harker's adapted generalised variation diagrams showing the curves for the alkaline (atlantic) and sub-alkaline (pacific) series, the normality or otherwise of the alkaline and sub-alkaline series of the rocks in question is shown, also the intermediate nature of the third series is made quite evident.

There is no question as to the reliability of the curves on Harker's generalised variation diagrams, and they furnish an excellent method of comparison. Harker's curves are plotted from analyses of all igneous rocks whereas we are concerned with volcanic rocks only, and although in certain minor respects the curves for volcanic rocks would differ from curves for plutonic rocks, the influence this would have on these comparisons might be considered of minor importance. In addition Harker's curves have not been drawn up from water-free analyses recalculated to 100 per cent.

There are many interesting features about the variation diagrams but the most outstanding thing is the general paucity of alumina and the general richness of iron-oxides for the rocks as a whole. Curves have been drawn for lime, magnesia, soda, potash, combined soda and potash, alumina, total iron-oxides as ferrous oxide, and combined alumina and total ferrous oxide. Well-shaped curves with the respective rocks of each series closely conforming to its particular curve can be drawn for lime, magnesia, soda, potash, combined soda and potash, and combined alumina and total iron-oxide as ferrous oxide.

In the case of alumina alone, and also of the total iron-oxides as ferrous oxide, it is impossible to draw curves of any value at all which have all the rocks conforming to them; but it is most noticeable that by combining these two values and plotting them, excellent curves, with the rocks closely conforming, can be drawn. An examination of Plate VIII. shows that the alumina values are as a rule markedly low and the ferrous oxide values markedly high, and, moreover, there is an antipathetic variation from the normal curve of these values in the same rock. Normally, curves for alumina and ferrous oxides are antipathetic, so that one might expect to obtain reasonable curves for the combined oxides. This expectation is very well fulfilled (*see* Plate IX.), and the curves for the three rock series are all very close and are closely comparable with the curves for these combined oxides which have been adapted from Harker's curves. The only rock that does not conform well is the Toowoomba basalt, and the low alumina value is accompanied by a high magnesia value; this rock is extremely rich in olivine.

Thus while the alumina is certainly low and the total iron-oxides as ferrous oxide certainly high, the combined oxides are thoroughly normal.

The curves for lime are all good ones, and when compared with the generalised curves of Harker it is seen that both the sub-alkaline and alkaline series are slightly lower than normal, while the third series occupies an intermediate position.

The curves for magnesia are, generally speaking, good, although the Burleigh Heads andesitic-basalt has a low value, and the Toowoomba basalt a high value. The Burleigh Heads rock in other respects is, however, nearly normal. The Toowoomba basalt is extremely rich in olivine, and this accounts for the high value for magnesia, and it is to be noted that the alumina value for this rock is correspondingly low. The curve for the sub-alkaline series is almost normal although a little low, but that for the alkaline series is considerably lower than the normal alkaline curve. The third series gives a very good curve which takes up an intermediate position between the other two.

The curves for soda are reasonably good, but in comparison with the generalised curves of Harker the alkaline curve is seen to be considerably higher, and the sub-alkaline curve, while nearly normal, is a shade high towards the basic end. The curve for the third series is again in an intermediate position. The trachyte from the summit of Mount Flinders is considerably below the alkaline curve, but in the potash diagram it is seen to be somewhat above. The rocks as a whole are a little above the normal in soda.

The curves for potash are not as good as those for soda, and show the alkaline series to be slightly above the normal, and the sub-alkaline series rather more so, except towards the basic end. The rhyolite from Glen Rock is considerably off the curve for the third series. The rocks as a whole are little above the normal in their potash value.

The curves for combined soda and potash are good curves, and both the alkaline and sub-alkaline curves are somewhat above the normal. The trachyte from Cainbable Creek, which on general considerations is regarded as belonging to the sub-alkaline series, is rather richer in alkalies than the others of that series. The third series of rocks again takes up an intermediate position. Curves for phosphorus pentoxide, titania and manganese oxide have not been drawn up.

After an investigation of these variation diagrams, it is clear that the rocks of the area belong to three series, an alkaline series, a sub-alkaline series, and a third series intermediate between these two, also that the rocks of the area as a whole are a little higher in both soda and potash, and a little lower in both lime and magnesia, than the normal, and although the alumina is low and the total iron-oxides are high, the combined oxides of aluminium and iron are normal.

The Alkaline Series.

The rocks of this series are from the Glass House Mountains, Flinders Range and the Main Range. There are eight analyses, and all are those of Dr. Jensen. These rocks form perhaps 5 per cent. of the volcanic rocks of this area, which has been generally regarded as one rich in alkaline eruptives.

The series ranges from acid to sub-acid and is much more restricted in that respect than the other series. It is particularly rich in alkalies and rather deficient in lime and magnesia, when compared with the alkaline rocks as a whole; but this is to be expected to some extent as alkaline volcanic extrusives are, in general, more salic than the equivalent plutonic types.

The occurrences are somewhat scattered and separated from one another. Dr. Jensen has dwelt on the fact that these alkaline rocks have been poured out near the junctions of the Palæozoic and Mesozoic formations. This is in general true, but we have had apparently similar conditions of folding, faulting and position with regard to Mesozoic coastlines &c., for both the alkaline and sub-alkaline series.

Dr. Jensen[46] has also advocated the assimilation of carbonate rocks by the parent magma with the resultant production of alkaline material. Daly[47] has elaborated this view, and indicates that, in the localities with which we are here concerned, highly calcareous Mesozoic sediments and possibly Palæozoic limestones have been cut by the alkaline eruptives. While small lenticular patches of limestone a few feet in diameter, and sandstone beds containing abundant calcareous material, are occasionally met in the Mesozoic sediments of this area, the use of the term "highly calcareous" does not seem at all justified for the formation as a whole; and, as far as the author can learn, there is no justification at all for assuming that Palæozoic limestones have been cut through, for the Mesozoic sediments lie unconformably on the old Palæozoic schists which are not at all specially calcareous but rather the reverse and which are older than any known deposit of limestone in this portion of Queensland. An analysis of a typical sample of these schists by the Agricultural Chemist, Brisbane, gave 1·59 per cent. CaO, 3·39 per cent. Na_2O, 3·07 per cent. K_2O.

As far as this area is concerned the evidence is rather against any special limestone assimilation by the sub-alkaline magma.

Daly apparently holds that the sub-alkaline magma as it traverses the formation absorbs the limestone or dolomite with the resultant production of alkaline material. The thickness of Mesozoic formations traversed by the alkaline rocks in the Glass House Mountains and Mount Flinders area is really small, especially at Mount Beerwah, and it seems inconceivable to the author that the alkaline nature of this material resulted subsequently to the passage of the material into the Mesozoic material. If it did so, then one is faced with explaining why one finds alkaline lavas and sub-alkaline lavas resting one on top of the other and poured out in all probability from the same opening.

At the Main Range, we have alkaline trachyte occurring between sub-alkaline, sub-basic, and basic lavas.

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[46] Proc. Linn. Soc., N.S.W., 1908, vol. xxxiii.

[47] Op. cit.

It is very difficult to fit in the above evidence with the idea that the alkaline magma results from the assimilation of limestone material as the Palæozoic and Mesozoic formations are intruded. It is conceivable that, in the magma reservoir, the absorption of limestone material would bring about a magmatic splitting resulting in an alkaline partial magma being formed, but it has already been shown that the sub-alkaline as well as the alkaline rocks are really slightly deficient in lime and magnesia.

It is of interest also to note that in connection with Daly's theory Professor P. Marshall states[48] :—" There appears to be no evidence in support of this theory as far as our knowledge of the alkaline rocks of the South Pacific Islands allows us to form a judgment at the present time."

The evidence from this area is certainly strongly in favour of differentiation of the original magma resulting in the formation of the alkaline material having taken place in the magma reservoir. The average composition of the alkaline rocks in the area has been estimated, and the Glass House Mountains area, Mount Flinders area, and the Main Range area were assumed to be of approximately equal importance in making the calculation.

The result is possibly a little high in soda and titania, as the Main Range trachyte was especially rich in these two, and perhaps more so than usual. Analyses used were those of rocks numbered 2, 7, 9, 10, 12, 14, 16, 21.

Sub-alkaline Series.

This series of rocks is represented in the upper, middle, and lower divisions, and embraces something more than 90 per cent. of the extruded material. The series ranges from acid to basic, and the rocks occur in all parts of the area. In comparison with normal sub-alkaline rocks, it has been shown that this series is characterised by a slightly higher alkali percentage and slightly lower lime and magnesia percentage; also, while the alumina is lower and the iron-oxides higher, the combination of these is about normal.

[48] Trans. and Proc., N. Z. Inst., vol. xlvii., 1915, p. 372.

There is little doubt as to the magmatic relationship of the rocks of this series, for in practically all the curves all the rocks conform closely.

Considering the extent of the area from which these rocks have been collected, and the fact that at least four different analysts carried out the chemical work, the general conformity to the curves might be considered good. The magmatic relationship existing between acid and basic rocks in this series is of note, because the alkaline series seems restricted to acid and sub-acid representatives.

The mean average composition of the sub-alkaline series has been determined, and in doing so the results of the eighteen analyses of the series were combined equally, for it was considered that the rocks analysed in the general way represented the rocks of the series in the proper proportions. Analyses used were those of rocks numbered 1, 3, 4, 6, 13, 15, 18, 20, 23, 24, 25, 26, 29, 30, 31, 32, 33, 34.

Intermediate Series.

This series embraces rocks from the upper, middle, and lower divisions, and their positions in these divisions are worthy of note. The basalt from Mount Lindsay is the uppermost flow of the lower division, and the basalts from the summit of Mount Spicer, Purga, and Fingal Point, Tweed Heads, are some of the most recent flows of the upper division, while the five remaining rocks of the series from the Esk district are believed to belong to the middle division. Whether the occurrence of these rocks at the termination of two periods of activity during which basic rocks have been poured out is a mere coincidence or not, is a question. It is true that following upon the Mount Lindsay basalt there were acid rocks made up almost entirely of quartz and alkali felspar, but whether this has any bearing or not on the somewhat intermediate character of this basalt is at present indefinite.

One may explain this series of rocks as resulting from a magma formed by an admixture of the alkaline and sub-alkaline magmas, or else from a separate partial magma which had been split off from the parent magma in the same way that one assumes other partial magmas to have resulted. This series is, perhaps, more closely allied to the sub-alkaline series than to the alkaline series. An estimate of the average composition of this series has been made, and in doing so the nine rocks analysed were taken as equally proportionate. Analyses used were those of rocks numbered 5, 8, 11, 17, 19, 22, 27, 28, 35.

TABLE IX.—AVERAGE COMPOSITIONS.

—	I.	II.	III.
SiO_2	66·13	58·24	59·06
Al_2O_3	14·69	14·07	14·44
Fe_2O_3	2·93	3·00	2·83
FeO	1·25	5·51	6·13
MgO	0·19	4·26	2·45
CaO	0·98	5·83	4·07
Na_2O	6·22	3·38	4·64
K_2O	4·61	2·52	2·54
H_2O+	0·98	1·21	1·42
H_2O-	0·66	0.47	0·47
TiO_2	1·27	1·03	1·30
P_2O_5	tr.	0·33	0.53
MnO	0·09	0·15	0.12
Total	100·00	100·00	100·00

Calculated as Water-Free.

	I.	II.	III.
SiO_2	67·23	59·25	60·19
Al_2O_3	14·95	14·29	14·73
Fe_2O_3	2·98	3·05	2·89
FeO	1·27	5·61	6·25
MgO	0·19	4·33	2·49
CaO	1·00	5·94	4·15
Na_2O	6·32	3·43	4·73
K_2O	4·68	2·56	2·59
TiO_2	1·29	1·05	1·32
P_2O_5	tr.	0·34	0·54
MnO	0·09	0·15	0·12
Total	100·00	100·00	100·00

I.—Average Composition of Alkaline Series of Volcanic Rocks.

II.—Average Composition of Sub-alkaline Series of Volcanic Rocks.

III.—Average Composition of Series intermediate between Alkaline and Sub-alkaline.

VII. PETROGRAPHIC PROVINCES.

The conclusions to be derived from the above considerations are—

1. During the ? Lower Cainozoic period there was an extensive basic to sub-basic sub-alkaline province over most of the southern and western portion of the area.
2. During the ? Middle Cainozoic period there was an acid sub-alkaline sub-province, and at least three acid to sub-acid alkaline sub-provinces, two of which, namely, those of the Main Range and Mount Flinders, were probably connected.
3. During the ? Upper Cainozoic period there was a basic to sub-basic sub-alkaline province over almost the whole area.

In addition to this, during the ? Middle Cainozoic period, there was a sub-province in the Esk district, particularly characterised by an acid to sub-acid series of rocks of a nature intermediate between the alkaline and sub-alkaline but more allied perhaps to the latter.

Relationship between the Volcanic Rocks and Earth Movements.

There is no evidence in this area of the folding movements such as Harker[49] associates with the pacific or sub-alkaline type of rocks; but, on the other hand, faulting on an extensive scale is known to have taken place along certain lines. The main fault-lines are in a general north and south direction along the eastern escarpment of the Main Range, and along a line to the west of Ipswich; there is a possible extension of this latter fault-line in a north-east and south-west direction to Mount Flinders.

The Main Range faulting took place at some time subsequent to the extrusion of the volcanic rocks of the upper division, as they had been dissected by streams to a depth of 1,500 feet at least, but whether faulting had occurred

[49] Natural History of Igneous Rocks.

along this line before, it is difficult to say. However, we have along this particular line both the upper and lower sub-alkaline extrusions with the alkaline extrusions between, so that it is difficult to see how Harker's generalisations hold here. The available evidence certainly does not support the generalisations made by Harker. Similar conclusions have been arrived at for the Victorian Cainozoic rocks by Professor Skeats and Dr. Summers.[50]

In all probability, further evidence of faulting will be forthcoming in the southern portion of the area, but there is nothing to suggest that folding except on a very minor scale has happened anywhere in the area since the Palæozoic era.

VIII. ORIGIN OF THE VOLCANIC ROCKS.

It has been shown that different portions and also in some cases the same portions of the area have been characterised by different series of volcanic rocks at various times. This one assumes to be the result of magmatic differences, and further that these different magmas have been derived from the parent magma. Certain characteristics which are common to the different series strengthen the belief that they are magmatically related. These characteristics have been frequently cited earlier, and are the general paucity in alumina and corresponding richness in iron-oxides, together with a slight lack of lime and magnesia and a slight excess of the alkalies.

An estimate of the general composition of this parent magma has been made, and it is very close to that of the average andesite.

That such a rock magma could exist is shown by the similarity of its composition with that of the andesite from the southern portion of Tamborine Plateau.

The parent magma split up in some way into a large sub-alkaline magma, and several smaller alkaline magmas, and magmas with a composition intermediate between the

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[50] Geol. Surv., Victoria, Bull. 24; and Proc. Roy. Soc., Vic., 1914, p. 289.

sub-alkaline and alkaline ones. Serial differentiation then went on in these magmas, and as a result the various rocks were separated out.

With the sub-alkaline magma, the order of separation and extrusion of the material seems to have been as follows: —Basic, then sub-basic and basic, extensive acid, still more extensive basic and sub-basic, and finally basic. While the sub-alkaline magma was extruding the acid material the alkali magmas were sending off acid and sub-acid material in the different centres, and these were exhausted before the sub-alkaline magma again extruded the basic and sub-basic material. The magmas of intermediate composition began extruding basic material previous to the acid sub-alkaline extrusions, and while the latter were being exhausted, acid and sub-acid material of an intermediate nature was separated off and extruded; some of the most recent flows in the area were the last extrusions of a basic nature from these magmas.

TABLE X.

—	I.	II.	III.	IV.
SiO_2	70·47	49·65	60·06	59·34
Al_2O_3	14·90	16·13	15·52	14·46
Fe_2O_3	1·63	5·47	3·55	2·67
FeO	1·68	6·45	4·06	5·99
MgO	0·98	6·14	3·56	3·97
CaO	2·17	9·07	5·62	5·53
Na_2O	3·31	3·24	3·28	3·59
K_2O	4·10	1·66	2·88	2·71
TiO_2	0·39	1·41	0·90	1·18
P_2O_5	0·24	0·48	0·36	0·42
MnO	0·13	0·30	0·21	0·14
Total ..	100·00	100·00	100·00	100·00

I.—Average Composition of Granites of the World. (*a*)

II.—Average Composition of Basalts of the World. (*a*)

III.—Mean of I. and II.

IV.—Average Composition of Volcanic Rocks of the Area.

(*a*) Daly, Igneous Rocks.

The estimated average composition of the parent magma bears a close relationship to the mean of the world's average granitic rock and the world's average basaltic rock. (*See* Table X.) Whether this has any significance or not it is difficult to say, but it is certainly a matter of interest in view of the fact that there are many ardent advocates of the view that there are two primary magmas, an acid and a basic one. In any case, a commingling of these two magmas could only be regarded as furnishing the magmatic material which became differentiated somewhat on the lines outlined above.

IX. SUMMARY.

The area dealt with is one of 4,000 square miles, and is in the extreme south-eastern corner of Queensland.

The physical features have several marked characteristics, and a close relationship between them and the volcanic rocks exists.

Important earth movements of a vertical kind only have taken place since the Palæozoic era.

Volcanic rocks occur in great abundance, and the distribution of these rocks and their relationship to the sedimentary and metamorphic rocks of the area have been described and illustrated by means of a sketch-map and sketch-sections.

The maximum thickness of the volcanic products is approximately 3,000 feet, and three well-marked stratigraphic divisions of these have been definitely established.

A close correlation between these volcanic rocks and those of Cainozoic age in New South Wales and Victoria has been shown.

The upper division has a maximum thickness of 2,000 feet, which is common throughout a large portion of the area, and which is made up of a large number of flows of basalt, andesitic basalt, and andesite; in some places pyroclastic accumulations occur.

The middle division has a maximum thickness of 1,000 feet, and is made up of acid and sub-acid lava flows, plugs, and in the south of a very extensive development of acid pyroclastic material.

The lower division has a maximum thickness in one place of 1,500 feet, though 100 feet is the average thickness, and it is made up mainly of basic lavas with occasional flows of andesitic material.

The age of the activity which produced all the volcanic material of this area, with the exception of the Brisbane tuff, is believed to be Cainozoic, and that of the lower, middle and upper divisions to be of approximately lower, middle and upper Cainozoic age.

The evidence of previous observers, notably E. O. Marks and R. A. Wearne, in favour of an upper Trias-Jura age for portion of the extruded material has been critically examined and rejected in favour of a post-Trias-Jura age for all the material.

The field occurrence of the volcanic rocks is recorded and they are shown in all cases to rest on top of the uppermost Trias-Jura deposits.

Extrusions both from fissures and central vents have taken place, though the greater portion of the basic and sub-basic material has been effused quietly from fissures.

Rhyolites, trachytes, dacites, andesites and basalts have been recognised and petrographic descriptions recorded.

The distribution of trachytes as indicated by Dr. Jensen is criticised, also a general sketch-section through the area which he has published.

The chemical characters of the rocks are illustrated by thirty-five complete analyses, twenty-five of which have been recently made in the laboratory of the State Agricultural Chemist.

By means of variation diagrams, the genetic relationship existing between all the rocks is shown and three definite series have been recognised.

The three series are—(*a*) An alkaline series, the members of which range from acid to sub-acid, and belong to the middle division; (*b*) a sub-alkaline series, embracing rocks from acid to basic, and occurring in all three divisions; and (*c*) a series intermediate between (*a*) and (*b*), containing rocks ranging from acid to basic and in all three divisions.

The chemical characters of the rocks in comparison with alkaline and sub-alkaline rocks in general is shown by means of variation diagrams. A general paucity in alumina with a corresponding richness in total iron-oxides, a slight lack of lime and magnesia, and a slight excess of alkalies, especially soda, are characteristic of both series.

It is considered improbable that the assimilation of limestone material &c. by the primary magma took place to form the partial magmas from which all the alkaline rocks were formed in this area.

An estimate of the chemical nature of the original parent magma from which all the volcanic rocks have been derived has been made, and compares very closely with that of the average andesite as given by Daly.

During the Cainozoic era, this area was a sub-alkaline province, but during the middle portion of the era, several small alkaline sub-provinces existed.

The volcanic alkaline rocks constitute at the most 5 per cent. of the volcanic material.

Harker's generalisation that sub-alkaline rocks are associated with folding earth movements is not borne out by the evidence from this area.

The nature of the parent magma, its differentiation with the resulting series of rocks, and the sequence of the flows have been discussed.

A geological sketch-map and four sketch-sections have been prepared to show the distribution, extent and stratigraphic relationships of the rocks of the area; also from the chemical analyses a number of variation diagrams and a set of Brögger diagrams have been drawn up to show the relationships of the volcanic rocks to one another; a series of microphotographs of the more important rocks is also appended.

In conclusion my best thanks are due to Mr. R. A. Wearne, B.A., of Ipswich, for invaluable aid in the field, to Mr. J. C. Brünnich the Agricultural Chemist and his officers, particularly Mr. G. Patten, for the many valuable rock-analyses which they have carried out, and to Professor E. W. Skeats, D.Sc., of the University of Melbourne, for very kindly criticisms.

X. DESCRIPTION OF PLATES.

Plate V.

Brögger Diagrams.

This shows Brögger diagrams for the thirty-five rocks whose analyses have been used to illustrate the chemical nature of the rocks. The diagrams are arranged in three divisions and show (*a*) the 18 rocks belonging to the sub-alkaline series, (*b*) the 9 rocks belonging to the intermediate series, and (*c*) the 8 rocks belonging to the alkaline series.

The diagrams have been drawn up in the usual way with the lengths laid off according to the molecular proportions of the different oxides; the iron-oxides have been calculated together as ferrous oxide.

An interesting comparison between the sub-alkaline and alkaline series is shown, and the differences between the lime, magnesia and alkalies are brought out in a striking manner.

The intermediate character of the third series is clearly indicated.

The numbers on the diagrams correspond to those of the rocks on Table VII. (page 183).

Plates VI.-IX.

Variation Diagrams.

These have been drawn up by plotting the silica percentages against the other oxides in percentages. In addition to the three curves for the three series, there are two curves as adapted by the author from curves drawn up by Harker.[51] In this way a comparison is obtained, not only of the rocks under consideration, but also of these with the world's average alkaline and sub-alkaline series.

Plate VI. shows diagrams for lime and magnesia.

Plate VII. shows diagrams for soda, potash and also combined soda and potash.

Plate VIII. shows diagrams for alumina and total iron-oxides as ferrous oxide.

Plate IX. shows a diagram for combined alumina and total iron-oxides as ferrous oxide.

The numbers of the rocks correspond to those given on Table VII. (page 183).

Plate X.

Geological Sketch-Map.

This is drawn up on a scale of six miles to an inch and is based on maps published by the Geological Survey and by H. I. Jensen, D.Sc., with additions and alterations by the author. It shows the extent and distribution of the volcanic rocks of the area. No attempt has been made to map in the other igneous rocks which intrude the Palæozoic rocks in the northern part of the area.

The basaltic and andesitic rocks of both the upper and lower divisions have been denoted by the same marking.

The thick black lines across the map indicate the lines of the sections shown on Plate XI.

Plate XI.

Geological Sketch-Sections.

This contains four geological sketch-sections which have been drawn along lines which are marked on the map (Plate X.) by continuous thick black lines.

Fig. I.—Geological sketch-section in a north-easterly direction from the Main Range to Mount Flinders, and then east to the Pacific Ocean.

[51] Harker, Nat. Hist. Igneous Rocks, pp. 150, 151

Fig. II.—Geological sketch-section in a general north-west direction from MacPherson's Range to the Albert River, north of Tamborine Plateau.

Fig. III.—Geological sketch-section north and south through Mount Lindsay.

Fig. IV.—Geological sketch-section east and west through Lamington Plateau.

These sketch-sections show clearly the relationships of volcanic rocks to the Mesozoic and Palæozoic rocks, the thickness of the volcanic rocks, and also the relative thicknesses of the upper, middle, and lower divisions of volcanic rocks in different places.

Plates XII.-XIV.

MICRO-PHOTOGRAPHS.

All the micro-photographs are x 30, and in ordinary light except where otherwise indicated.

Plate XII.

Fig. 1.—Pitchstone from Mount Lindsay, showing fluxion structure around a phenocryst of felspar. The felspar shows corrosion and a partial replacement by the brown glassy matrix. *Sp.* 228.

Fig. 2.—Perlitic pitchstone, Glass Cutting, Springbrook Plateau. *Sp.* 135.

Fig. 3.—Pitchstone, Moogerah School, near Mount Alford. It shows spherulites, axiolites and a phenocryst of felspar. *Sp.* 20x.

Fig. 4.—Rhyolite, Mount Lindsay. X nicols. *Sp.* 223.

Fig. 5.—Rhyolite, Mount Barney, showing micrographic structure. X nicols. *Sp.* 220.

Fig. 6.—Rhyolite, S.E. of Tamborine Plateau, shows microspherulitic structure. X nicols. *Sp.* 54c.

Plate XIII.

Fig. 1.—Rhyolite, Glennie's Pulpit, Mount Alford, showing corroded phenocrysts of quartz and sanidine. X nicols. *Sp.* 101.

Fig. 2.—Rhyolite, Glen Rock, Esk. *Sp.* 234.

Fig. 3.—Volcanic Breccia, Lamington Glen, Christmas Creek. *Sp.* 99.

Fig. 4.—Augite-Andesite, portion 28v, parish of Biarra, near Ottaba Station, showing the resorption borders around the augite phenocrysts. *Sp.* 224.

Fig. 5.—Andesite, portion 18, parish of Witherin, Tamborine Plateau, showing the inclusions in the plagioclase phenocrysts, also the clear borders of the latter. *Sp.* 123.

Fig. 6.—Andesite, One Tree Hill, Coolangatta. Showing one phenocryst of plagioclase with a zonal arrangement of inclusions, and another thickly studded with inclusions. *Sp.* 9.

Plate XIV.

Fig. 1.—Andesitic-Basalt, upper flow, Point Danger, showing portion of a large plagioclase phenocryst. X nicols. *Sp.* 11.

Fig. 2.—Andesitic-Basalt, Lamington Plateau, showing phenocrysts of plagioclase and olivine, the latter mineral being much altered into iddingsite. X nicols. *Sp.* 85.

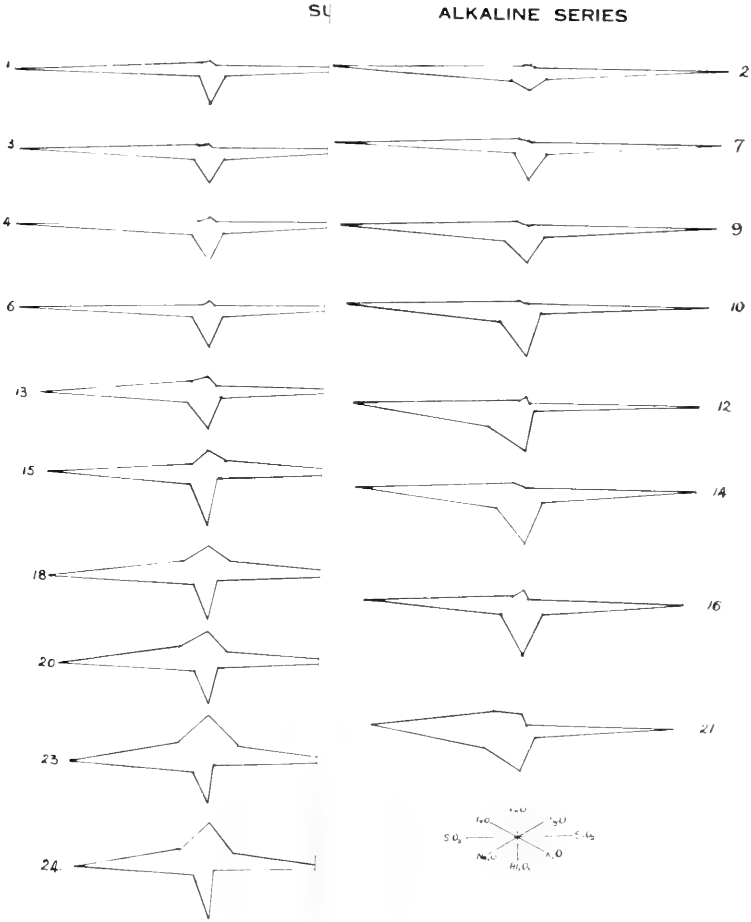
Fig. 3.—Lower Basalt, Chinghee Creek, portion 69, parish of Telemon. *Sp.* 94.

Fig. 4.—Basalt, Quarries, Bundamba, showing patches of glass thickly studded with rods of the iron-ores. *Sp.* 237.

Fig. 5.—Oligoclase Basalt, Spicer's Peak, showing a phenocryst of olivine altering into serpentine. The other dark patches are mainly chlorite. *Sp.* 116.

Fig. 6.—Basalt, 3,000-ft. level, south-east slope of Mount Lindsay, showing the very fine-grained nature, the fluxion structure and the somewhat banded appearance. *Sp.* 221.

Anthony James Cumming, Government Printer, Brisbane.


SU
ALKALINE SERIES
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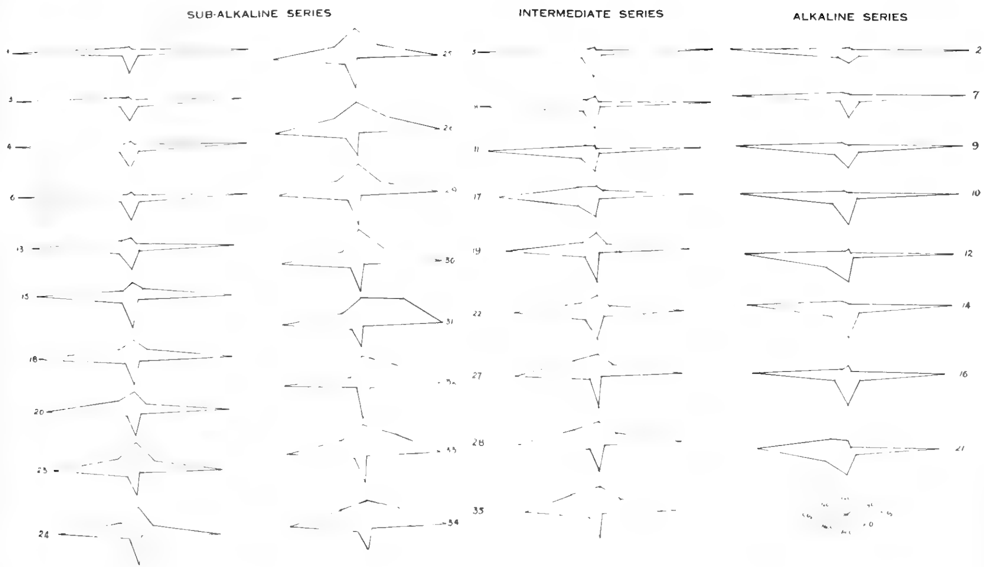
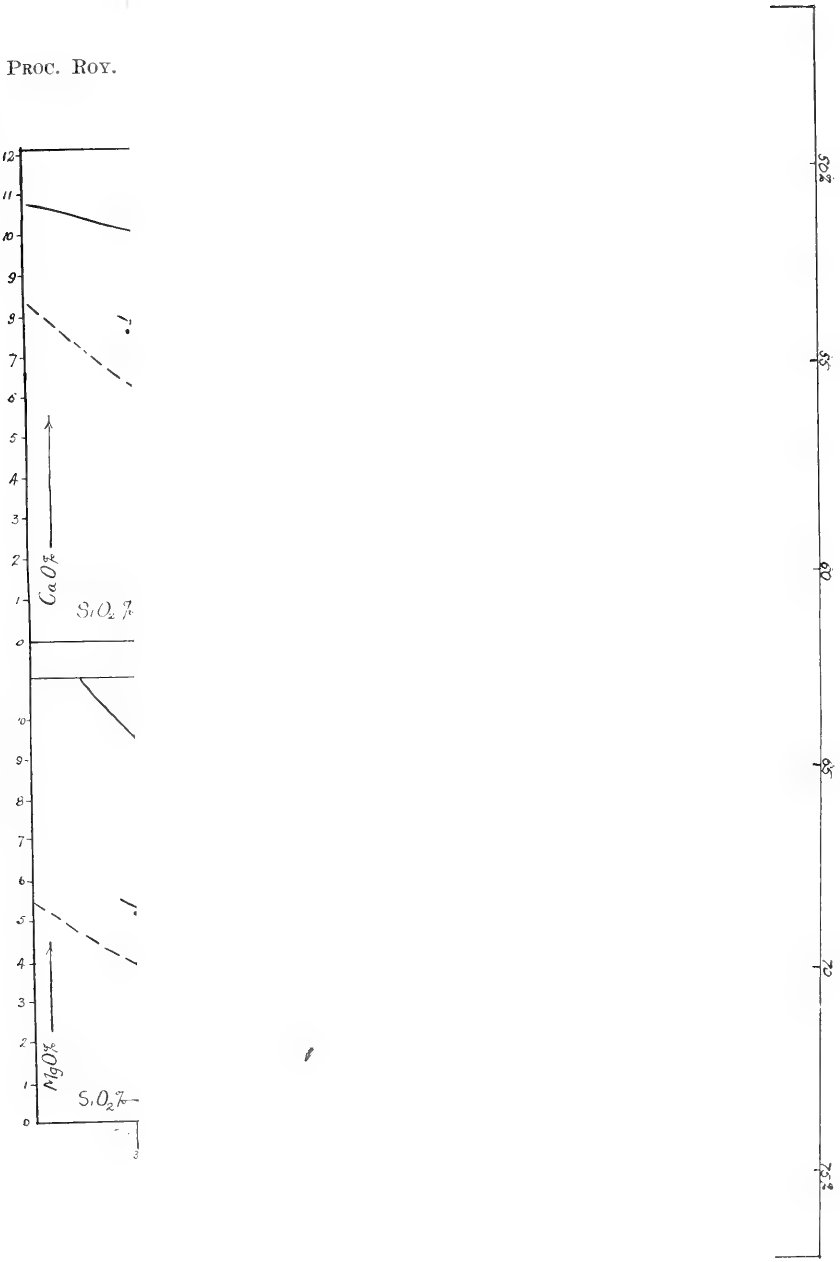

SUB-ALKALINE SERIES
INTERMEDIATE SERIES
ALKALINE SERIES



CaO %
SiO2 %
MgO %
SiO2 %
12
11
10
9
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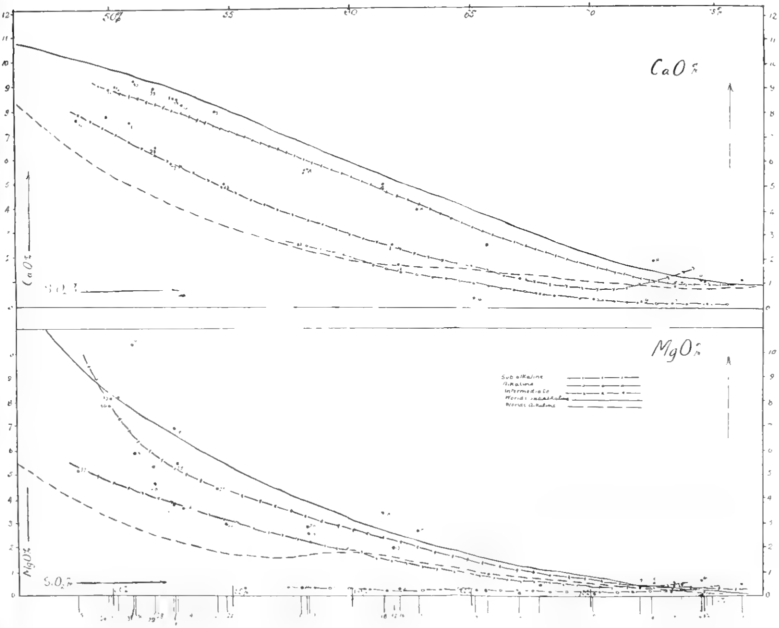
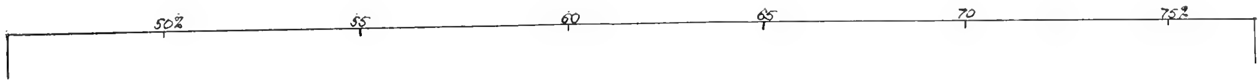
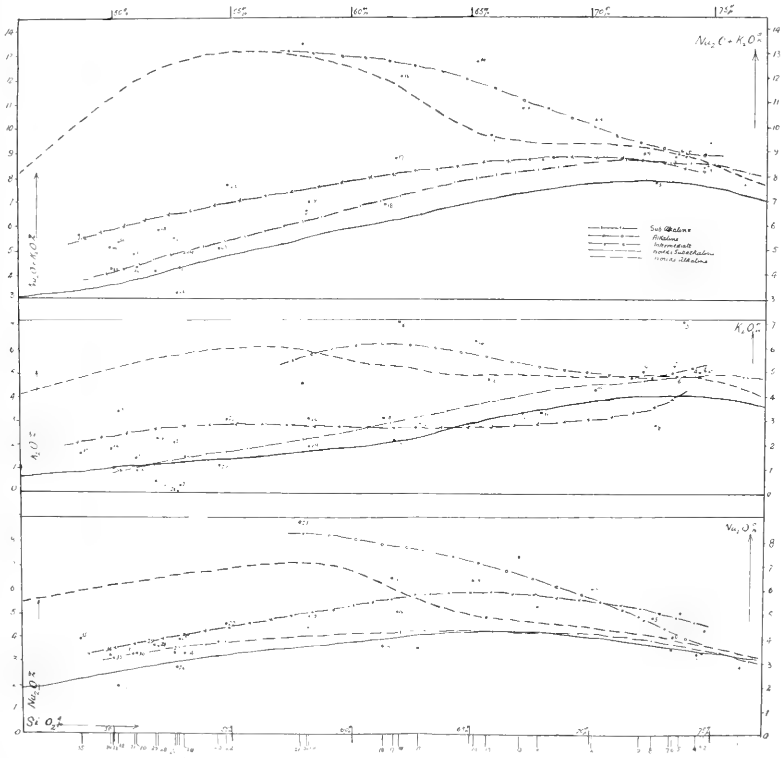
0
50 %
55
60
65
70
75 %

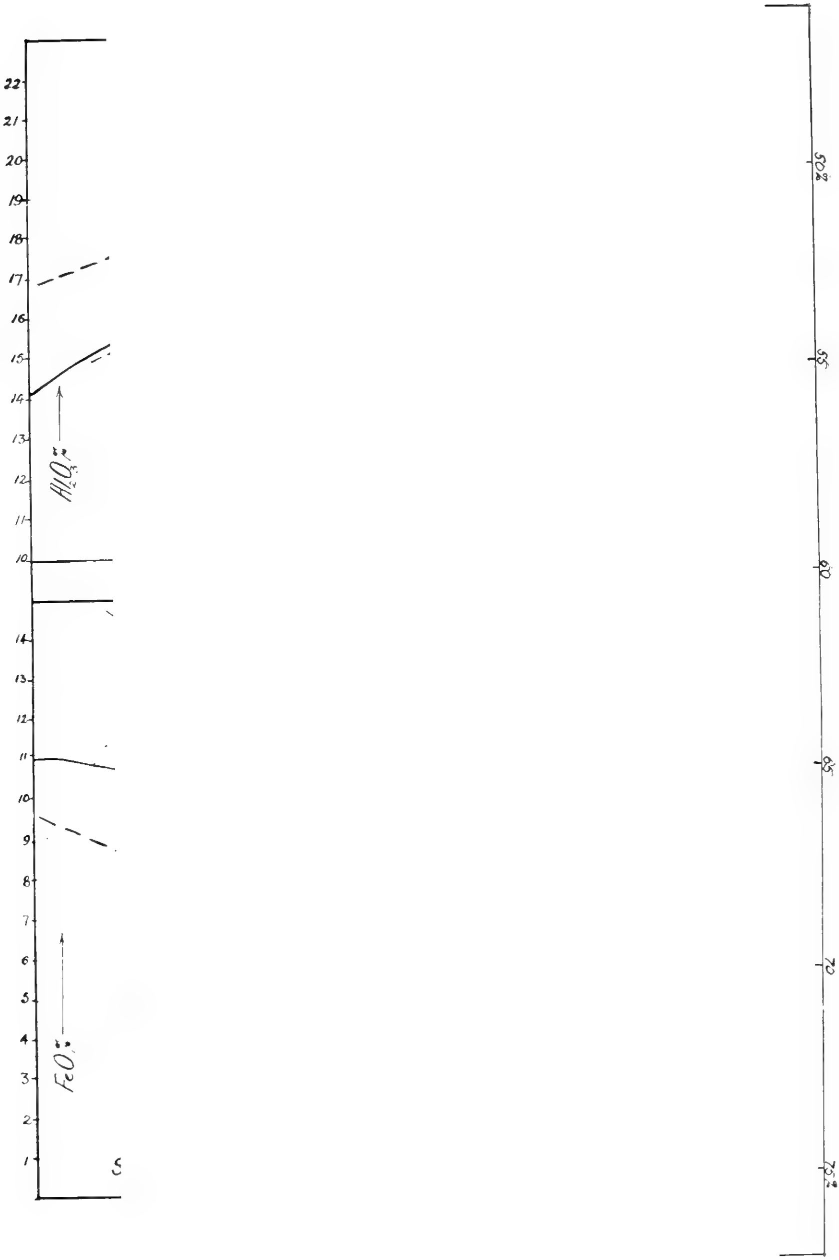

CaO %
MgO %
Sub alkaline
Alkaline
Intermediate
World's subalkaline
World's alkaline

C.





50%
55%
60%
65%
70%
75%
Na2O + K2O %
K2O %
Na2O %
SiO2 %
Sub Alkaline
Alkaline
Intermediate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12
11
10
Al_2O_3
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13
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9
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7
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5
4
3
2
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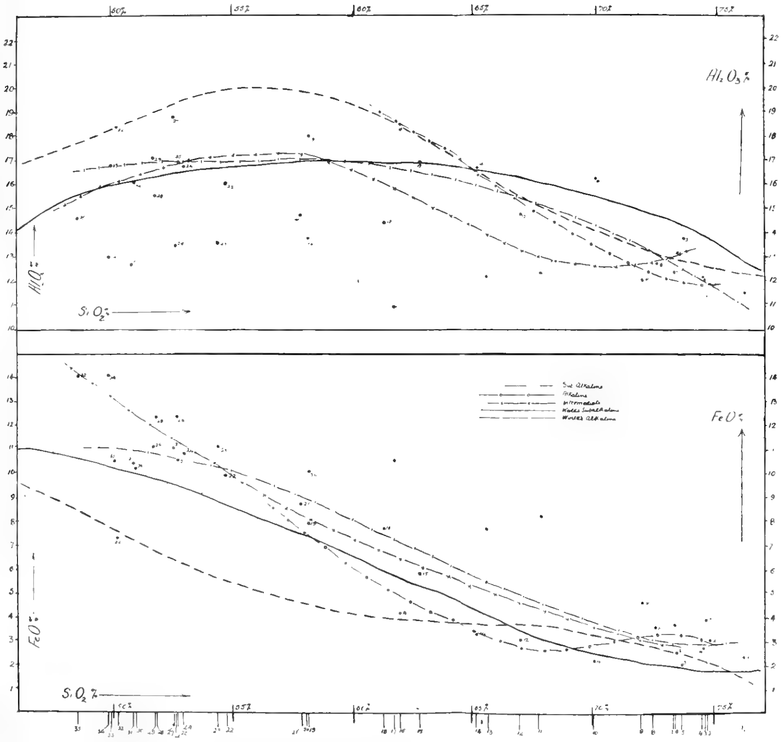
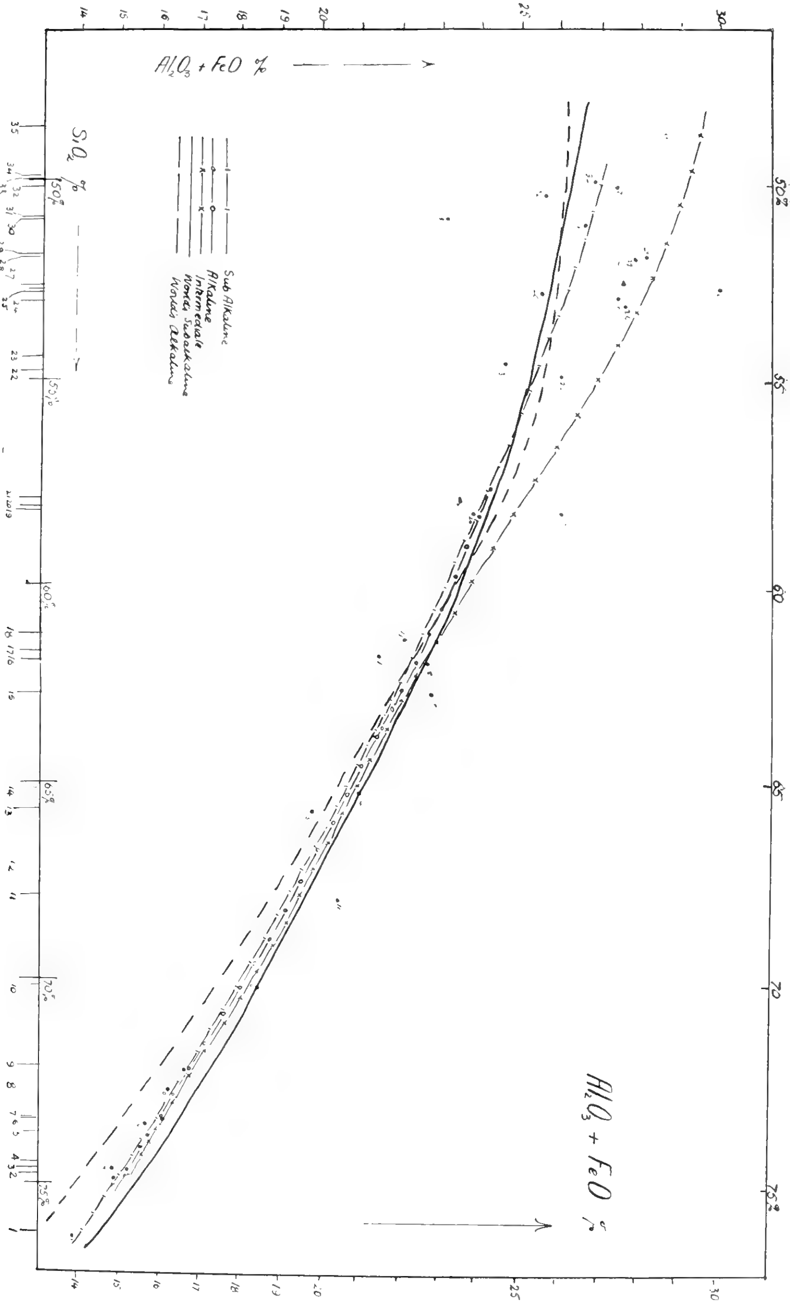
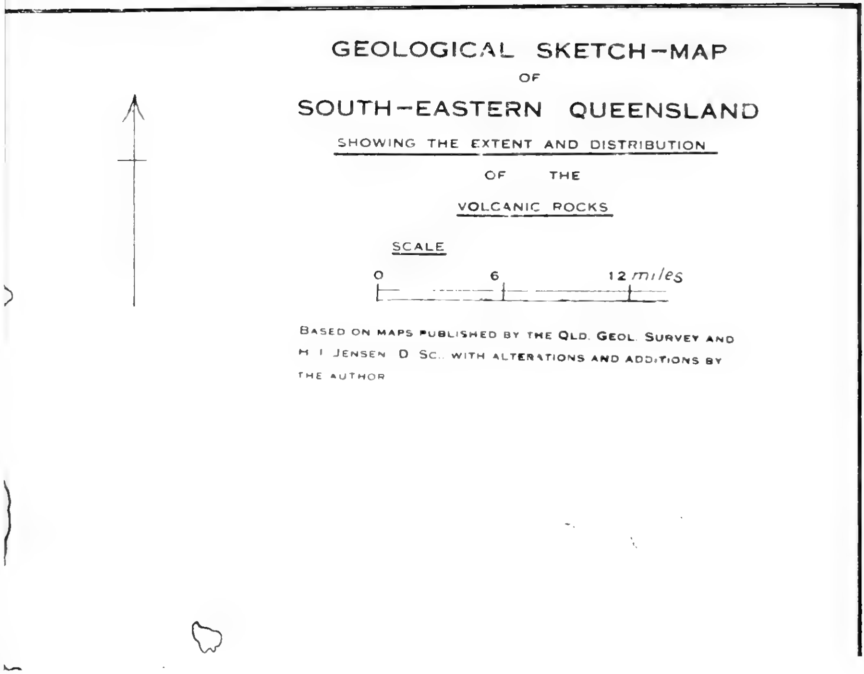
FeO
50%
55
60
65
70
75%



Al_2O_3 %
SiO_2 %
FeO %
SiO_2 %
50%
55%
60%
65%
70%
75%
Alkaline
Intermediate


Al2O3 + FeO %
SiO2 %
Sub Alkaline
Alkaline
Intermediate
World's Subalkaline
World's Alkaline
50%
55
60
65
70
75%
Al2O3 + FeO %


GEOLOGICAL SKETCH-MAP
OF
SOUTH-EASTERN QUEENSLAND
SHOWING THE EXTENT AND DISTRIBUTION
OF THE
VOLCANIC ROCKS
SCALE
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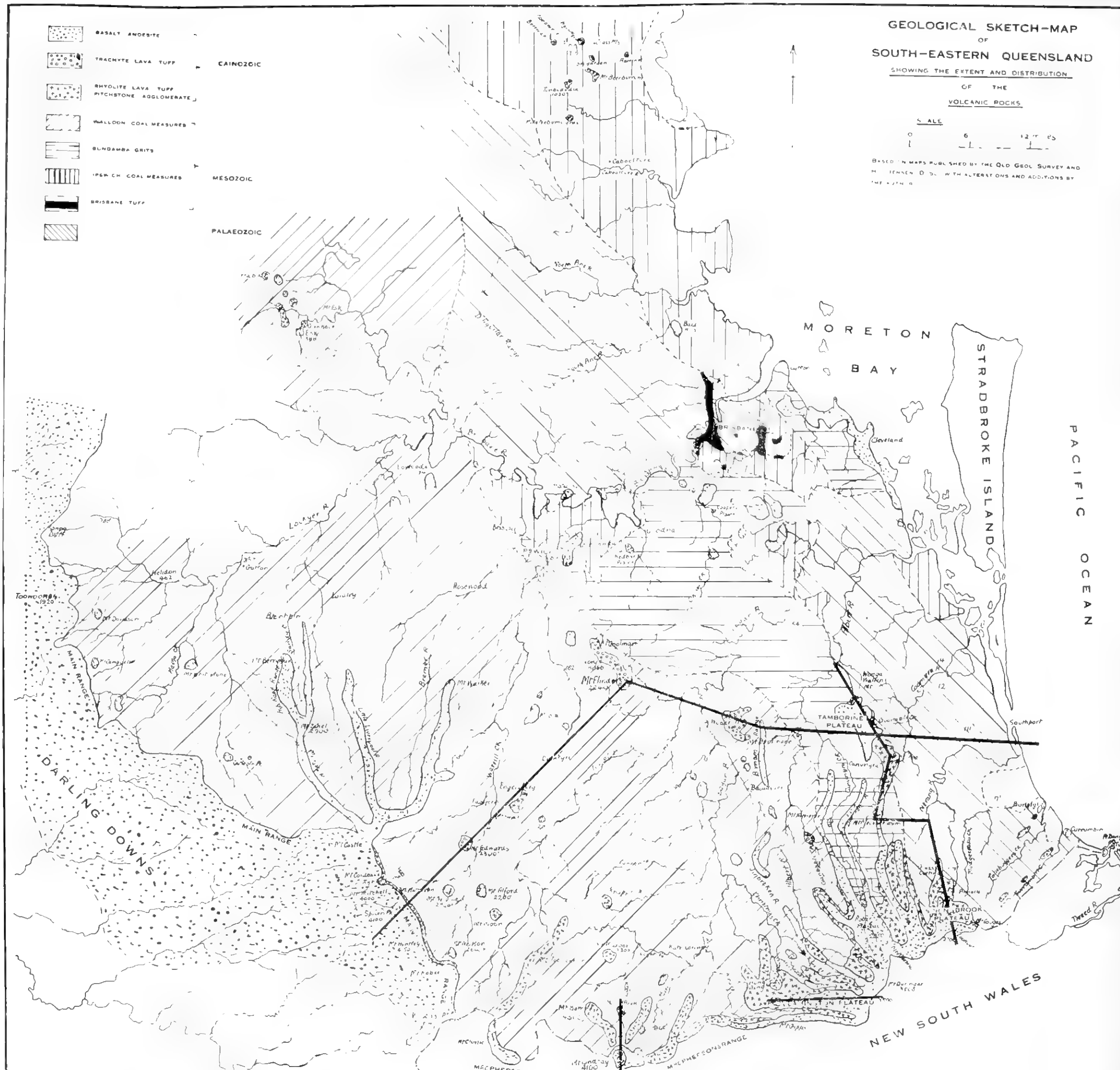
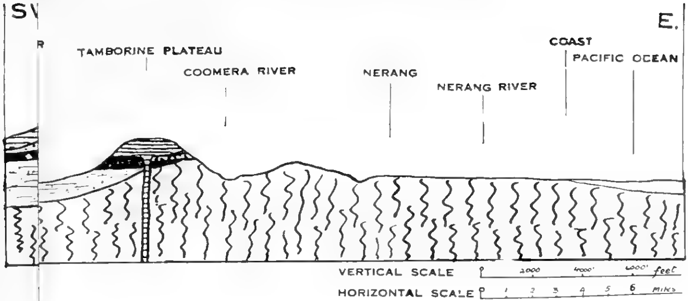
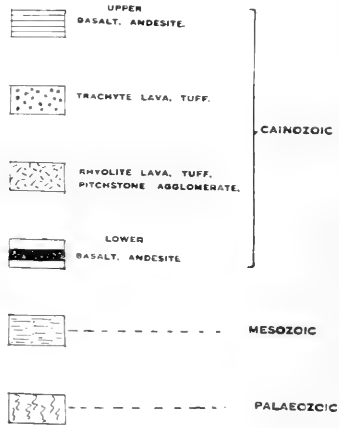
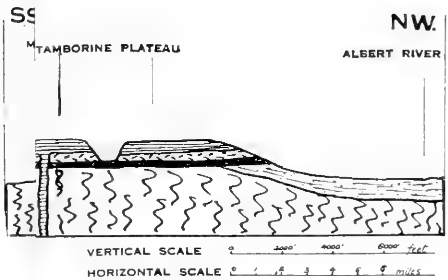
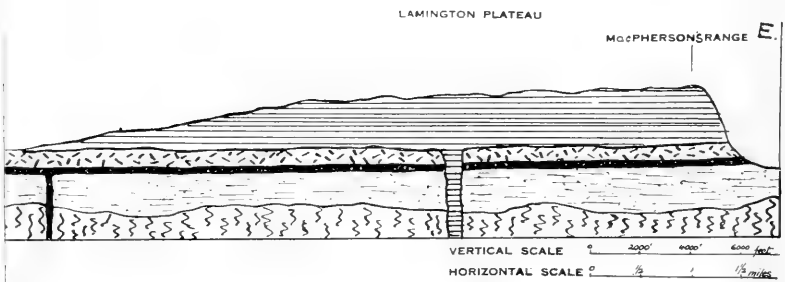
BASED ON MAPS PUBLISHED BY THE QLD. GEOL. SURVEY AND
H. I. JENSEN D. SC., WITH ALTERATIONS AND ADDITIONS BY
THE AUTHOR


GEOLOGICAL SKETCH-MAP OF SOUTH-EASTERN QUEENSLAND
SHOWING THE EXTENT AND DISTRIBUTION OF THE VOLCANIC ROCKS
BASALT ANDESITE
TRACHYTE LAVA TUFF
CAINOZOIC
RHYOLITE LAVA TUFF PITCHSTONE AGGLOMERATE
WALLOON COAL MEASURES
BUNDAMBA GRITS
IPSWICH COAL MEASURES
MESOZOIC
BRISBANE TUFF
PALAEOZOIC
MORETON BAY
STRADBROKE ISLAND
PACIFIC OCEAN
NEW SOUTH WALES
DARLING DOWNS
MAIN RANGE
TAMBORINE PLATEAU
MCPHERSONS RANGE
Cleveland
Southport
Rosewood
Helidon
Lockyer R.
Toowoomba 1920
Mt Flinders
Mt Alford 2200
Mt Edwards 2300
Currumbin
Tweed R.









AL SKETCH-SECTION E.&.W. THROUGH LAMINGTON PLATEAU.

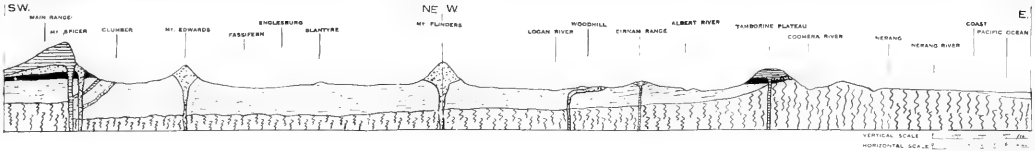
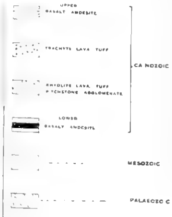


FIG. I. GEOLOGICAL SKETCH-SECTION N.E. FROM MAIN RANGE TO MT. FLINDERS AND EAST TO PACIFIC OCEAN.



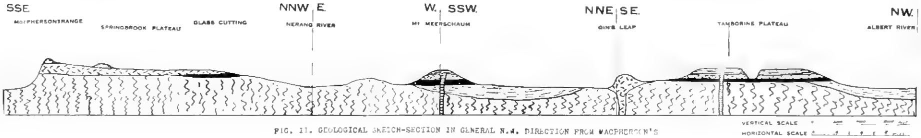
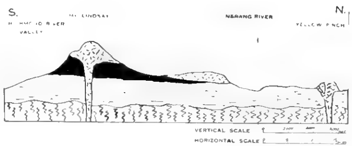


FIG. II. GEOLOGICAL SKETCH-SECTION IN GENERAL N.W. DIRECTION FROM MACPHERSON'S RANGE TO ALBERT RIVER.



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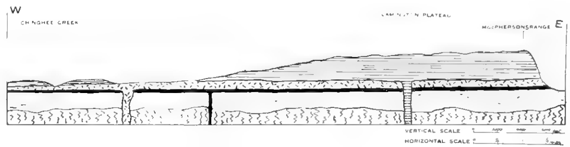

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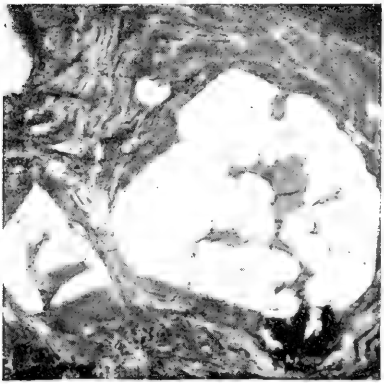

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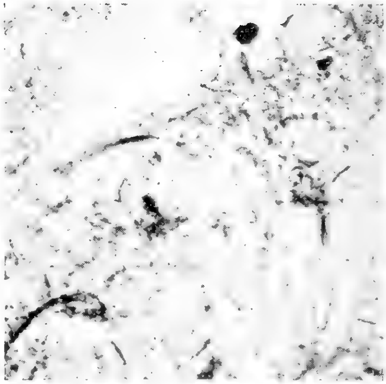

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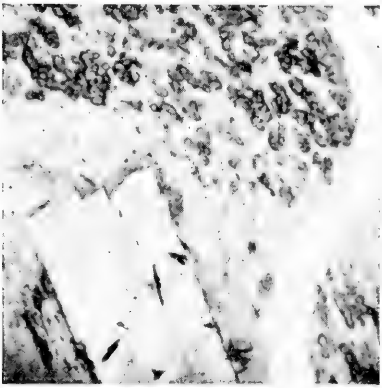

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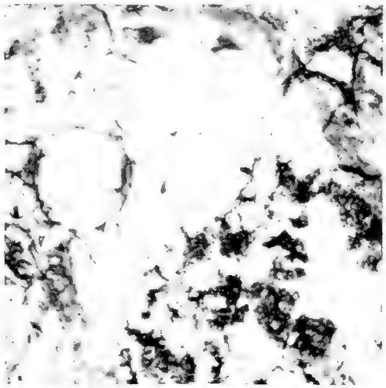

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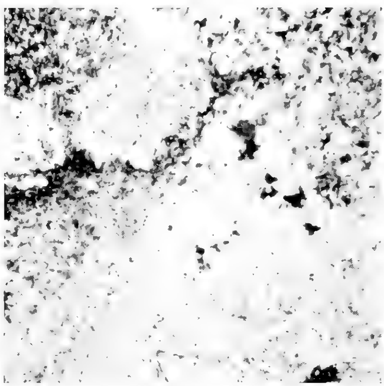

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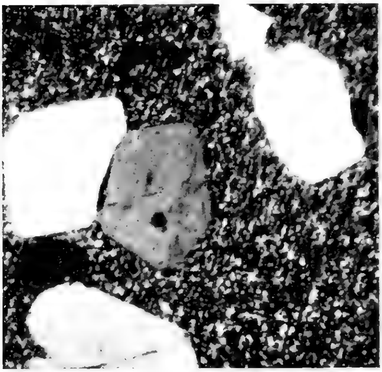

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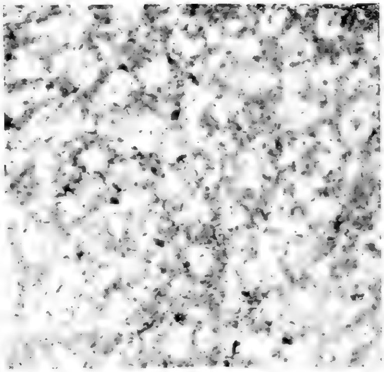

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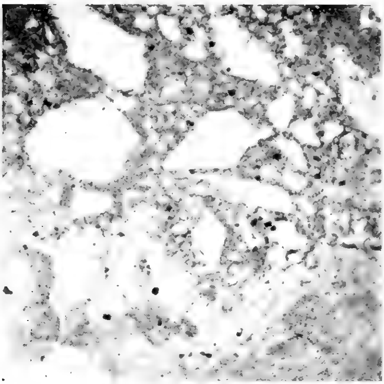

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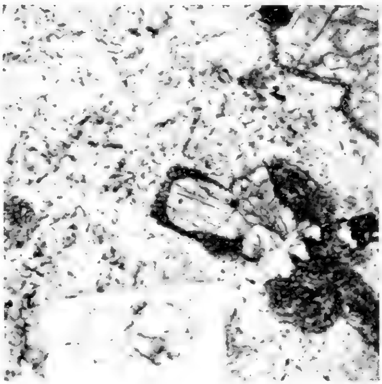

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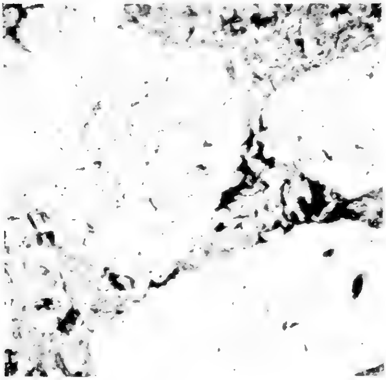

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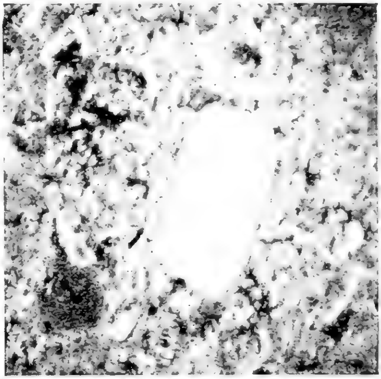

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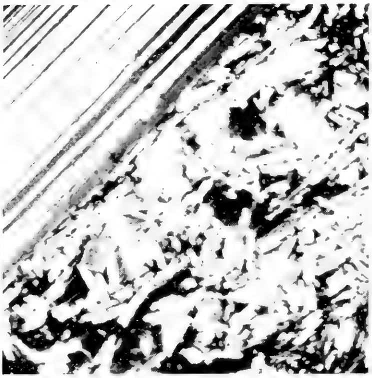

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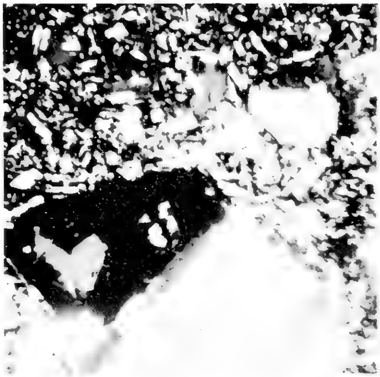

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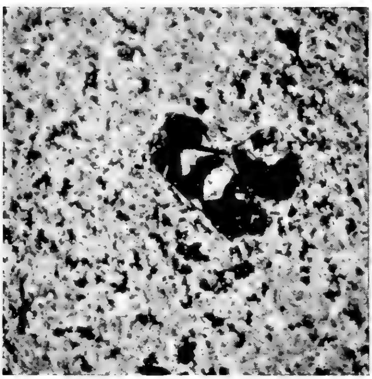

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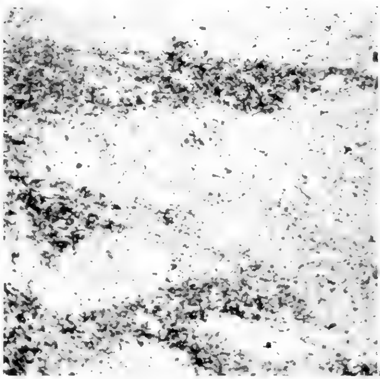

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PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND

FOR 1915.

VOL. XXVII.—PART II.

ISSUED 18TH MARCH, 1916.

PRINTED FOR THE SOCIETY
BY
ANTHONY JAMES CUMMING, GOVERNMENT PRINTER, BRISBANE,
AND
H. POLE & CO., PRINTERS, ELIZABETH STREET, BRISBANE.

1916.

Price: Five Shillings.