PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND

FOR 1914.

VOL. XXVI.

Edited by
A. B. WALKOM, B.Sc.

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

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1914

THE

Royal Society of Queensland

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HIS EXCELLENCY SIR WILLIAM MACGREGOR,
M.D., G.C.M.G., C.B., ETC.

OFFICERS, 1914.

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Vice-President :

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GEO. WATKINS.

CONTENTS.

VOLUME XXVI.

Abstract of Proceedings of the Royal Society of Queensland

Abstract of Proceedings, March 30th, 1914.

The Annual General Meeting of the Society was held at the University at 8 p.m

Mr. H. C. Richards, President, in the chair

Twenty-four members and a number of friends were present.

The minutes of the preceding Annual Meeting were read and confirmed.

The Secretary read the Report of the Council as follows :—

"Eight Ordinary Monthly Meetings and nine Council Meetings were held during the year.

"During the year six members were admitted, four died, and fourteen resigned ; of the latter some had left the State ; others were hampered by increasing age.

"It will thus be seen that we have had unusually heavy losses by death during the past year. Of these, the Hon. A. Norton, M.L.C., was a Trustee of the Society, and an indefatigable worker in its interests. He was the means of adding many new and valuable members to the Society, and his presence on deputations was invaluable. Mr. Jno. Sutton was President in 1899 and a prominent officer and worker in bygone years, till advancing age restricted his attendance. The Hon. R. M. Collins was one of our best pioneers, and took a general interest in every laudable object. The Hon. Alex Raff was, as a member of the Philosophical Society, a life member of our Society. A letter of condolence was sent to the relatives of the Hon. R. M. Collins, and the same course is to be pursued in regard to Mr. Sutton and the Hon. Albert Norton.

"We have now on our roll 14 honorary members and 100 ordinary members.

"Vol. XXIV of our Proceedings was issued during the year, and proved of great value. Dr. T. Harvey Johnston, D.Sc., our Honorary Librarian, was awarded the Syme Research prize during the year.

"The forthcoming volume will, on the whole, scarcely be equal to the average issue. Our more prominent members have been too busy with routine work and unavoidable official duties, and we have not been as fortunate as usual in chance contributions. The outlook for the present year is, however, promising, though the visit of the British Association for the Advancement of Science may absorb some of our members' time and energies.

"During the absence of Dr. Harvey Johnston, on the Prickly Pear Commission, the Library exchanges have been under the care of Mr. C. D. Gillies, and have been well looked after.

"In accordance with the wishes of the Honorary Auditor, the books were closed on December 31st instead of at a later date, as was usual of recent years. This reversion to the previous custom makes our credit balance seem lower, but the financial position of the Society is quite satisfactory. There are some outstanding subscriptions (about £34) to come in, and it would facilitate the work of the Council if these and the present year's subscriptions were forwarded early, as it is intended to issue the Proceedings at once, the President's Address and this Report appearing in the next volume according to resolution.

"During the year a Sub-section was formed to deal with the interests of Forestry."

This report was adopted on the motion of Dr. J. Shirley, seconded by Mr. C. W. Costin.

The following financial statement was presented by the Hon. Treasurer (Mr. J. C. Brünnich) and adopted.

RECEIPTS.

	£	s.	d.
To Balance from 1912	40	0	8
,, Admission Fees and Subscriptions	72	10	0
,, Sale of Proceedings	2	5	0
,, Sundry Small Receipts	0	1	10
,, By Secretary (Petty Cash)	0	2	9
	£115	0	3

EXPENDITURE.

	£	s.	d.
By Printing (Pole & Co.)	72	12	7
,, Postage of Monthly Notices	4	9	2
,, Postage of Proceedings and Librarian's Postage	5	10	0
,, Postage on Circulars	0	7	6
,, Insurance	1	2	6
,, General Postage and Petty Cash	5	17	11
,, Caretaker and Refreshments	3	11	0
,, Landing Charges	0	12	9
,, Refund to Hon. Secretary	0	12	0
,, Tea Urn, Cups, Saucers, Spoons, etc.	1	3	0
,, Bank Charges	0	10	0
,, Balance as per Bank Book	18	11	10
	£115	0	3

Examined and found correct.

GEO. WATKINS, Hon. Auditor.

BRISBANE, January 30th, 1914.

J. C. BRÜNNICH, Hon. Treasurer.

The President then delivered the Annual Address.

Dr. J. Shirley moved, and Mr. D. Eglinton seconded, a vote of thanks to the President.

There being no other nominations, the President declared the following gentlemen elected for the coming year :—

President, J. Shirley, D.Sc.

Hon. Treasurer—J. C. Brünnich, F.I.C.

Hon. Secretary—F. Bennett.

Hon. Librarian—T. Harvey Johnston, M.A., D.Sc.

Asst. Hon. Librarian—C. D. Gillies.

Members of Council—E. H. Gurney, H. C. Richards, M.Sc., A. B. Walkom, B.Sc., P. L. Weston, B.Sc., B.E.

Mr. G. Watkins was elected Auditor on the motion of Dr. J. Shirley, seconded by Mr. J. C. Brünnich.

Mr. R. H. Roe was elected a Trustee (in the place of the Hon. A. Norton, M.L.C., deceased) on the motion of Dr. J. Shirley, seconded by Mr. F. Bennett.

Mr. Richards, the outgoing President, then installed Dr. Shirley as President for the coming year, and the latter returned thanks to the members.

Abstract of Proceedings, April 27th, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Mr. H. C. Richards in the chair.

The minutes of the previous meeting were read and confirmed.

The following papers were read :

1. The Composition of the Oil of Prickly Pear Seed (*Opuntia* spp.), by Frank Smith, B.Sc., F.I.C., and L. A. Meston.
2. Some Oil-bearing Seeds Indigenous to Queensland. 1. The Seed of *Macadamia ternifolia* and its Oil, by Frank Smith, B.Sc., F.I.C., and L. A. Meston.

The discussion on these two papers was taken part in by Messrs Bennett, Gurney, and Longman, and the President.

3. Notes on a Plant-bearing Common Black Opal from Tweed Heads, N.S.W., by Ernest W. Skeats, D.Sc., A.R.C.S., F.G.S. (communicated by Mr. H. C. Richards.)

Abstract of Proceedings, May 25th, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

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

The minutes of the previous meeting were read and confirmed.

Messrs. E. C. Saint-Smith, A.S.T.C., and L. A. Meston were proposed as members.

The following paper was read :

Radiogenesis in Evolution, by H. A. Longman.

A discussion followed in which Dr. T. H. Johnston, Dr. Jefferis Turner, Dr. F. Hamilton-Kenny, Messrs. Brünnich, T. Parker and Bennett, and the President took part.

Dr. T. Harvey Johnston was welcomed back after his tour with the Prickly Pear Commission.

Abstract of Proceedings, June 29th, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the School of Arts, at 8 p.m.

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

The minutes were deferred to a future meeting.

Miss Alison J. Greene, and Messrs. E. C. Saint-Smith and L. A. Meston, were elected members.

The following papers were read :

1. Cactæ or Prickly Pears, by J. Shirley, D.Sc., and C. A. Lambert.

Professor Skertchly, Messrs. J. F. Bailey, Brünnich, and Tryon, and Dr. T. Harvey Johnston took part in the discussion.

2. Notes on the Marine Mollusca of Queensland. Part III. By J. Shirley, D.Sc.

Exhibits.

Mr. J. F. Bailey exhibited, on behalf of His Excellency Sir William MacGregor, botanical specimens obtained by the Peary Expedition of 1908.

Mr. Dunstan exhibited, also on behalf of His Excellency, geological specimens obtained by the same Expedition ; also gold specimens from Gympie.

Mr. Dunstan also exhibited specimens collected by Mr. Blake during the Australasian Antarctic Expedition ; and also specimens of the siliceous sponge, *Purisiphonia*, from the Rolling Downs Formation at Wallumbilla.

Abstract of Proceedings, August 14th, 1914.

The ordinary general meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

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

The minutes of the two previous meetings were read and confirmed.

The appointment, by the Council, of Mr. A. B. Walkom as Hon. Editor of the Proceedings was confirmed, on the motion of Dr. T. H. Johnston, and Mr. H. A. Longman.

Miss H. Cleminson, B.Sc., was proposed as an Associate member.

The President announced that a preliminary meeting had been held in connection with the formation of a Biology Section, and that details were to be laid before the Council of the Society at its next meeting.

The following papers were read :

1. Some Oil-bearing Seeds Indigenous to Queensland. II. The oil of *Callophyllum inophyllum* (Domba Nut). III. The oil of the seed of *Hernandia bivalvis* (Grease Nut). IV. Note on Queensland Candlenut Oil. by Frank Smith, B.Sc., F.I.C.

Remarks were made by Messrs. Bagster, Hargreaves and White.

2. A note on the Precaval System of *Hyla cærulea*, White. By C. D. Gillies, B.Sc.

Remarks were made by Dr. T. Harvey Johnston. Miss Bage and the President.

Exhibits :

Mr. Frank Smith exhibited a series of fruits and oils illustrating his paper.

The President exhibited specimens of *Callophyllum inophyllum* and *Hernandia bivalvis*.

Dr. T. Harvey Johnston exhibited specimens of Trematodes (see p. 69 of Proceedings).

Abstract of Proceedings, September 28th, 1914.

The ordinary monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

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

The minutes of the previous meeting were read and confirmed.

Miss H. Cleminson, B.Sc., was elected an Associate member.

Mr. A. P. Dodd was proposed as an ordinary member.

The following paper was read :

Additions to the Rotifera of Queensland, by W. R. Colledge.

The paper was illustrated by a series of lantern slides. Miss Bage, Mr. Longman, Dr. T. H. Johnston and the President took part in the discussion which followed.

Exhibits :

Dr. T. Harvey Johnston and Mr. C. D. Gillies exhibited under the microscope a number of living "vinegar eels," *Anguillula aceti*, from vinegar. The exhibit was obtained in Brisbane.

Mr. W. R. Colledge exhibited a number of Rotifers under the microscope.

ABSTRACT OF PROCEEDINGS, NOVEMBER 9th, 1914.

The monthly meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

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

The minutes of the previous meeting were read and confirmed.

Mr. Alan P. Dodd was elected a member.

The President announced the action taken by the Forestry Section (see proceedings of Forestry Section).

He also announced that the Council had selected Dr. W. F. Taylor as Trustee in the place of Mr. John Cameron, deceased. Dr. Taylor had signified his willingness to act, and his appointment was confirmed by the meeting.

The following papers were read :—

1. Further new genera and species of Australian Proctotrypoidea, by Alan P. Dodd.

The paper was communicated by the President. Remarks were made by Mr. Colledge, and Dr. T. Harvey Johnston.

2. The freezing point of some Abnormal Milks, by J. B. Henderson, F.I.C., and L. A. Meston.

Messrs. L. A. Meston, and F. Smith offered remarks.

3. Some new Queensland Endoparasites, by T. Harvey Johnston, M.A., D.Sc.

Remarks were made by Mr. H. A. Longman.

Abstract of Proceedings, November 30th, 1914.

A special general meeting of the Royal Society of Queensland was held in the University, at 8 p.m.

Mr. T. R. Pearce was proposed as a member.

The rules as revised by a sub-committee of the Council were submitted to the meeting for approval, and were adopted without further alteration.

The following paper was read:

The Geology and Petrology of the Enoggera Granite and the Allied Intrusives, by W. H. Bryan, B.Sc.

Remarks were made by Messrs. Richards and Walkom, and Dr. Shirley.

The President announced that the proceedings for the present year would be ready in December.

Exhibits:

Dr. T. Harvey Johnston exhibited under the microscope some interesting fresh water Protozoa, including *Peridinium sp.* and *Ceratium sp.* from the Enoggera Reservoir, and an *Actinosphærium* found in abundance amongst wet moss on the cliffs near the sea-shore at Caloundra.

Mr. H. A. Longman exhibited a live specimen of *Dipsadomorphus fuscus*, Gray, the brown tree snake, captured at Toowong.

Proceedings of Forestry Section.

Australian Forest League.

A conference of representatives of the various branches of the League was held in the Town Hall, Melbourne, on October 29th last, His Excellency Sir Ronald Munro-Ferguson presiding.

The Queensland Section was represented by Hon. L. E. Groom and Mr. Stumm, Federal members for the Darling Downs and Lilley electorates. Messrs. Maughan and Turley were also asked to act as representatives, but they were unable to be present.

It was moved by Professor Watt (Sydney), "that this meeting approves of the formation of a national organization to be called The Australian Forest League."

Mr. Groom in seconding referred to the rapid disappearance of our soft timbers, and to the greatly increased import of pine, when with conservation we might have supplied all our wants for years to come.

The following officers were elected :—Patron, Sir Ronald Munro-Ferguson ; Federal President, Sir Frank Madden ; Secretary, Dr. Harvey Sutton.

Abstract of Proceedings of Geology Section.

MEETING, JUNE 4th, 1914.

A meeting was held on Thursday, June 4th, with the object of forming a Geology Section of the Royal Society of Queensland. The following were present: Messrs. L. C. Ball, W. H. Bryan, B. Dunstan, H. C. Richards, E. C. Saint-Smith and A. B. Walkom.

Office bearers were elected as follows:—President B. Dunstan, F.G.S.; Vice-President, H. C. Richards, M.Sc., Hon. Secretary, A. B. Walkom, B.Sc.

It was carried, "that the aim of the Section be primarily for the general discussion of geological matters, both academic and economic, pertaining particularly to Australia; the discussion of current literature in Geology, and the exhibition of specimens of particular interest to members of the Section."

The order of business at meetings was decided on as follows:—

1. Minutes.
2. Correspondence.
3. Current literature.
4. Exhibits.
5. Discussion.
6. General.

MEETING, JUNE 30th, 1914.

Mr. Dunstan in the chair.

Eight members and one visitor present.

Mr. Dunstan exhibited specimens of a siliceous sponge (*Purisiphonia clarkei*) from the Rolling Downs Formation, near Roma.

A discussion followed, the subject being the intake beds of the Australian Artesian Water Basin. Messrs. Saint-Smith, Dunstan, Richards, Thom, and Walkom, and Dr. Shirley, took part in the discussion.

The discussion tended to show that the main intake beds are freshwater sandstones containing fossil plant remains indicating a Trias-Jura age. These beds lie conformably below the Rolling Downs Formation, which contain plentiful remains of marine shells.

It was pointed out by Mr. Saint-Smith that in the country to the N.E. and E. of Roma, the desert sandstone formation is non-existent, and that areas previously mapped as Desert Sandstone are occupied by beds of either the Trias-Jura System or Rolling Downs Formation. It was also pointed out that the so-called Blythesdale Braystone as mapped is made up partly of porous sandstone of Trias-Jura age, and partly of impervious calcareous beds of the Rolling Downs Formation.

The most important point brought out by the discussion was the fact that the intake beds occupy a much greater area than was formerly supposed, including, as they now do, a large area of rocks of Trias-Jura age.

Meeting, July 30th, 1914.

Mr. Dunstan in the chair.

Ten members were present.

Mr. Dunstan exhibited specimens of fossil cephalopods from Western Queensland, including *Nautilus*, *Ammonites*, *Crioceras* and *Belemnites*.

Mr. Richards exhibited a specimen of galena showing twinning.

A discussion took place on the possibility of obtaining oil at Roma. Mr. Cameron opened the discussion, outlining the history of the boring operations at Roma. Messrs. Connah, Dunstan, Richards, Saint-Smith, and Walkom took part in the discussion.

Meeting, October 1st, 1914.

Mr. Dunstan in the chair.

Seven members and one visitor were present.

Mr. Blake exhibited a specimen of Emperor Penguin.

A discussion took place on "Recent developments in the Burrum Coalfield." Mr. Dunstan outlined the work done on the Burrum field, showing the relations existing between the coal measures and marine beds. Messrs. Richards, Cameron, Ball, and Walkom, and Dr. Shirley contributed to the discussion.

Meeting, November 12th, 1914.

Mr. Dunstan in the chair.

Seven members were present.

After some discussion it was decided that the subject for the next meeting, to be held about the end of March, 1915, should be "The Oxley Beds."

A discussion took place on "Rock Classification." Mr. Richards introduced the subject, and gave a summary of the various systems of rock classification.

Messrs. Ball and Dunstan, and Dr. Shirley took part in the discussion.

Proceedings of Biology Section.

MEETING, SEPTEMBER 8TH, 1914.

Dr. J. Shirley in the chair.

Six members present.

Dr. Shirley exhibited specimens of the "Grey Gum" of Queensland, and pointed out that the Queensland Grey Gum, though usually set down as *E. saligna* does not agree with the description of the species given in Müller's Eucalypts of Australia. It is probable that the tree referred to by Queensland botanists as *E. botryoides*. Smith, is the true *E. saligna*. Among the specimens supplied to Dr. Shirley as examples of Grey Gum, from various parts of Queensland were :—*E. melliodora*. *E. baueriana*. and *E. propinqua*.

Most of those present took part in a discussion of the fruits, leaves, etc., Mr. Smith pointing out the relation existing between the type of venation and the kind of products obtained from Eucalyptus leaves.

MEETING, OCTOBER 13TH, 1914.

Dr. J. Shirley in the chair.

Three members and one visitor present.

Dr. Shirley exhibited specimens of several different species of Chitons, a group belonging to the class Amphineura of the Mollusca. He then gave a short description of their distribution and general anatomy, illustrated by reference to the specimens.

The chairman pointed out that the group is not a typical Molluscan one, especially in regard to its nervous system, which is simple. Some discussion ensued as to whether this signified a primitive or a degenerate form, Dr. Shirley inclining to the former view.

Meeting, November 10th, 1914.

Dr. J. Shirley in the chair.

Five members present.

Mr. W. R. Colledge exhibited some slides and micro-photographs of a family of flies, Simulidæ. He pointed out that this family is distributed all over the world, but its representatives are not very numerous in Australia. In Europe and America they are injurious to stock. A short description of their life-history and general appearance was given by Mr. Colledge, with reference to the photos and slides.

Dr. Shirley referred to the investigations lately being made in regard to one of the species of *Simulium* as a carrier of a disease of the scalp, prevalent in Italy and Roumania.

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.

AMERICA.

CANADA.

- Canadian Institute.
- 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.
- Societa Cientifica, Mexico.

UNITED STATES.

- Academy of Natural Sciences, Philadelphia.
- Academy of Science, Rochester, N.Y.
- Academy of Science, Wisconsin.
- 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.

UNITED STATES—*Continued.*

- Boston 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.
- 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.
- Minnesota Academy of Natural Science.
- Missouri Botanic Gardens, St. Louis.
- New York Academy of Sciences.
- 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.

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.
Department of Mines.
Field Naturalists' Club.
Linnean Society of N.S.W.
Public Library, Sydney.
Royal Anthropological Society.
Royal Society of N.S.W.
Technological Museum, Sydney.
The University of Sydney.

New Zealand.

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

Queensland.

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

South Australia.

Department of Mines.
National Museum, Adelaide.
Royal Geographical Society.
Royal Society of S.A.
The University of Adelaide.

Tasmania.

Field Naturalists' Club.
Royal Society of Tasmania.
The University of Tasmania.

Victoria.

Australian Institute of Mining Engineers.
Australian Ornithologists' Union.
Department of Agriculture.
Dept. of Fisheries (Commonwealth).
Department of Mines.
Field Naturalists' Society of Victoria.
Government Botanist, Melbourne.
National Museum, Melbourne.
Public Library, Melbourne.
Royal Geographical Society.
Royal Society of Victoria.
The University of Melbourne.

Western Australia.

Department of Mines.
Museum, Perth.
Royal Society of W.A. (late Natural History Society).
The University of W.A.
W.A. Astronomical Society.

EUROPE.

Austria.

Astronomische Arbeiten, Vienna.
K.K. Geographische Gesellschaft.
K.K. Gradmessige Bureau.

Belgium.

Academie Royale de Belgique.
Jardin Botanique de l'Etat, Brussels.
Société Royale de Botanique de Belgique.
Solvay Institute of Sociology, Brussels.

ENGLAND.

British Museum.

Cambridge Philosophical Society.

Conchological Society.

Imperial Institute.

Linnean Society of London.

Philosophical and Literary Society, Leeds.

Philosophical and Literary Society, Manchester.

Royal Botanic Gardens, Kew.

Royal Colonial Institute.

Royal Society of London.

FRANCE.

Faculté des jeunes Naturalistes, Paris.

Faculté des Sciences, Marseilles.

Instituto de Zoologie de l'Université de Montpellier.

Museum de Histoire naturelle, Paris.

Société des Sciences naturelles, Nantes.

GERMANY.

Naturforschende Gesellschaft, Frankfurt-am-Main.

Naturhistorischer Verein der Preussischen Rheinland and Westfalens, Bonn.

Verein für Naturkunde zu Cassel.

HOLLAND.

Koninklyke Naturkundige Vereenigingin Nederlandsch.

(See also under Java).

HUNGARY.

Naturwissenschaftliche Verein de Kormitates, Trencsin.

IRELAND.

Royal Irish Academy.

ITALY.

Academia Real della Scienza della Instituto Bologna.

ITALY—*Continued.*

Laboratorio di Zoologia Generale di Agraria.

Museo Civico di Storia Naturale, Genoa.

Rassegna Mensile di Botanica ("Malpighia"), Catania.

Societa Africana d'Italiana, Naples.

Societa Toscana di Scienze Naturale, Pisa.

PORTUGAL.

Academia Polytechnica Porto (Oporto).

RUSSIA.

Impèriale Academie des Sciences, Petrograd.

Société des Naturalistes, Kazan.

Société Impèriale Russe de Geographie, Petrograd.

SCOTLAND.

Botanical Society of Edinburgh.

Royal Botanic Gardens.

Royal Observatory.

Royal Society of Edinburgh.

SPAIN.

Academia Real de Ciencias, Madrid.

Academia Real dell Ciencias y Artes, Barcelona.

SWEDEN.

Geological Institute, Upsala.

SWITZERLAND.

Naturforschende Gesellschaft, Basel.

Naturforschende Gesellschaft, Zurich.

Société de Physique et d'Histoire Naturelle, Geneva.

OCEANIA.

SANDWICH ISLANDS.

Bernice Pauahi Bishop Museum, Honolulu.

List of Members.

Corresponding Members.

Brown, Rev. G., D.D.	Methodist Mission Office, Castlereagh St., Sydney, N.S.W.
Cockle, Dr.	
‡ Danes, Dr. J. V. ..	Czech University, Prague, Bohemia.
David, Professor T.W.E.	The University, Sydney, N.S.W.
‡ Domin, Dr. K. ..	Czech University, Prague, Bohemia.
‡ Hedley, C., F.L.S. ..	Australian Museum, Sydney, N.S.W.
‡ Jensen, H. I., D.Sc. ..	Darwin, Northern Territory.
Liversidge, Prof. A., F.R.S.	Fieldhead, Coombe Warren, Kingston Hill, Surrey, England.
‡ Maiden, J. H., F.L.S.	Botanic Gardens, Sydney, N.S.W.
‡ Maitland, A. Gibb, F.G.S.	Geological Survey Office, Perth, W.A.
Pollock, Prof. J.A. ..	The University, Sydney, N.S.W.
Rennie, Professor E. H.	The University, Adelaide, S.A.
‡ Skeats, Professor E. W.	The University, Melbourne, Vic.

Ordinary Members, Etc.

Archer, R. S.	Gracemere, Rockhampton
Badger, J. S.	C/o Brisbane Tramways Co., Ltd., Brisbane.
Bage, Miss F., M.Sc.	The Women's College, Kangaroo Pt., Brisbane.
Bagster, L. S., B.Sc. ..	The University, Brisbane.
‡ Ball, L. C., B.E. ..	Geological Survey Office, George St., Brisbane.
‡†Bailey, F.M., C.M.G., F.L.S.	Dept. of Agriculture, Brisbane.
‡†Bailey, J. F.	Botanic Gardens, Brisbane.
Barton, E. C., A.M.I.C.E.	Service Institute, Valley, Brisbane.
Bell, D. J.	State School, Eagle Junction, Brisbane.
‡ Bennett, F.	State School, Toowong, Brisbane.
‡ Brünnich, J. C., F.I.C. ..	Agricultural Chemist's Lab., William St., Brisbane.
Brydon, Mrs.	Technical College, Ann Street, Brisbane.
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DEVELOPMENT OF PETROLOGY DURING THE PRESENT CENTURY.

(Presidential Address).

By HENRY C. RICHARDS, M.Sc.,
Lecturer in Geology, University of Queensland.

Read at the Annual Meeting of the Royal Society of Queensland, 30th March, 1914.

In 1857 the late Dr. H. C. Sorby communicated to the *Quart. Journ. Geol. Soc.* two very important papers embodying the results of his investigations on the microscopical structure of crystals, with particular reference to the origin of minerals and rocks. Previous to this several other investigators—Cordier, Bunsen, Durocher, Scrope, etc., had been investigating the origin of rocks, but the impetus of Sorby's work was particularly pronounced and has had a very great influence.

Many factors have played a prominent part in the recent advances in Petrology, but the development in physical-chemistry, the more intimate knowledge of the structure of the earth's crust, the accumulated knowledge of the distribution of rocks both in space and time, the perfection of optical determinations, and a more intimate knowledge of the specific properties of minerals, have very considerably furthered our knowledge of the origin of rocks, their diversity and genetic relationships.

In petrogenesis the dominating factor at the close of the last century was, perhaps, differentiation, but the application of the principles of solution to the crystallization of igneous rock-magmas by Vogt and his determination of the approximate "eutectic ratios" for a number of pairs of minerals accounted for the theory of eutectics playing the chief role for a few years.

The principles of differentiation, eutectics and the absorption and assimilation of rock-matter by molten rock-magmas now form the bases of the various hypotheses put forward to account for the genesis and diversity of igneous rocks.

During the present century there have been published several works of an epoch making nature.

Amongst the many important publications we find notably: "The Quantitative Classification of the Igneous Rock," by the four eminent American petrologists, Cross, Iddings, Pirsson, and Washington; "Die Silikatschmelzlösungen," by Vogt; a "Treatise on Metamorphism," by Van Hise; "Die Krystallinen Schiefer," by Grubenmann; "Natural History of Igneous Rocks," by A. Harker; and the various publications by R. A. Daly dealing with his "Overhead Stoping Theory" and "Alkaline Rocks"; by F. E. Wright on "Microscopic Petrography"; and by Day and others of the Carnegie Institute, Washington, on the physical properties of minerals.

For many years after the application of microscopic methods to the study of rocks, a tremendous amount of descriptive work was carried out and was ready for use in the formation of the generalisations which have been formulated during the present century.

Such has been the influence of the developments of physical chemistry and the various factors enumerated above, that petrology is now rapidly passing from a purely descriptive into an inductive science.

Whitman Cross in his "Review of the Development of Systematic Petrography in the Nineteenth Century," summarises the position at the close of that century as follows:

1. There is as yet no comprehensive and properly systematic classification of all rocks. . . . . .

2. Rocks of igneous origin have been much more thoroughly investigated than others and they have received correspondingly more definite and systematic classification. . . . . .

3. The rocks which have been formed on the surface of the earth by the destruction of older rocks may be viewed from so many standpoints. . . . . . that no consistent arrangement of these objects, deserving the name of a petrographic system, has been proposed.

4. Metamorphic Rocks. . . . . . . defy systematic treatment at the present time.

The above may be taken to fairly represent the position at that period.

On all four points very great advances have been made since that time; the systematic classification of rocks is on a much sounder basis and the sedimentary and metamorphic rocks have been more closely studied, also we find that as the result of the labours of many, but particularly Van Hise and Grubenmann, metamorphic rocks are now capable of fairly systematic treatment.

The year 1901 was not marked by any great development. Dr. Teall in his Presidential Address to the Geological Society of London, dealt with the consolidation of rocks from molten-magmas and their differentiation into species. After discussing these matters thoroughly in the light of the most recent investigations, he concludes thus: "The origin of petrographical species, so far as the igneous rocks are concerned, is a problem the final solution of which has been handed on by the nineteenth century to its successor."

The year 1902, however, saw the launching of the "Quantitative Classification of Igneous Rocks," by Cross, Iddings, Pirsson, and Washington.

This classification was an entirely new system for the classification and nomenclature of igneous rocks. "It is a chemico-mineralogical system based on its own principles and is in nowise an attempt to reduce any one of the existing systems to a chemical basis, or to formulate any of them in a chemical way." A new nomenclature was demanded in this classification and all igneous rocks are classified on a basis of their chemical composition.

It is essential for the use of this system of classification to know the chemical composition of the rock, either actually by chemical analysis, approximately so by physical means, or by microscopic optical methods indicated by the authors. . . .

This scheme of classification has been most ingeniously worked out, and no doubt was the result of very great labour on the part of the authors. While its adoption has not, however, been universal, it is used to some extent by almost all petrologists, and in many respects supplied a long felt want.

The amount of criticism levelled at this scheme since its inception has been considerable, and its adoption by the Americans has been more pronounced than by others. Petrologists have been seeking for a truly natural classification of igneous rocks, and perhaps the main objection to the American classification is that it is not a natural one.

The year 1903 was an important one, as several works of great value were issued. Two important memoirs were published by Vogt, of Christiania, "Die Silikatschmelzlösungen," I. and II., and therein he gave his results of certain experiments upon slags, and fused silicates, and showed how the laws of solution may be applied to the cyrstallization of igneous rock-magmas. The results of researches by Doelter and Ebelmen were also availed of by Vogt in his deductions. Vogt applied the principles of physical chemistry with great success and acted in this way:—Slags of rock-magmas are believed to be solutions; their constituents are known; one can therefore proceed to experiment with their constituents and to predict the behaviour of their mixture according to the principles of physical chemistry.

Vogt made the first comprehensive attempt to apply the principles of solutions to the crystallization of the igneous rock-magmas and even for that alone Petrology owes him a great deal.

In this year "A Treatise on Metamorphism," by C. R. Van Hise, was published as Monograph XLVII, U.S. Geol. Survey. This is a treatise of monumental proportions and is really an attempt to reduce the phenomena of metamorphism to order under the principles of physics and chemistry. Van Hise took seven years in actually preparing this work and he advanced the knowledge of metamorphic rocks and the conditions of their formation very extensively indeed.

The first of a series of papers by R. A. Daly on the "Mechanics of Igneous Intrusion," was published in this year. In this first paper Daly concluded that dykes, sheets, laccolites, bysmaliths, and perhaps a few of the smaller stock-like plutonic bodies are conceived to be due to crustal displacement permitting intrusion; that marginal assimilation in the preparation of subterranean magma chambers is quite subordinate to magmatic overhead stoping, and that abyssal assimilation, in contrast to marginal (hybabyssal) is responsible for the preparation or notable modifications of magmas whence come, through differentiation, the igneous rocks of the globe.

We thus have the putting forward of Daly's "Overhead Stoping Theory," which has met with fairly general acceptance.

One other publication during the year which deserves special notice is the "Chemical Analyses of Igneous Rocks," by H. S. Washington and published as Prof. Paper 14 U.S. Geol. Survey. This work is a collection of analyses published from 1884-1900 with a critical discussion of the character and use of analyses. The value of this publication to petrographers and chemists has been very great indeed, and although published ten years ago, it continues to be used to a considerable extent.

After the specially rich year in 1903 we find rather leaner times in 1904, 1905, 1906, in the productions of works dealing in a general way with Petrology. "Die Kristallinen Schiefer," by U. Grubenmann, in 1907, was an all important work. The author presented therein a highly systematic treatment of the crystalline schists—something which had been sought after for a considerable time.

Grubenmann explained the characteristics of the crystalline schists and their occurrence in the crust of the earth, according to physico-chemical laws. He made a threefold division of the crust of the earth and these three zones in a general way correspond to Van Hise's two zones.

He gave an exhaustive treatment of the effects in each zone with their determining factors and divided up the rocks into twelve groups. The work was a valuable contribution to our knowledge of metamorphic rocks, in that it summarised the existing knowledge, added new material, put forth a new theory, and set out a classification which although recognised by the author as not a perfect system, has proved of very great value.

In 1908 Dr. H. C. Sorby shortly before his death presented to the Geol. Society of London, a highly important memoir on the "Application of Quantitative Methods to the Study of Rocks." He applied experimental physics to the study of various sedimentary and metamorphic rocks and gave the results of many years experiment and reflection. Like all scientific writings of this distinguished author, it was marked by a great wealth of experimental detail and showed the great bearing of accurate quantitative methods on the study of these rocks. During this year, R. A. Daly in the "Origin of Augite Andesite and of related Ultra-basic Rocks." strongly supported the early views of Scrope, Darwin and others as to the efficiency of fractional crystallization in the formation of igneous rocks, and stated his belief that the syntectic (assimilation) theory and the fractional crystallization theory were essential and principal elements in the final solution of the genetic problem of the igneous rocks.

The publication of the "Natural History of Igneous Rocks," by Alfred Harker, of the University of Cambridge, in 1909, was of great importance as the work was of an epoch-making nature. Within the few years previous to its publication, a great number of papers, making important contributions to the science of petrology, had been written and a work giving a systematic presentation of the existing knowledge on the subject was needed. Harker's work supplied this want and his lucid treatment of the subject has made this publication a most popular one amongst students of petrology.

Harker believed that a correlation exists between the general geological history and igneous activity of a given region, that igneous action is the result of crustal movements, and that these movements produce magmatic differentiation over continental areas, so that we have magmas of different composition in regions affected by different kinds of crustal movements.

Harker accepts the idea of differentiation and explains petrological provinces as due to differentiation over large areas, and the origin of different types within a given province is also explained as due to differentiation.

Harker, in his final chapter speaks of the American quantitative classification as marking "a retrograde movement, for here the artificial element is applied to the complete exclusion of the natural."

While he does not consider the time yet ripe for a natural classification of igneous rocks, along with Becker he believes that such a classification will be based upon the eutectics occurring in the rocks ; that the differentiation of the various rock types from the single parent magma, will be involved, and something similar to the principle of descent used in the classification of animals and plants will be developed. It is interesting to note that closely following on Harker's book, J. P. Iddings, of the University of Chicago, brought out "Igneous Rocks," Vol. I. In many respects the treatment is the same as that of Harker, particularly in those sections dealing with the newer petrology, and Iddings, although differing from Harker on the question of rock classification, agrees with him that the existing systems are unsystematic, unsatisfactory and confusing.

Following up the question of rocks classification, we find Cross, in 1910, in "Natural Classification of Igneous Rocks," giving an excellent summary of the various classifications suggested, and with criticisms of them. It is in the main a defence of the Quantitative Classification originated by himself and three other American petrologists in 1902. He does not subscribe to a classification by eutectics as advocated by Becker and Vogt, owing to its being extremely hypothetical and based on a part of the rock at best. He also reviews the usual fundamental objections to the systematic use of the factors of mineral and textural characters. Cross states : "It appears that a natural classification of igneous rocks, expressing a relation between their most notable chemical and physical properties and the origin of those properties in the geological occurrence is impossible. The natural history of the objects is too complex. The only remaining basis for systematic classification is in the characters of the objects themselves. The chemical, mineral and textural characters of igneous rocks are each gradational as regards several elements. No systematic division can be made except along arbitrary or artificial lines, and in this sense petrographic classification must be unnatural."

Harker, however, believes we have already the germ of a natural system in a classification by eutectics.

On the question of *Alkaline Rocks* to which gradually increasing importance has been attached, Daly furnished during 1910 an interesting hypothesis with regard to their origin. His hypothesis is that most of the alkaline species are formed by the interaction of basaltic magma and limestone.

This view as to the origin of alkaline rocks is still in the hypothetical stage, and as far as Australian representatives of these rocks are concerned, it has not been very favourably received.

In the succeeding year, 1911, Daly in "Magmatic Differentiation in Hawaii," stated as his belief that "all late pre-Cambrian and younger 'Alkaline' rocks are the result of differentiation within primary basaltic magma or within syntectic magmas formed by the solution of solid, generally sedimentary, rock in the primary basalt. The marvellously uniform composition of the basaltic magma issuing from countless fissures in every ocean basin, as in every continental plateau, seems capable of explanation only on the premise that it forms the material of a continuous world-circling substratum. The facts of geology suggest that this substratum was formed by an ancient liquidation which took place when the globe was molten at the surface." He also holds that the division of igneous rocks into "*Atlantic*" and "*Pacific*" groups as suggested by Becke and so strongly advocated by Harker, is not warranted. On this latter question Cross, Iddings, and others are with Daly.

In the "Origin of Igneous Rocks" (1911) by F. Loewinson-Lessing we find a modification of the ideas which were held by Bunsen and Michel Lévy.

The author concludes that there are two original independent magmas and that these predominate in the earth's crust. These two primordial magmas are the granitic and gabbroidal (basaltic) and all other igneous rocks are derivations from them and subordinate to them in their occurrence. All igneous rocks belong to those types: (1) primordial magmas; (2) rocks due to differentiation; (3) rocks produced by a mingling of the two magmas. In addition, all igneous rocks of all geological periods originated principally by the refusion of the earth's crust, so that we meet in successive periods the same types of rocks.

It is not generally conceded that Loewinson-Lessing was justified in coming to the above conclusions on the available evidence.

"The Methods of Petro-Microscopic Research," by F. E. Wright, which was published by the Carnegie Institution in 1911, was a most important contribution. Wright justly states in petrology: "The quality of our quantitative work is far more important than the quantity of our qualitative work," and his publication is one which certainly makes for increased efficiency in quantitative work.

An interesting paper by L. L. Fermor, in 1912, on the "Systematic Position of the Kodurite Series" in India, discloses a novel idea in the use of garnet as a geological barometer.

Kodurite when classified according to the American classification, gives a *norm* of Orthoclase, Leucite, Apatite, Anorthite, Hedenbergite, Wollastonite, Tephroite, and Magnetite. The *Mode* is Orthoclase, a manganese garnet known as Spandite, and Apatite. Comparison of the specific gravities of the norm and mode of this rock showed that the garnetiferous form (the mode) was of a considerably higher specific gravity and consequently occupied a considerably smaller volume (10 per cent. less) than the non-garnetiferous form (the norm). Fermor, therefore, concluded that Kodurite must have been formed under considerable pressure and that below a certain depth all the ferro-magnesian minerals, such as pyroxene, amphibole, olivine, and biotite with anorthite have arranged themselves as far as possible into garnets, for thereby the maximum reduction in volume and absorption of heat is effected.

Fermor then goes on to suggest that beneath the rocks now known as *plutonic*, there must be a zone of garnetiferous rocks extending downwards in a plastic solid form as far as the presumed metallic core of the earth. For this zone he proposes the term "Infra-Plutonic."

Fermor's publication is very interesting and his conclusions ingenious, but in view of the occurrence of garnet in certain limestone contact-rocks, etc., it would be better perhaps to regard certain other minerals of high specific gravity and highly endothermic character in their formation under pressure, as being more characteristic of the "infra-plutonic zone" than garnet.

Within the last few months "Igneous Rocks," Vol. II., by J. P. Iddings, has been published. It is interesting to note that the classification of rock-groups is based mainly on the old "qualitative" system and not on the "American Classification" of which Iddings is one of the founders.

Conclusion.

An attempt has been made to deal with the various advances made in petrology during the last thirteen years. Owing to the great number of publications bearing on this question, and the difficulty of obtaining them here, it is felt that this review cannot be other than incomplete; but it is hoped that at least the main developments have been chronicled. With regard to the *classifications of igneous rocks* in vogue at present, those based upon (a) mineral (or chemical) composition and (b) texture or geologic mode of occurrence are perhaps the most satisfactory. It is hoped that as our knowledge becomes more complete classifications may be based on the principles of eutectics and the methods of genesis of igneous types.

The main objections to the existing American Classification are that it can not be used without a fairly intimate knowledge of the chemical composition of the rock, and it usually replaces the actual mineral composition by an imaginary mineral composition (the norm). On the other hand it has proved of very great service in revealing chemical characteristics and relationships.

There has been a great deal of controversy on the "*Relations between tectonic and petrographical facies*," as Harker terms it. Harker concludes that "*as regards the younger igneous rocks*, the main alkaline and calcic regions correspond to the areas characterised by the Atlantic and Pacific types of the coastline respectively," and holds that the alkaline rocks are typically associated with subsidence due to radial contraction of the globe, and the calcic rocks with folding due to lateral compression. Cross and others, however, hold that whether the relationship involved, is true or not, it is not responsible for the chemical differences of the magmatic series; nor does it appear that the generalization of distribution applies to the older rocks.

Several other authors have expressed their views on the origin of *Alkaline Rocks*. *Becke* suggested that during a gaseous stage of the earth the action of gravity separated the magma into an upper, subalkaline or calcic, layer and a lower, alkaline, layer.

Jensen suggested "that alkaline rocks are derived from Archæan saline beds, which by chemical attacks on the adjacent sediments, have given rise to an alkaline magma in the process of metamorphosis. This magma has been squeezed laterally into continental areas and has undergone differentiation, or it has mixed with other magmas, chiefly basic, and then differentiated.

The views of *Harker* and *Daly* have already been given. *C. H. Smyth, Junr.* however, suggests that alkaline rocks are derived from ordinary subalkaline magmas through the agency of mineralisers.

The present position with respect to *Metamorphic rocks* is that two of the fundamental problems of the origin of crystalline schists are now settled, viz., the source of the crystalline rocks and their relation to time. It is generally accepted that they have been developed from both igneous and sedimentary rocks in various periods and not in Archæan times alone as previously supposed. There are two divergent views, however, as to the mode of origin: (1) that the processes of development are devoid of the agency of igneous rocks; (2) that the agency of igneous rocks is the controlling factor.

THE COMPOSITION OF THE OIL OF PRICKLY-PEAR SEED (*Opuntia spp.*)

By FRANK SMITH, B.Sc., F.I.C., and L. A. MESTON.

(*Read before the Royal Society of Queensland, 27th April,* 1914.)

The Seed.

Opuntia species, the prickly-pear of America and Australia, bear considerable quantities of fruit of more or less edible quality and containing proportion of seed varying in varieties examined in America from 5 to 9 per cent. by weight of the edible pulp. In Queensland varieties examined the seed has been found to comprise 6 to 11 per cent. of the fruit.*

The seeds are distributed throughout the mass of the pulp. They are somewhat disc-shaped and are from one-eighth to three-sixteenths of an inch in diameter. The seed coats are very hard and would be extremely difficult of mastication and digestion by herbivora.

On analysis the seed were found to have the following composition† :—

Moisture	2.47 per cent.
Protein	4.65 per cent.
Woody Fibre (König)	39.77 per cent.
Oil	7.12 per cent.
Ash	3.29 per cent.
Other Carbohydrates	42.70 per cent.

Other samples of seed were found by the authors to contain from 6-8 per cent. of oil.

* Report of the Agricultural Chemist for 1912-1913.

† By permission of the Agricultural Chemist.

The Oil.

It is difficult to form any estimate of the amount of oil produced by prickly-pear in bearing. It is urged, however, that the oil from the low percentage present in the seed, and on account of the nature and mode of distribution of the latter, can have no commercial value, and the present communication must be viewed merely in the light of a contribution to the chemistry of *opuntia spp.*

For the purpose of investigation a quantity of prickly-pear seed was collected for us by Dr. Jean White, of the Dulacca Prickly Pear Experiment Station, to whom our thanks are due. The oil was removed by petroleum spirit and the solvent removed by evaporation, finally in a brisk stream of carbon dioxide.

The oil is of a clear amber colour, and on examination was found to have the following constants :—

Sp. gr at 15°/15° C.	.9242
Refraction (Zeiss at 20° C.)	74.8
(Abbe at 20° C.)	1.475
(Oleo at 22°)	+26
Acid Value	2.8
Saponification Value	187.5
Iodine Value (Hübl)	130
Bromine-thermal Value	24.2
Hehner Value	94.9
Reichert-Meissl Value	.4

The Fatty Acids.

The mixed fatty acids were found to have an iodine value of 133, and a neutralisation value of 201. The mean molecular weight is 279.

The liquid and solid acids composing the mixed fatty acids were separated by the usual method of taking advantage of the different solubilities of their lead-salts in ether.

The mixed fatty acids consist approximately of (1) 83 per cent liquid acids ; (2) 17 per cent. of solid acids.

The Liquid Fatty Acids.

The iodine value of the liquid acids was found to be 136, and the mean molecular weight 283. The oxidation products by the alkaline permanganate method of Hazura and Grüssner were examined. Typical crystals of dioxystearic acid, melting at 130° C., and crystals of an isomer of sativic acid (tetroxystearic acid), M.Pt. 156-159° C.

were obtained, but no product that could be identified with linusic acid (hexahydroxystearic acid). Examination of the oil for linolenic esters by the bromination process yielded a negligible amount of hexabromide.

Accordingly the liquid fatty acids of prickly-pear seed oil consist of a mixture of oleic and linoleic acids.

The Solid Fatty Acids.

The solid fatty acids were obtained as a yellowish cake (M.Pt. 50-53° C.). The mean molecular weight was determined as 259, hence it was assumed that the solid acids consist almost entirely of palmitic acid. On purification by crystallisation from alcohol fractions with melting points from 58° to 61.5° C., were obtained. (M.Pt. of palmitic acid: 62.6° C.). A small fraction difficultly soluble in alcohol, and separating in white flocks, was also obtained. It melted from 78° C. to 82° C, was evidently a mixture, and probably consists mainly of lignoceric acid.

Summary.

1. The oil of prickly-pear seed is of the class of semi-drying oils.

2. It is composed of glycerides of oleic, linoleic, and palmitic acids, with probably a small percentage of the glyceride of lignoceric acid.

SOME OIL-BEARING SEEDS INDIGENOUS TO QUEENSLAND.

By FRANK SMITH, B.Sc., F.I.C., and L. A. MESTON.

(*Read before the Royal Society of Queensland, 27th April, 1914.*)

I.—THE SEED OF MACADAMIA TERNIFOLIA AND ITS OIL.

Macadamia ternifolia (F. v. M.) (N. O. Proteacae), the Queensland Nut, the nut tree of sub-tropical Eastern Australia is of common occurrence in the northern brush-forests of New South Wales and the coastal scrubs of Southern Queensland.

It is a tall, evergreen tree, bearing dark green, dense foliage, attaining a height of sixty feet, and is remarkable in that its foliage is rich in cyanogenetic glucoside. Greshoff* in specimens propagated at Kew, obtained 1 per cent of hydrocyanic acid from the green leaves. One of us (F. Smith) has found .05 per cent. of hydrocyanic acid in leaves collected during the winter months. Petrie† has observed the occurrence of hydrocyanic acid in both varieties distinguished by Maiden, viz.: M. ternifolia and M. ternifolia var. integrifolia. The trees come into bearing during the winter, producing when mature a fair crop. The fruit hangs in racemes, and consists of a two valved coriaceous exocarp enclosing a slightly roughened and shiny endocarp containing a single globular seed.

The Nut.

The nut has an average weight of 4.8 grammes and is composed of approximately 75 per cent. shell and 25 per cent. kernel. The shell is hard and brittle and from

* Kew Bulletin, No. 10, 1909.

† Proc. Linnean Soc. N.S.W., 1912, Vol. 37, Part I., p. 220.

one-sixteenth to one-eighth inch in thickness. The kernel is oily and of pleasant nutty flavour, reminiscent of the chestnut. W. J. Allen (Agric. Gaz. of N.S.W., XVI., 1905, 1028), describes it as one of the best flavoured nuts, finding in New South Wales, where is has been cultivated to a slight extent, a ready market at sixpence to sevenpence per pound. Analysis of the kernel showed it to have the following composition which is compared with that of almonds.

	Queensland Nut.	Almond
Mixture	3.0 per cent.	4.8 per cent.
Protein	8.8 per cent.	20.0 per cent.
Oil	66.0 per cent.	54.9 per cent.
Carbohydrates ..	15.4 per cent.	17.3 per cent.
Crude Fibre ..	5.1 per cent.	2.0 per cent.
Ash	1.7 per cent.	2.0 per cent.

The Queensland Nut contains less protein, but a larger percentage of oil and of fibre than do almond kernels.

The kernels are starch free, contain 5.68 per cent. of non-reducing sugar, and are free from cyanogenetic glucoside.

THE OIL.

A quantity of ground kernels were extracted with low boiling point petroleum ether, and the solvent evaporated finally in a stream of warm dry carbon dioxide.

The pale, clear, yellowish oil was found to have the following constants :—

Sp. grav. 15°-15° C.	.9162	per cent.
(Refraction Zeiss at 20° C.) ..	61.0	per cent.
(Abbe at 20° C.) ..	1.466	per cent.
(Oleo at 22° C.) ..	—.7	per cent.
Acid Value	2.1	per cent.
Saponification Value	194.5	per cent
Iodine Value ..	68.0	
Hehner Value	95.9	
Reichert-Meissl Value	.6	

The oil is of the non-drying class, possessing lower iodine value than the common vegetable edible oils, as almond and olive oils.

THE INSOLUBLE FATTY ACIDS, comprising 95.9 per cent of the oil, were found to have an iodine value of 73.0, and a mean molecular weight of 275.9.

Separation of the liquid and solid acids by the lead-salt-ether method yielded approximately (1) 75 per cent. liquid acids, and (2) 25 per cent. solid acids.

The Liquid Fatty Acids were found to have a mean molecular weight of 277.0. The iodine value is 84.0. We conclude that the unsaturated acid of Queensland nut oil is wholly oleic acid.

The mean molecular weight and iodine value obtained are, however, considerably lower than the value for pure oleic acid (282 and 90), an indication of the presence of a saturated acid of lower molecular weight.*

The Solid Fatty Acids were obtained as a white cake melting at 54° C. They were found to have a mean molecular weight of 273.0 Fractional crystallisation from alcohol gave in order of solubility fractions melting as under.

(1) 50° C.-55° C., a mixture, containing also proportion of unsaturated acid
(2) 56° C. -58° C., principally palmitic acid.
(3) 62° C., pure palmitic acid.
(4) 69.5° C., pure stearic acid.

From the lithium salts prepared from the fraction of lowest melting point was obtained by appropriate treatment of alcohol a small portion of salt yielding on decomposition with mineral acid, crystalline acid melting at 51° C. The melting point of myristic acid (Mol. Wt. 228) is 53° C. Myristic acid is probably present and may also occur in some quantity in the liquid fatty acids prepared by the lead-salt-ether process.

Summary.

(1) The nut of Macadamia ternifolia compares favourably in composition with that of edible nuts, such as the almond.

(2) It contains 66 per cent. of an edible non-drying oil of low iodine value, and comparatively high content of glyceride of saturated fatty acids.

(3) The oil is composed of glycerides of oleic, palmitic and stearic acids, with some proportion of glyceride of myristic acid.

We desire to acknowledge our indebtedness to the chiefs of the Government Laboratories, Brisbane, for facilities for the carrying out the present and preceding investigation on the composition of prickly-pear seed oil.

* The lead-salt-ether method does not affect the absolute separation of unsaturated and saturated acid.

NOTES ON A PLANT-BEARING COMMON BLACK OPAL FROM TWEED HEADS, N.S.W.

By ERNEST W. SKEATS, D.Sc., A.R.C.S., F.G.S.

(Professor of Geology and Mineralogy, University of Melbourne.)

(*Read before the Royal Society of Queensland, April 27th,* 1914.)

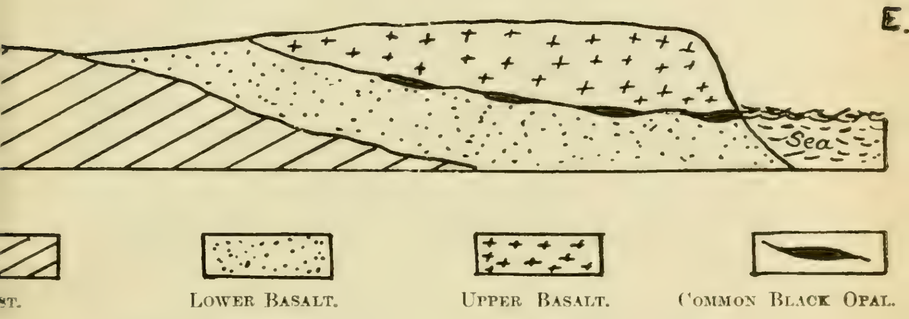
Introduction.

About two years ago, Mr. H. C. Richards, M.Sc., Lecturer in Geology at the University of Queensland, sent me some fragments of a dense black, hard material, which he found associated with the basalt flows of Tweed Heads, New South Wales. Mr. Richards quite naturally, from its appearance and occurrence, described it to me as tachylyte, and as forming the glassy selvage to a basic lava flow. I concurred in the indentification, but at the time had no occasion to test it critically. Towards the end of the year 1912, however, I had occasion to determine its specific gravity, and that of some tachylytes from Victoria and elsewhere. To my surprise I found that it differed entirely in its properties from tachylyte.

Geological Occurrence.

The mode of occurrence of the material will be seen from the sketch section, from information kindly supplied by Mr. Richards. The basalt of Tweed Heads was the subject of a short note by Mr. E. C. Andrews, B.A., in the

Annual Report of the Department of Mines, New South Wales, 1904, pp. 145-146.



SKETCH SECTION showing occurrence of Common Black Opal between the two flows of Basalt at Point Danger. Vertical and Horizontal Scale 200 feet to one inch.

Mr. Andrews described the basalt as of Tertiary age, resting on a denuded surface of (?) Carboniferous rocks nearly at sea level.. As basalts of Jura-Trias age are known from adjoining areas, the precise age of the Tweed Heads basalt is, perhaps, to some extent, an open question. Mr. Andrews' description and section show only one flow of basalt. Mr. Richards, however, who is working at the geology of that area, tells me (see section) that two flows occur; that certain depressions probably formed by erosion occur on the surface of the older flow, and that the occurrence of the black material appears to be restricted to these hollows. The later flow sealed them up and they have been recently exposed during quarrying operations. The quarries occur near Point Danger and about 100 yards south of the Queensland border.

IDENTIFICATION OF THE MATERIAL.

SPECIFIC GRAVITY. Two determinations with a Walker's steel yard gave values of 2.07 and 2.09. The specific gravity of the tachylyte from the Merri Creek, near Melbourne, is 2.74, the normal value for a glassy basic rock. The specific gravity of opal ranges from 1.9 to 2.3

MICROSCOPIC CHARACTERS.

Five rock sections have been prepared, one of which was left uncovered, so that the refractive index of the material could be determined against various oils.

The refractive index of the material was found to be very low, lower indeed than that of any known rock.

It was found to have almost the same refractive index as that of chloroform, namely 1.45. The refractive index of tachylyte was found to be considerably above 1.53. In thin sections the material is a brownish-red colour, contains, in places, rounded or irregular concretions of pyrite, and is completely isotropic except for minute grains of quartz and possibly felspar embedded in it. In contains no microlites.

Chemical Characters.

Blowpipe tests showed the abundance of silica by the residue or skeleton left in a bead of microcosmic salt: in the closed tube much water was condensed on heating, strong reactions of sulphur were obtained on a silver coin and the residue, after heating, being magnetic, indicated the presence of iron. It will be noticed that all the physical characters, such as specific gravity, refractive index and isotropism, as well as the chemical characters, agree with those of the mineral common opal. The colour and lustre of the material are, however, unusual. It is dense, dull black in colour, with a pitch-like lustre and a notable conchoidal fracture. The occurrence of irregular masses of nodules of common opal, associated with volcanic rocks, such as trachytes and basalts is, of course, not uncommon, but such as I have seen have been either creamy white, yellow, brown, or greenish in colour. The black opal is interesting also from the fact that it is crowded with fragments of fossil plants.

Fossiliferous Characters.

Several thin sections of the black opal were made and examined. It was at once noticed that these sections were largely composed of the remains of plants or rather cell structure of vegetable origin The plant material was very much broken up and disintegrated as a reference to the photomicrographs, Plate I. figs 1 and 2, and Plate II., fig. 1, will show.

Professor Ewart kindly examined the sections for me. He found the material generally too fragmentary for precise determination, but noted the presence of sieve tubes, cork cells, epidermis with cuticle, and in one place, part of the woody tissue of a plant, probably a transverse section of scalariform tracheids. Some of the structures appeared to represent sections of fresh water algæ, others of various plants, including the spore of a fungus, a transverse section of a leaf and, possibly, a section of a small petiole. There was a remarkable paucity of woody tissue represented in the sections.

In one of two places rounded or oval cellular areas occur consisting of silica which now affects polarized light. Their size and the character of their siliceous network suggest that they may be altered radiolaria.

Perhaps the most interesting organism is seen in Plate II, fig. 2. It consists of an oblique section through an appendage of one of the arthropoda and may represent the section of a leg of a fossil spider. The minute hairs projecting from the surface of the appendage are clearly noticeable in the photomicrograph. In New South Wales, Victoria, and elsewhere, some deposits of common opal are found to contain abundant skeletons of the siliceous frustules of the diatomaceae, and close search for diatoms has been made of the thin sections from this deposit, but with entirely negative results.

Mode of Formation of the Deposit.

Reference to the sketch geological section, fig. 1, shows that the black opal occurs in shallow depressions in the surface of the basaltic flow which has been subsequently covered with a younger flow. It would appear that in the time interval between the two lava flows, erosion of the earlier flow produced slight depressions which became swampy. Plants growing near the depressed areas contributed leaves to the deposit, while fresh water plants grew and accumulated in the swampy depressions. The mechanism by which the material was converted into opal, cannot be clearly pictured, but it is possible that thermal waters stimulated by proximity to an active volcanic centre, dissolved silica from rocks through which the water passed and that this silica and some of the water was depositec in depressions in the form of common black opal.

EXPLANATION OF PLATES.

Plate I.

Fig. 1.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales, showing fragments of plants, and an elliptical section possibly radiolarian, in a ground mass of opal. × 14 diameters, ordinary light.

Fig. 2.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. Section showing plant remains in matrix of light brown coloured opal. × 120 diameters, ordinary light.

Plate II.

Fig. 1.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. The cell structure of a plant adjoins a crack in centre of section. × 120 diameters, ordinary light.

Fig. 2.—Photomicrograph of section of Common Black Opal, Tweed Heads, New South Wales. In the centre of the field is an oblique section of leg of an arthropod which may be a spider. Surrounding it are plant fragments and concretions of pyrite, in a matrix of brown opal. × 120 diameters, ordinary light.

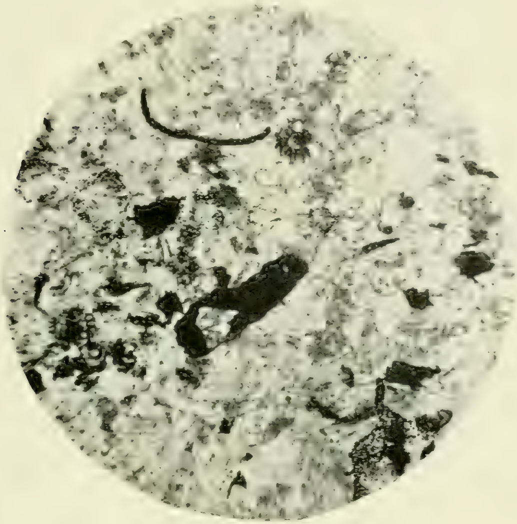


FIG 1. × 14.

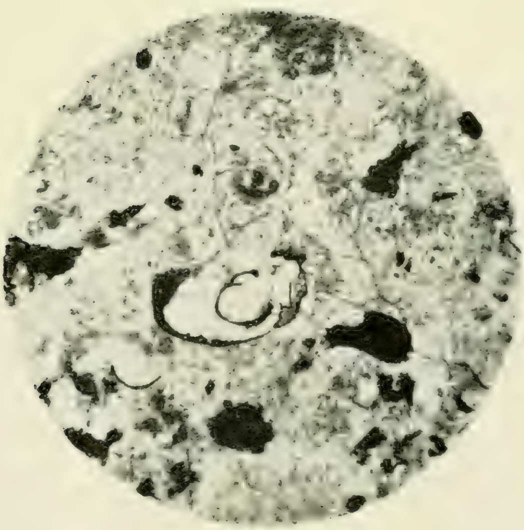


FIG 2. × 120

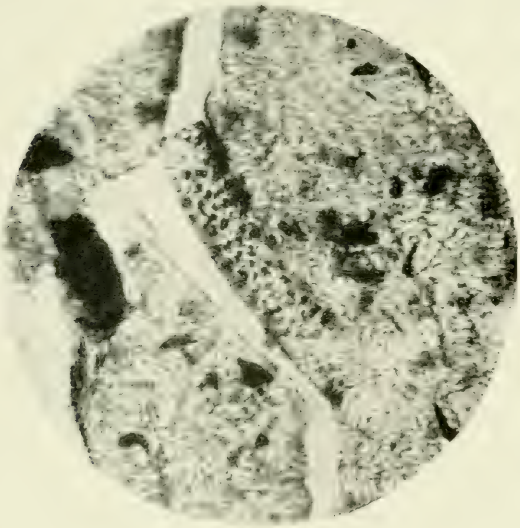


Fig 1. 120.

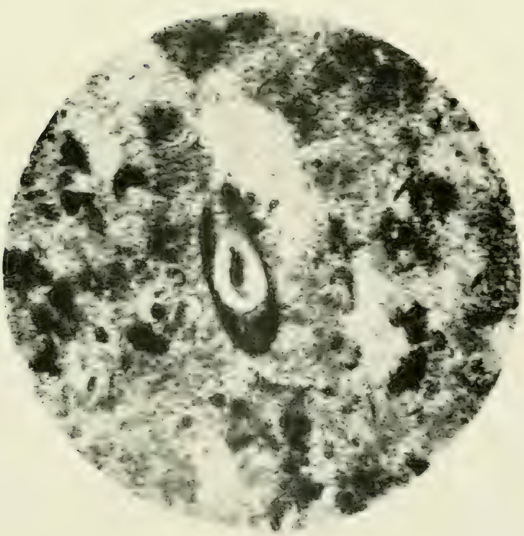


Fig 2. 120

RADIOGENESIS IN EVOLUTION.

By HEBER A. LONGMAN.
(Queensland Museum).

(*Read before the Royal Society of Queensland, May* 25, 1914)

The somewhat ponderous title heading this paper requires a little explanation. For some time past the writer has been engaged in a kind of stock-taking of such literature on Evolution as has been available for purposes of study. And with this stock-taking, and the putting into shape of a numerous collection of notes, there has seemed to be a personal need for a re-setting of views and an elaboration of old aspects. Probably many persons who are more or less conversant with modern evolutionary literature have been at times puzzled by conflicting theories, and have felt a similar need to attempt to gauge the present position. Thus there may be some utility in putting these notes on record, even though the actual merit of originality be very slight. The Evolution of thirty years ago is not the Evolution of to-day. The impetus given by the work of the great Darwin to many of his contemporaries was responsible for a wealth of literature and research records, much of which is of the greatest value: but with this, there has been a tendency on the part of a few to dogmatic utterances, and also an enthusiasm which sometimes puts theorising far in advance of facts. Both as to the processes and the dynamics of Evolution, assertions have been made which are very inadequate, and, in some cases, quite incorrect in the light of fuller knowledge. Numerous theories, some of which are comparatively modern, have been established around the facts of variation. Through studying these, Radiogenesis came to mind as a suggestive term for epitomising certain complex phenomena. In some respects it escapes many of the objections which have been raised against the commonly-used Orthogenesis, and it has the advantage, to my mind, of not bearing so definite a teleological interpretation. Hence the title of this paper. And as it is obviously impossible to isolate one phase of Evolution, the writer feels that no apology is needed for touching, even though very casually, on other points.

In some quarters there is a tendency, which is by no means new, to postulate universal laws as the result of a few experiments and observations. In several instances this is doubtless justifiable, but it is becoming more and more apparent that generalisations which may seem to govern certain sets of phenomena may not be arbitrarily applied as laws throughout the realm of nature. In science, as in politics and other schools of life, loyalty to an attitude or a theory tends sometimes to develop a species of dogmatism which, occasionally, creates strenuous controversies.

Many instances may here be given. Let us take first the unceasing discussion of the inheritance of acquired characteristics. Weismann distinguishes acquired characteristics as somatogenic, denoting that such arise only through special influences affecting the body or individual parts of it: in contradistinction to these are blastogenic characteristics which originate solely in the primary constituents of the germ. With Wallace, Ray Lankester, J. Arthur Thomson and others, he holds that acquired characteristics, as so defined, cannot be transmitted to offspring, and so far as negative evidence goes, the position is a strong one. Lankester, it should be noted, believes in the transmittance of what he suggestively terms "educability,"* and thus his attitude is somewhat qualified. The Neo-Lamarckian school strongly criticises the view that acquired characteristics are not transmitted, and Haeckel firmly supports them here. Dendy has also

*Pres. Address, Brit. Association, York, 1906.

pointed out "that it is not difficult to imagine a mechanism by which somatogenic characters may gradually be converted into blastogenic ones, and if this is in any way possible, there is no reason why we should deny the possibility of their inheritance."* And he associates with his remarks experiments which seem to point conclusively to the inheritance of acquired characters. Although in the great majority of experiments, mutilations are in no way transmitted, yet there are several notable cases which call for comment. Prof. Eugene W. Hilgard, of the University of California, records the case of a cat which sustained a compound fracture of her tail which caused a marked displacement; this peculiarity was noted in some of her offspring, and was aggravated by inbreeding and artificial selection until a race of cats with crooked tails was established.† The ecaudate condition of the famous Manxian felines has somehow to be accounted for, and it is rather difficult to imagine how such a trait could be of a strictly blastogenic origin. Several cases of transmitted deformities (caused by accidents) in human beings have been placed on record, but space forbids their recapitulation here. Apparently, there is no hard and fast criterion as to the susceptibility of organs, or organisms, and, whilst the majority are rigid, some are easily perturbed.

G. Archdall Reid claims that no logical distinction can be made between "acquired" and "inborn" characteristics. He asserts that there are invariably two factors concerned in all development—nature and nurture, and that all the individual inherits is a bundle of potentialities to grow this way and that in response to this stimulus or that. "His nature is the sum of his potentialities; his nurture is the sum of the influences that play on him, and convert his potentialities into actualities. . . . . . if any character is an acquirement, all characters are acquirements."‡ So states the Chesterton of modern science.

A brief review of literature dealing with the Mendelian theory also shows the incongruity of trying to establish

*"Outlines of Evolutionary Biology," p. 404.
† *Vide* Cope, "Primary Factors of Organic Evolution," p. 432 (1896).
‡"Bedrock," January, 1914.

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a set of universal laws. Karl Pearson,* G. Archdall Reid† and others have pointed out that in certain demonstrable cases, Mendelian laws are contradicted or superseded, and even the acceptance of what modern Mendelians call "independent inheritance," does not solve the question. Elsewhere, I have ventured to summarise my impressions as follow:—"The supposed universality of the Mendelic principle has been largely suggested by focussing attention on certain points and ignoring others. Heredity is more often a complex synthesis than a mosaic of dominants and recessives."‡ It must be added that several writers, amongst whom may be noted E. C. MacDowell,** have endeavoured to interpret blended inheritance on Mendelian lines by "multiple factors." But whatever views are expressed as to the range of the Mendelian laws, there can be no question that some of the most valuable work on heredity during recent years has been the result of investigators who have sought to establish this theory. The accumulation of facts is of the utmost value, even though theories which stimulated the workers who place facts on record may have to be qualified.

The majority of writers do not now dogmatise on the "all-sufficiency" of natural selection. Even the query as to the evolution of structure preceding the evolution of function cannot always be answered in the affirmative. Nowadays, it is not so much a case of putting the views of Darwin against those of Lamarck, but of associating the two, and laying the major stress on natural selection. Instances are given of processes which cannot be wholly explained by natural selection. Speaking on "By-products of Evolution," Dendy,†† points out that natural selection cannot be directly responsible for the minute differences of the spicules of sponges, as these cannot be of importance in the soft tissues of the sponge. Yet these minute spicules exhibit constant specific characters. Possibly, they are subject to an indirect control through being co-related to

*"On a Generalized Theory of Alternative Inheritance, with special reference to Mendel's Laws," (1904).

† "Bedrock," July, 1913, p. 232.

‡Pres. Address, Qld. Field Naturalists' Club, 1914.

**Jour. Exper. Zoology, Vol. XVI., No. 2, pp. 177-194, 1914.

††Pres. Address, Quekett Microscopical Club, 1913.

other adaptive characters. Under the principle of natural selection, we may understand that it is an advantage for certain skink and gecko lizards to be able to lose their tails, but can we explain by the same process the power of regenerating them? It is difficult to diagnose the actual origin of an organ, say, the limb of a vertebrate, though once the limbs are there we can conceive a selective process to modifications. We can comprehend that a paddle has been independently evolved in turtles, penguins, ichthyosaurs, seals and whales. Many naturalists assert that minute variations, especially in their initial stages, could not have a survival value. A partial explanation is Darwin's view of co-related variations. But actual facts of variation greatly worried Darwin. As he quaintly expressed himself when writing to Huxley:—" If, as I think, external conditions produce little *direct* effect, what the devil determines each particular variation?"

Writing of some cases of mimicry, R. H. Lock says, " the brain reels before the task of picturing the gradual building-up of such a resemblance by the successive additions of small differences, each one useful to the possessor of it."*

We naturally look here to the Mutationists for information and help. The principles associated by De Vries with his well-known examples of mutation have recently been subjected to much criticism. Several authorities assert that the mutations noted of the Evening Primrose (*Œnothera lamarckiana*) were in reality due to an ancestral natural hybridism. The Onagraceæ are evidently far more susceptible to hybridising than most other orders. Prof. E. C. Jeffrey, of Harvard University, even goes so far as to say that the mutation theory " may apparently be now relegated to the limbo of discarded hypotheses."† But this is an unwarrantable dictum. Hybridism may be often associated with mutations, but it would be exceedingly difficult to explain all mutations—especially, as we shall see, those noted by palaeontologists—in this way. There has been no mere repetition of " repertoire

*" Variation, Heredity and Evolution," p. 57.
†" Science," April 3rd, 1914.

patterns" (to use the term applied by A. Bacot). The actual facts of mutation are too big for that.

Ample evidence has been provided by Bateson,* that even specific distinctions frequently arise as single variations. Nature leaps as well as creeps. Thus certain meristic variations—or variations in symmetry and the number of organs—may be frequently noted, and many of these cannot develop through intermediate stages. Thus, plants with a four-fold arrangement may jump to a perfectly-developed five-fold form. Bateson also lays stress on what he terms Homœosis, or the variation established when one organ takes on the character of another organ, such as a disc floret of a composite flower appearing in the likeness of a ray. Whatever may be the opinion as to the operation of natural selection on infinitesimal variations, there can be no question as to its inevitable effects, preserving or exterminating, great steps or mutations. The non-viable forms are ruthlessly stamped out, and the fittest survive.

Asa Gray believed that "variation has been led along certain beneficial lines." To this and similar views the name of Orthogenesis has been given. This term implies a guiding principle in variations, suggesting a proceeding along certain definite lines. Plate uses the term ectogenesis, or ectogenetic orthogenesis, for "definitely directed variation." Naturally this view strongly appeals to teleologists, and in certain philosophical quarters, it has been unwarrantably used. It is a very comfortable sentiment and appeals to the popular imagination. But when it comes to an inquiry into actual facts, it falls to the ground. Bateson goes as far as to say that "no fragment of real evidence can be produced in its support."†

There are, of course, other views of Orthogenesis. Thus, Hans Gadow speaks of orthogenetic changes "as predictable in their results as the river which tends to shorten its course to the direct line from its head waters to the sea. That is the river's 'entelechy', and no more due to purpose or design than is the series of improvements

*"Materials for the Study of Variation," Macmillan, 1894.
†"Darwin and Modern Science," p. 101.

from the many gill-bearing partitions of a shark to the fewer and more highly-finished comb-shaped gills of a Telostean fish."*

Kellogg writes of believers in a kind of Orthogenesis, implying that "organic evolution has been, and is now, ruled by unknown inner forces inherent in organisms, and has been independent of the influence of the outer world. The lines of evolution are immanent, unchangeable, and ever slowly stretch towards some ideal goal."† Such a belief savours more of abstract philosophy than of science.

J. M. Baldwin, recognising the difficulties associated with the term Orthogenesis, used the term Orthoplasy,‡ thus suggesting a freer play of the laws of natural selection. But this term is inadequate to typify the facts. The phenomena of variation are wider than any of the theories.

Very concisely I have endeavoured to enumerate a number of other standpoints. Hans Driesch formulated a view which suggests a kind of "directive soul" for organisms, an "entelechy" operating on its course of variations. Samuel Butler and Semon propounded a theory of organic memory, and the latter opines that the results of stimuli can never be wholly lost. The quintessence of Weismannism is a struggle between hereditary forces, with nutrition as a contributory factor. De Vries looks upon nutrition as a dynamic of individual variability and mutation, and here may be gathered much evidence from many practical experimenters. Of intense interest are the researches of Loeb and Poulton who have recorded many experiments—the former chiefly with marine invertebrates and the latter mostly with the pupal stages of insects—which apparently demonstrate that variation, and even the life form itself mechanically react to chemical and other external processes. The experiments of C. W. Beebe, New York Zoological Society, are illuminating in the same respect with relation to Passerine birds. He shows that alterations in temperature and food are accompanied by changes in plumage and in the moulting season, and that

*Pres. Ad. Zool. Sect. Brit. Assn., 1913.
†" Darwinism To-day," p. 278.
‡Quoted by Osborn. Op. cit. post.

the inherited succession of plumage may be interrupted at the will of the experimenter.* In the summary of the Horn Expedition, Baldwin Spencer notes the varying sizes of mature specimens of the smaller marsupials, especially *Phascologale cristicauda*, found in the central district of Australia. In good seasons large specimens were found, but during the series of bad seasons and dearth of food, the animals secured were much smaller.† Do we not see here a diminutive form in process of evolution? If certain forms are dwarfed through partial starvation, the result is very obvious in the life of the individual, and this may be intensified in offspring subjected to the same conditions, whether the principle of natural selection operate or not. Perhaps such diminutive forms as the Shetland cattle and ponies may here be given as an island parallel to arid conditions in continental areas. To take a wider outlook, there is indubitable evidence that the known history of the Marsupialia in Australia is mainly a record of the survival of relatively small forms, whilst the larger monotremes, wombats, kangaroos and polyprotodonts, to say nothing of the giant *Diprotodon* and *Nototherium*, have died out. This has been a concomitant of the gradual change from more exuberant conditions of the Pleistocene period.

In contradistinction to Loeb, the most distinguished representative of the vitalist school—Bergson, claims that variations cannot be explained as mere mechanical response to stimuli, but spring from an internal creative impulse. Here may be added Ray Lankester's timely reminder that "variation is a common attribute of many natural substances of which living matter is only one."‡ Even Astronomy furnishes an example, for has not Saturn a satellite which goes round "the wrong way"!

Of exceptional interest is the work done by Karl Pearson, who in his "Grammar of Science" has accumulated a multitude of observations on heredity and variation largely with reference to the problems of humanity itself.

*"Zoologica," Feb., 1914.
†Horn Expedition, Pl. I., p. 143.
‡"Science from an Easy Chair," Ser. I., p. 35.

In connection with these observations the term "Biometrics" is coming into popular usage.

Henry F. Osborn, a well-known American writer, claims that there are four inseparable and inter-associated factors of evolution, viz.: Heredity, Ontogeny, Environment and Selection. The working of these four factors he elaborates under the term Tetraplasy. He defines Ontogeny as the expression of heredity reaching to and modified by the conditions of life, of environment and of selection, and summarises no less than 24 ontogenic processes.* Here we have a much wider outlook and one which is more in harmony with the complex phenomena of variations. Osborn's work cannot be neglected by any careful student of Heredity.

Thomson and Geddes have given us an attractive theory of evolutionary processes which owes much of its charm to the poetic feeling and literary style of the authors. They write of definite variations which branch dichotomously, "forms thrown from the rhythmic oscillation of the loom of life," chiefly as the result of vegetative and reproductive forces. Nature to them is no "gladiators' show" (to use Huxley's term). They view variations as definite rather than indefinite, "with progress essentially through the subordination of individual struggle and development to species-maintaining ends. The ideal of evolution is thus no gladiators' show, but an Eden; and though competition can never be wholly eliminated—the line of progress is thus no straight line, but at most an asymptote—it is much for our natural history to see no longer struggle, but love as 'creation's final law'."

But with all due regard to the prestige of these able writers, may we not see here the result of theorising too much on physiological analyses of present day organisms, instead of endeavouring to obtain a comprehensive view of the march of life from the past to the present. Does not modern palaeontology suggest that variations have branched not definitely and simply but polychotomously? The key to the process has been Radiogenesis, and not Orthogenesis, even though the latter term be much qualified.

*Journ. Acad. Nat. Sci. Phil. 2nd Ser. Vol. XV, 1912.

And it would surely be hypocritical to deny that nature manifests its "gladiators' shows", even though the amphitheatre be an Eden.

We have now on record a multitude of examples of a wide range of radial variation in many groups. For the purposes of this paper but two instances are given. In the Hawaiian Islands the song birds which constitute the family Drepanidæ show remarkable diversity. Each island has its group of species, and some of these are confined to a small district, "to a single kind of thicket, or a single species of tree." To quote Jordan and Kellogg, "In this family are about forty species of birds all much alike as to general structure, but diverging amazingly from each other in the form of the bill, with, also, striking differences in the colour of the plumage. . . . we find Drepanidæ in Hawaii fitted to almost every kind of life for which a song bird in the tropics may possibly become adapted."* For the second example we may quote, from the same authorities, the land snails of Oahu, (Hawaii.) "According to Mr. Gulick, the land snails of the wooded portion of Oahu have become split up into 175 species represented by 700 or 800 varieties. He frequently finds a genus represented in several successive valleys by allied species, sometimes feeding on the same and similar plants. In every case, the valleys that are nearest each other furnish the most nearly allied forms, and a full set of the varieties of each species presents a minute gradation between the more divergent types found in the more widely separated localities."† The establishment of these variations, in both birds and snails, is almost certainly due to isolation, but the actual variability itself may be well expressed by a principle of Radiogenesis.

It is now an axiom that similar structures have been independently developed in different groups. "The eye," says Hans Gadow, "has been invented dozens of times."‡ Walter Stapley writes: "It seems a process of narrow reasoning which admits the origin of new species, but refuses to admit that new structures may be evolved. The denial

*"Evolution and Animal Life," p. 124.
†Op. cit., p. 123.
‡Op. cit.

of the appearance of new structures seems to be the basis of the theory of atavism."* Stapley illustrates this standpoint by demonstrating that where neck ribs have degenerated into vestiges in certain cases they have re-evolved in response to a different impluse. Doubtless many structures once traced to atavistic influences are in reality new. Here we may appropriately note that Hans Gadow in his presidential address to the Zoological Section of the British Association last year gave a most useful summary of both facts and nomenclature associated with the old terms of convergence and parallelism.

Then, too, there are evidences of the exuberance of life for which we need seek no causal explanation. Darwin was content to look upon certain manifestations as being incidental and unimportant. In the "Descent of Man"† he says: "Bearing in mind how many substances closely analogous to natural organic compounds have been recently formed by chemists, and which exhibit the most splendid colours, it would have been a strange fact if substances similarly coloured had not often originated, independently if any useful end thus gained, in the complex laboratory of living things." Bateson says,‡ "I feel sure that we shall be rightly interpreting the facts of nature if we cease to expect to find purposefulness wherever we meet with definite structures or patterns." Starr Jordan, when writing of the bright colours of coral fishes, says that these cannot be explained on protective lines, and that nature seems to revel in bright colours when it is safe for her creatures to have them. Dendy instances the sculptured patterns on the calcareous shells of Foraminifera as characters which are of no adaptive value and which might be equally well replaced by alternative characters. These patterns are of a specific nature, but he cogently asks, "Does one pattern help a unicellular foraminiferan or radiolarian more than another in the struggle for existence?"** The theories of warning, protective, adaptive and sexual colouration and recognition marks account for a large proportion

*Pro. Roy. Soc., Vic., XXV., Pt. I., Aug., 1912.
†2nd Edition, p. 262.
‡" Darwin and Modern Science," p. 100.
**" Outlines of Evolutionary Biology," p. 419.

of chromatic characteristics, but many critics are demonstrating that these theories have been pushed to absurd lengths. Here I may mention the work of Dewar and Finn* and of Punnett. The very perfection of some mimetic resemblances in butterflies, the simulation of fungoid growths on a leaf pattern, for instance, is so unnecessary and elaborate that it is difficult to account for on utilitarian lines. There is a rich diversity of pattern and colour which is a manifestation of radiogenetic variation. In passing we may note that such cases cannot be claimed as evidence by the exponents of Vitalism. Radiogenesis, when compared with Orthogenesis, is at variance with any teleological conception. But I must not be tempted to dwell on this point, more especially as I have dealt with it elsewhere.†

The striking divergence of opinions among authorities shows the difficulties attending the present study of variation and heredity. And here it seems to me that more light can sometimes be shown by a study of the past than by an analysis of the present. May we not learn more, both of laws and of dynamics, by collating evidence as to the paths variations have gone, rather than by endeavouring to trace the tracks they are taking? It has been aptly stated that man's outlook on the processes of nature during his life-time is comparable to the momentary illumination of a landscape during a lightning flash in a midnight storm. It is therefore not to be wondered at, keen though our observers be, that investigations in laboratories and experiment grounds during the last half century have not satisfactorily elucidated what nature has accumulated during long geological periods.

Palaeontology is one of the youngest of sciences, but it has not escaped many initial errors. Nor are we here referring to such obviously incorrect views as the "Catastrophism" of Cuvier. The principle of some of the older workers was to judge the complete biota of past geological periods merely as preparatory stages for the life of to-day. The assurance with which Haeckel drew up genealogical trees (tentatively, it is true) startled even

*"The Making of Species," John Lane, 1909.
†"The Religion of a Naturalist," p. 38. (R.P.A.—Watts & Co.)

Darwin. Endeavours were made to read into all extinct forms some lineal association with modern organisms. This resulted from a very natural idea that our modern world with its fauna and flora was in reality the *summum bonum* of all life and that the processes of nature, without exception, were so arranged as to establish a suitable environment for man. Now we have somewhat to amend this view. We cannot always judge the past by the present. In each era life has radiated out apparently to the full gamut of potentiality. There have been rich developments of certain groups in different periods. One may note such well-known instances as the abundance of Trilobites in the Cambrian, Dipnoid fish in the Devonian, *Nautiloidea* in the Silurian and *Ammonoidea* in the Trias. Systematists have already noted about 5000 species of Ammonites, and so abundant is material that the evolution of the group from its origin to its extinction has been well worked out. Some of the forms were very highly specialised, and the maze of their sutures—often beautifully shown in our Queensland Cretaceous specimens—demonstrates an organism of great complexity. The protean development of marine, land and air forms of reptilian life in Mesozoic times exhausts the most superlative of adjectives when description is attempted. The great majority of these forms were lateral offshoots from the main stream of life, and they have no lineal relationship with the animals of to-day. Many were apparently the victims of over-specialisation, of hypertrophy. Here the multitude of diverse forms gives evidence of radial evolution, of wild exuberance of life flourishing for a time until cut short by the iron laws of natural selection. And in the succeeding age of mammals we find a similar story. Tertiary times show a rich development of mammalian life, including gigantic types, and many of these were not potential for the future. Certain forms came upon the stage of existence, played but a brief part, geologically speaking, and then disappeared. These were the derelicts of nature, the failures in the struggle of life. Yet they were no weaklings, and some carried a bulk of bone which is astounding. They were not lacking in virility, but in plasticity. Other forms were forerunners of the fauna of to-day; their very life-blood runs in present-day species. We know the lineage of the horse, the elephant, the camel and several other groups. Although there are lacunæ in our palaeontological knowledge we can never hope to fill, some strata have yielded surprisingly complete evidence on the evolution of certain groups.

Still more familiar examples to Australasian workers of radial evolution may be noted. In New Zealand wingless avian forms developed on such lines as though they had striven to take the place of the missing land mammals. These existed until recent times, and their pigmy cousins (the Kiwis) are with us still. In Australia among the living and extinct marsupial forms, the majority of the types found in the true placentals have their analogues. We have, or have had, large and small herbivorous, insectivorous and carnivorous forms, and there are diverse examples of semi-subterranean, burrowing, arboreal, parachuting and saltatorial habits. Divergencies may be illustrated by the dental characteristics, say, of *Thylacoleo*, *Sarcophilus*, *Hypsiprymnus*, *Diprotodon*, *Phascolomys*, *Myrmecobius* and *Notoryctes*. Such striking distinctions in an order in one region may be generalised as due to a principle of Radiogenesis. These marsupials have not been stationary since Tertiary times; they show processes of rapid evolution, and in some cases we have evidence of degeneracy; nor can we translate the characteristics of many of our extinct forms in terms of lineal relationship with the life of to-day, and they add further complexity to our fauna.

Thus the life of the past makes multifold the variation of to-day. Perhaps the crux of the whole problem may be expressed in the two questions put by Osborn, the American palaeontologist.* "Is it true that the greater number of new or *germinal characters* which appear are *orderly and according to some entirely unknown law* of adaptation? Or is it true that the greater number of new characters are accidental, disorderly, fortuitous, adaptive or inadaptive, fitted or unfitted, and that order comes out of chaos by the selection of those which happen to be fit?" —natural selection mimicking design, as Balfour puts it.

*Jour. Acad. Nat. Sci., Phil., Ser. 2, Vol. XV., 1912, p. 301.

But must these questions be arbitrarily put as alternatives? To vary the phrasing, was Samuel Butler—"that clever but contradictious writer," as Lankester calls him—justified in opposing "Luck to Cunning?" Are not both "Luck" and "Cunning" factors in evolutionary processes?

Theories of variation are incomplete unless they provide for the facts of momentum, or excessive growth, for the tendencies to develop colossal structures such as the huge dorsal plates of the Stegosaurs, the teeth of the sabre tiger, the antlers of the Irish elk, the tusks of the mammoth, and the horns of the weird *Arsinoitherium*. Theories have to be elastic enough to allow for teratological phenomena, for malformations and abnormalities, for such growths as are associated under the term Dysteleology. Some examples, which might be noted here, so far as the individual is concerned, exhibit no principle of radiogenesis, but rather one of orthogenesis almost "run mad," to our human view, for some of the structures associated with extinct animals appear to have been carried to a degree far in excess of utility.

Zittel, in the introduction to his well-known text-book of Palaeontology, says: "Evolution in the organic world has not advanced in a simple, straight-forward direction, but in an exceedingly complicated and circuitous." Palaeobotanists also tell us that the development of plants has sometimes been accompanied by a progress from the complex to the simple, which is almost a retrogression.* Such processes are not, of course, the general rule, but they are notable exceptions. D. H. Scott notes that in the evolution of plants there have been long periods of stability—"that times of comparative constancy have alternated with intervals of apparently rapid change."

In the "Natural History of Plants" (Kerner, translated by Oliver,) which is one of the most authoritative botanical works, the difficulties of theories of progressive development are emphasised. The impossibility is stated of estimating any order of plants as being the most highly

*Scott: "Evolution of Plants," p. 17.

developed. Thus certain sea-weeds (*Macrocystis*) are as large as forest trees, and the cell structure of Diatoms and Desmids "must be regarded as more highly organized than many small annual composites." The author asks which group has reached the highest point—"is it the Aristolochiaceæ, Cannaceæ, Magnoliaceæ, the Orchids, the Composites, the Ranunculaceæ, the Papilionaceæ or the Pomegranates ? . . . Like the theory of adaptability, that of progressive transformations from inherent forces fails to give us a reasonable explanation of the variations which plants have undergone in process of time."*

Cope used the term "expression-point" for the fixed and definite acquisition of some new character which has marked a new advance in the gradation of life. And Smith Woodward adds that this "seems to have rendered possible, or, at least, been an essential accompaniment of a fresh outburst of developmental energy." The same writer says: "Palaeontology, indeed, is clearly in favour of the theory of discontinuous mutation, or advance by sudden changes, which has lately received so much support from the botanical experiments of H. de Vries."†

Dendy in his lucid work, "Outlines of Evolutionary Biology,"‡ states that the branching of the phylogenetic tree, representing the evolution of life, has been monopodial rather than dichotomous or polychotomous. But here we think there is a great deal of opposing evidence. Latterly there has been accumulated palaeontological material which points to a multiple origin of many types. It seems not unlikely that even man himself arose radially from a number of mutable anthropoid forms. The authority of Arthur Keith** may be quoted to the effect that certain fossil crania, amongst which may be included the famous Piltdown skull, *Eoanthropus Dawsoni*, and Neanderthal types, represent distinct and extinct types of humanity and not forms ancestral to modern man. And there is no arbitrary reason why these distinct genera and species

*Vol. II., p. 599.

†Ann. & Mag. of Nat. His., Vol. 18, 1906, p. 316.

‡Op. cit., p. 230.

**"Bedrock," January, 1914. (In the same journal, April, 1914, G. Elliot Smith strongly dissents from this view).

should be traced back to one isolated mutation ; in fact, many observations on the origin of mutations and variations to-day are opposed to that view, for such often arise in profusion and not in isolation.

Have we not undoubted evidence that the paths of variation in the past, even under the iron restriction of natural selection, have been radial ? It seems to me that radial diagrams, such as those used by H. W. Conn, represent the courses of evolution more accurately than simple dichotomous branching ; and, to be logical, one must assume that such diagrams should be primarily radial, and secondarily polychotomous. Such diagrams, although necessarily tentative, are surely an appropriate expression of the labyrinthine processes of evolution.

CACTI, OR PRICKLY PEARS

By JOHN SHIRLEY, D.Sc., and C. A. LAMBERT.

(*Read before the Royal Society of Queensland, June 29th*, 1914)

1.—Introductory.

No plant of the Cactus family is a native of Australia : their native home is America ; they inhabit the drier districts of the S.W. United States, Mexico, the West Indies, Central America, and the warmer parts of South America. Just as the name of Mr. Walter Hill is often held up for scorn as the introducer of the so-called *Sida retusa* into Queensland, when he merely carried it from one part of Queensland to another, recognising its possibilities as a fibre plant, so various persons have been given the credit, or discredit, of introducing different Cacti into Australia. Mr. J. H. Maiden,* Government Botanist of New South Wales, a most diligent and methodical investigator of plants of this family, has shown that their introduction to Australia was due to Governor Phillip, and that the first cuttings were brought out by the fleet that founded Sydney, and took possession of Australia on behalf of the Empire.

2.—Peculiarities of the Cactus Family.

The ideal country for the establishment of the Cacti, known to us as Prickly Pears, is one in which a rainy season

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*A preliminary Study of the Prickly Pears naturalised in New South Wales : Department of Agriculture, N.S.W., Miscellaneous Publication, No. 253

PLATE IV.

FIGURE 1—Tangential section of developing spine of *Opuntia inermis*, D.C.

FIGURE 2—Epidermis of *Opuntia inermis*, D.C., showing numerous sphere-crystals of oxalate of lime.

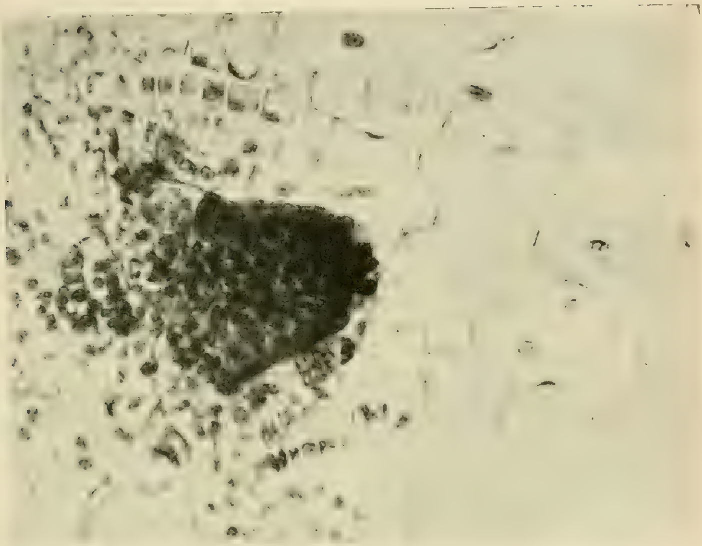

FIG 1.

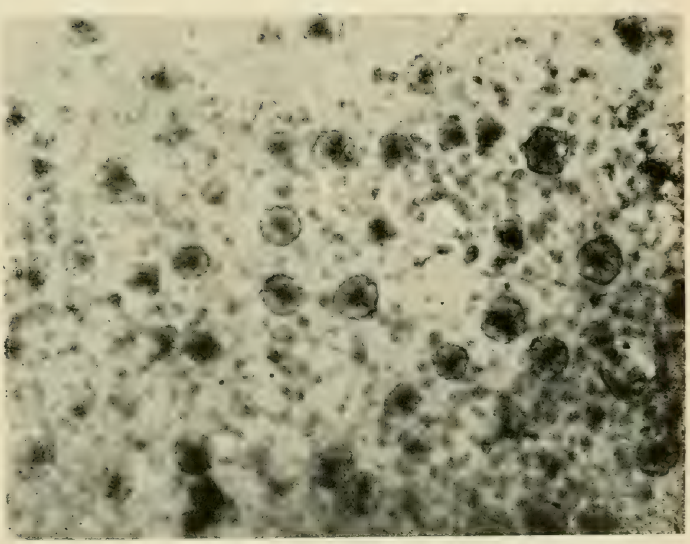

FIG 2.

PLATE V.

FIGURE 1—Transverse section of cladode of *Opuntia inermis*, D.C., showing from the outer layer inwards—

I. The epidermis of one layer of cells.

II. Single layer containing crystals of oxalate of lime.

III. Dermis or collenchyma of five layers of cells.

IV. Palisade parenchyma.

V. On the right centre a stomatal tube.

VI. Below it a mass of crystal sand.

FIGURE 2—Epidermis of *Cereus grandiflorus*, Haw., showing seven stomata.

FIG 1.

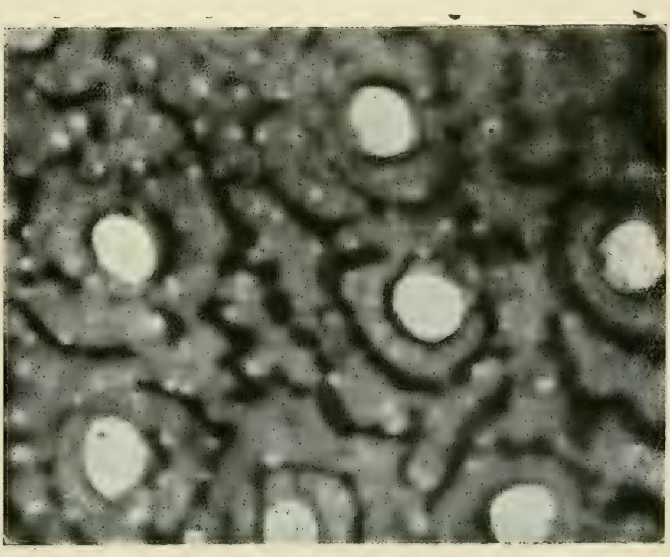

FIG 2

PLATE VI.

FIGURE 1—Transverse section of cladode of *Cereus grandiflorus*, Haw., showing from the outer surface inwards—

I. Epidermis with uneven cuticularisation.

II. Dermis or collenchyma of four layers of cells with greatly strengthened cell-walls.

III. Palisade parenchyma.

IV. In the centre a stomatal tube.

FIGURE 2—Transverse section through the flower-bud of *Peireskia aculeata*, Mill., showing parts of several petals and sepals.

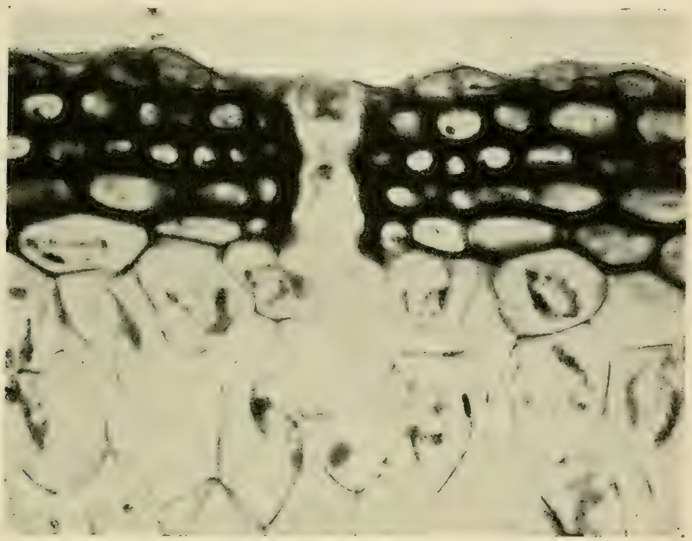

Fig 1.

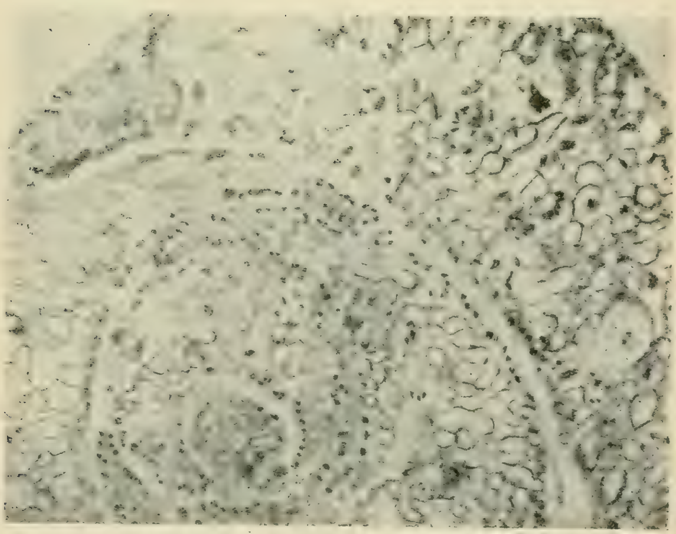

Fig 2.

alternates with periods of dry weather, or even of drought, in which there is little trouble from frost; where there is a depth of soil not less than ten inches in thickness, containing a fair percentage of lime; and where there is a rainfall for the year of at least ten to twelve inches. All these conditions are provided in the greater part of Queensland and Northern N.S. Wales, hence the rapidity with which introduced plants of this family have spread in these States, as well as in countries providing like conditions—S. India, Ceylon, S. Africa, etc.

An introduced plant in a new country has many advantages over native species. It has left its natural enemies behind, and the insects or mammals that are likely to prey upon it are some time before they discover its uses. It therefore thrives and spreads at this stage more readily than in its native haunts. But the Cacti are specially adapted to ward off enemies. Those that are proving pests in Australia have no true leaves; the stems are flattened, they retain their epidermis, and are green because their cells are furnished with chlorophyll. The true leaves fall off when young, or are changed into spines. It is much more difficult for noxious insects to damage these cladodes, as the flattened stems are called, than to damage an ordinary foliage leaf. Again, at each node, the point from which leaves or flowers spring, instead of leaves or branches, there are sharp spines, in some species 2-3 inches long, and a tuft of bristles or spinules, often furnished with a most formidable clothing of recurved barbs. These defences serve to keep away most of the grazing mammals. On the grazing farms in Texas, the spines are burnt off by means of flames from small acetylene tanks, borne by employees, and the cattle following the workmen feed upon the disarmed cactus.

As a protection against insects, all species yet examined by the authors of this paper are found to have the cells of some portion of the cladode, or in *Peireskia* of the leaf, armed with crystals of oxalate of lime. In *Opuntia inermis*, D.C., the pest pear of Queensland and New South Wales, and *Opuntia aurantiaca*, Gillies established near Warwick, sphere-crystals form an almost continuous layer, occupying cells lying directly below the epidermis; other needle-shaped crystals of similar or nearly similar composition are to be found in the cell walls of cortical and deeper layers. The vascular strands are also protected on each side, in many species, by other cells filled with sphæroraphides. Not only are these crystals a kind of protective armour whose sharp points repel the attacks of insect larvæ*, of coccids, and other soft-bodied creatures, but the cells containing them seem to be avoided by fungi. In making sections of Cacti so protected, each of the two workers found the knives of their microtomes rapidly blunted, and far more difficulty was experienced in obtaining good sections than with any other vegetable tissue. The needle-shaped crystals, true raphides, are very abundant in our grass trees, and make the sectioning of parts of those plants difficult; but the sphere-crystals or sphæroraphides of the cortex of *Opuntia* offer far more difficulty.

3.—Plants Naturalised in Queensland.

Omitting plants like the night-blooming Cereus, *C. grandiflorus*, which may occasionally be seen climbing over scrub or forest trees near a deserted homestead, the Barbadoes Gooseberry, *Peireskia aculeata*, already mentioned, and species of *Rhipsalis*, *Echinocactus*, *Melocactus*, and *Mammillaria* seen in our bush-houses, the introduced species that have fully established themselves in our State belong to two genera, *Nopalea* and *Opuntia*. In *Nopalea* the essential organs, the stamens and pistil, protrude from the petals, which press closely around them, or are connivent, as the botanist expresses it. In *Opuntia* the essential organs are shorter than the petals, which encircle them at a distance, together forming a funnel-shaped corolla.

The following table is a list of species likely to spread with some of the localities from which they have been reported:—

*Evans' Botany, p. 93.

SPECIES OF *Opuntia* AND *Nopalea* NATURALISED IN QUEENSLAND.

Species.	Habitat.
Opuntia aurantiaca, Gill. ..	Warwick, common about the banks of the Condamine, near the town.
,, *Dillenii*, Haw. ..	Brisbane, Gayndah, Rockhampton.
,, *ficus-indica*, Mill.	Occasionally seen near deserted stations, etc., but usually reports of the presence of this pear prove to refer to *O. tomentosa*.
,, *inermis*, D.C. ..	This is the pest pear, said by Mr. Temple Clerk, in his booklet, "The Prickly Pear Problem," to cover 30 million acres in Queensland alone, and to be spreading at the rate of one million acres a year.
,, *monacantha*, Haw.	On both sides the Suttor River.
,, *nigricans*, Haw. ..	Yelarbon, S.W. Queensland.
,, *tomentosa*, Salm-Dyck	Dulacca, Gracemere, Helidon, Warra, etc.
Nopalea coccinellifera, Mill.	Emerald.
,, *dejecta*, Salm-Dyck.	Rockhampton district.

4.—Histological Notes.

Besides specimens of *Opuntia inermis, O. aurantiaca*, and *O. monacantha*, by the kindness of Mr. J. F. Bailey, Director, Botanic Gardens, Brisbane, we obtained specimens of *Cereus grandiflorus*, Haw., *Echinocactus Eyresii*, Luce., *Peireskia aculeata*, Mill., and *Rhipsalis salicornoides*, D.C. These were all sectioned, and examined under the microscope, the main study being centred on the pest species.

I.—*Opuntia aurantiaca*, Gillies.

This species is so well armed with a close layer of subcutaneous cells containing sphere-crystals of calcium oxalate, as to be likely to defy all insect pests, and to spread rapidly. It is provided with small, elongated-ovate joints, and is easily recognisable by its reddish epidermis, especially noticeable in young growth. See Plate III., Fig. 1. The epidermal cells are from $\frac{1}{60}$ to $\frac{1}{75}$ mm. in length, by one-half those dimensions in breadth. The outer wall is thickened with a deposit of cutin until it equals one-third the whole width of the cell, or $\frac{1}{350}$ to $\frac{1}{450}$ mm.

The dermal layer is formed of five rows of cells, those of the first layer lying immediately below the epidermis, contain the sphæroraphides of oxalate of lime, and show like silver stars under polarised light. The cells of the dermis increase in size in each successive and deeper layer. In some places there is a sixth layer, whose cells deviate from the usual brick-shaped form and are cut off at the corners so as to be almost prismatic. This change from the brick-shaped to the prismatic form can be gradually traced from the surface inwards. The dermal cells are very thick walled, and the cell walls take up the stains as freely almost as the nuclei of the cells.

Since the flattened joints of *Opuntia* have to perform the functions both of leaf and stem, it is not surprising to find the cortical tissue playing the part, and copying the structure of the outer mesophyll of foliage leaves, and the same term, palisade parenchyma, may be applied to it This tissue is found immediately below the dermis, on each side of the stem, with a depth of about 10 rows of oblong cells, set with the long axis at right angles to the epidermis. An average cell is about $\frac{1}{12}$ mm. long by about half that breadth. The outer palisade cells are supplied with numerous chloroplasts, but these are replaced by leucoplasts in the inner layers. When viewed in direct sunlight, or in polarised light, the walls of these cells were seen to contain minute crystals of acicular form. Some few cells of the outer or sub-dermal rows contained masses of yellow-brown crystals, the so-called crystal sand. The sphærocrystals were $\frac{1}{60}$ mm. in diameter. See Plate III., Fig. 1., and Fig. 2.

II.—*Opuntia inermis*, D.C.

The same general structure is seen in this as in *O. aurantiaca*, but the sphere-crystals though quite as numerous, and occupying the same sub-epidermal position, are smaller, varying from $\frac{1}{75}$ to $\frac{1}{90}$ mm. The walls of the palisade cells are studded with smaller and isolated crystals. Tawny masses of crystal sand were also evident in this species. Plate IV., Figs. 1 and 2.

In a transverse section of a joint or flattened stem, the vascular bundles are found at the base of each mass of palisade parenchyma. The wood vessels are few in number*, and usually showed spiral strengthening layers. The bast vessels form a larger mass of tissue, and in a few of the vascular bundles appeared to be bi-collateral.

In the palisade parenchyma, and also in the medullary or water-storing tissue of the stele, are numerous air-cavities. The inner walls of these cavities take up some stains readily, and, under a low power, look like dark blotches, but with proper focussing, and with a high power, the outlines of the cells lining them can be revealed. In a rather thick section, stained with hæmatoxylin, there are signs of tubes connecting the air cells of the medulla with those of the two layers of parenchyma, and in all cases there are passages from the stomata to the air-spaces. The breathing spaces are $\frac{1}{6}$ to $\frac{1}{10}$ mm. in greatest diameter, and are usually globular or elliptical in shape. Plate V., Fig. 1.

On each side of the vascular bundles the sphere-crystals are thickly scattered; they are sparingly seen in the walls of the medullary tissue or aqueous tissue as it has been termed, because its cells store up water after every fall of rain.†

III.—*Opuntia monacantha*, Haw.

An examination of stems of this pear make it easy to understand why the cochineal insect can damage this species, while its attacks have no effect on such plants as *O. inermis* and *O. aurantiaca*. The armour of sphere-crystals is almost absent from the subepidermal layer of the dermis, and though there are traces of small oxalate of lime crystals in the walls of the palisade cells, they are only seen with high powers, and are not by any means too evident even then, though sought for with the aid of polarised light. In all other respects the histology agrees with that reported for the species already mentioned.

IV.—*Peireskia aculeata*, Mill.

The Barbadoes Gooseberry possesses true foliage leaves, and its flowers prove an excellent attraction for bees; specimens seen near the river banks at Corinda

*Possibly because for ease in sectioning young tissue was usually selected.

†Kerner and Oliver, I., 329.

and in the Botanic Gardens always claim attention during the flowering period by the buzzing of their numerous visitors.

The sepals have an upper and a lower epidermis, and, as is usual, show little differentiation of the mesophyll into spongy and palisade parenchyma. Air spaces are very numerous, and take up a large portion of the whole space filled by the mesophyll. Massed crystals, less acute than those forming the sphere-crystals of *Opuntia*, are found in the subepidermal layer, parallel to both surfaces.

The stem shows the usual division, on transverse section, into palisade layers, vascular bundles, and medulla or aqueous layer, as in *Opuntia*; but in all tissues except the vascular bundles, the cells are shortly oblong in outline, the longer axis being to the transverse axis as 3 : 2. In palisade cells the long axis is at right angles to the epidermis, in aqueous tissue it is parallel to the surface. Plate VI., Fig. 2.

V.—*Cereus grandiflorus*, Haw.

Epidermal cells have the wavy outline so common in similar cells of foliage leaves in numerous dicotyledons. The cells of the internal tissue are crowded with acicular (true) raphides, or crystals of oxalate of lime; and these are seen like a halo round the circumference of the plant section, having escaped from cut cells. A wound on the surface of this cactus, exposes a number of slime-cells containing raphides. Any rain or dew that fell would be imbibed by them in excess, and, their walls rupturing, the contained needles would be extruded, and form defensive *chevaux-de-frise* round the wounded portion. Plate V., Fig 2, and Plate VI., Fig. 1.

VI.—*Echinocactus Eyresii*, Luc.

The stem of this plant shows little differentiation of internal tissue. The cells of the central medulla differ little in shape from those of the palisade parenchyma, although the longest axis is parallel to the epidermis. In places the true epidermis, which does not take up the stain, is 6-7 cells thick, the extra layers formed of cork cells. It is probable that this is a defence against fungal attack. On the opposite surface the epidermis was normal—one cell thick. In all positions it has a dermal layer, two cells in thickness, giving the reactions in the cell-wall for true cellulose. These cell walls are greatly strengthened and absorb colour readily. In re-entering angles the dermal layer, or collenchyma, may be 4-5 cells thick. In places the strengthening layers have almost obliterated the cell cavity. In other respects the structure is that normal to the order. Plate VII., Figs. 1, 2.

VII —*Rhipsalis salicornoides*, D.C.

The thong-like stems of this plant, an epiphyte from the American forests, are in structure more like the stem of an ordinary dicotyledon, than any other yet examined. The stele contains numerous wood vessels, mostly spiral, but has the central aqueous tissue of the Cactæ instead of pith. The cortical regions, as shewn in longitudinal sections, are filled with the usual air-cavities, joined by tubes or passages to the stomata. All the cells—palisade cells and medullary tissue—are very minute. Crystals of oxalate of lime, in rhomboidal or irregular masses, are found mainly in the stele, and especially near the woody tissue

NOTES ON THE MARINE MOLLUSCA OF QUEENSLAND.

PART III

By JOHN SHIRLEY, D.Sc., F.M.S.

(*Read before the Royal Society of Queensland, June 29th, 1914.*)

SINCE publishing my last list of additions to the Queensland Marine Mollusca, a number of additional species have been reported, and there have been some changes in nomenclature to which attention should be drawn.

Class PELECYPODA.

Family ARCIDÆ.

Genus ARCA. Linnæus.

ARCA FUSCA, *Bruguière*, No. 25, Hedley's list.

s. Arca pistachia, Lamarck. Hanley, Recent Shells, p. 154, remarks "Smaller, but scarcely differing from *A. fusca.*" From Murray Island specimens of *Arca fusca* have been received, some marked with a white ray from the umbo for some distance down the anterior slope, and with granulated ribs and delicate transverse striae: others without the ray and with decussated striae; and others again intermediate between the two forms.

Family PANDORIDÆ.

Genus CŒLODON, Carpenter.

CŒLODON AVERSUS, *Hedley.* Studies on Aust. Moll., Pt. XI., P.L.S. N.S.W., Vol. 38, 1913, Pt. 2, p. 266.

s. *Cœlodon elongatus*, Hedley *non* Carpenter, P.L.S. N.S.W., 1906, Vol. 31, Pt. 3, p. 473; Hedley's List No. 180.

Family TELLINIDÆ.

Genus STRIGILLA, Turton.

STRIGILLA SINCERA, *Hanley.* Studies on Aust. Moll., Pt. XI., P.L.S. N.S.W., Vol. 38, 272.

s. *Strigilla Grossiana*, Hedley, P.L.S. N.S.W., Vol. 33, 1908, p. 474, Pl. 9, f. 21. No. 427, Hedley's list.

Family DONACIDÆ.

Genus DONAX, Linnæus.

DONAX VERUINUS, *Hedley.* Studies on Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 274.

s. *D. nitida*, Reeve, of which the name is pre-occupied. No. 461, Hedley's list.

Class GASTROPODA.

Order Amphineura.

Sub-Order POLYPLACOPHORA.

Chitones Regulares.

Group ISCHNOIDEA.

Genus CALLOCHITON, Gray.

CALLOCHITON PLATESSA, *Gould*, Caloundra, T. Iredale, Proc. Mal. Soc., Vol. IX., Part III., Sep., 1910, p. 157.

Genus ISCHNOCHITON, Gray.

ISCHNOCHITON CRISPUS, *Reeve*, Caloundra, loc. cit, p. 157.

ISCHNOCHITON DIVERGENS, *Reeve*, Caloundra, loc. cit, p. 157

ISCHNOCHITON SMARAGDINUS, *Angas*, Caloundra, loc cit. p. 157.

Ischnochiton smaragdinus picturatus, *Pilsby*, Caloundra, loc. cit., p. 157.

Group LOPHYROIDEA.

Genus CHITON, Linnæus.

Chiton limans, *Sykes*, Caloundra, loc. cit., p. 157.

Chiton nr. Coxi, *Pilsbry*, Caloundra, loc. cit., p. 157.

Chitones Irregulares.

Group PLACIPHOROIDEA.

Genus ORNITHOCHITON, Gray.

Ornithochiton quercinus, *Gould*, Caloundra. T. Iredale, Proc. Mal. Soc., Vol. IX., Part III., Sep., 1910, p. 157.

Genus PLAXIPHORA, Gray.

Plaxiphora costata, *Blainville*, Caloundra, loc. cit., p. 157.

Group MOPALOIDEA.

Genus ACANTHOCHITES, Risso.

Acanthochites costatus, *Adams and Angas*, Caloundra, loc. cit., p. 157.

Acanthochites variabilis, *Adams and Angas*, Caloundra, loc. cit., p. 157.

Acanthochites rejectus, *Pilsbry*, Caloundra, loc. cit. p. 157.

Order Prosobranchiata

Family FISSURELLIDÆ.

Genus EMARGINULA, Lamarck.

Emarginula bajula, *Hedley*, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 276.

s. E. dilecta, Hedley *non* A. Adams, P.L.S. N.S.W., Nov., 1906, Pt. 4, p. 521, No. 565, Hedley's list.

Family TROCHIDÆ.

Genus CALLIOSTOMA. Swainson.

CALLIOSTOMA POLYCHROMA, *A. Adams* (Hedley's list, No. 651). Studies Aust. Moll. P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 279.

s. *Trochus monile*, Hedley *non* Reeve, P.L.S. N.S.W., Vol. 33, 1907, p. 479. Hedley's list, No. 649.

CALLIOSTOMA COMPTUM, *A. Adams*, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 279.

s. *C. purpureo-cinctum*, Hedley, P.L.S. N.S.W., Vol. 19, 1894, p. 35, text-figure.

Genus CANTHARIDUS, Montfort.

CANTHARIDUS FOURNIERI, *Crosse*. Hedley, Stud. Aust. Moll., P.L.S. N.S.W., 38, Pt. 2, 1913, p. 281.

s. *Calliostoma oberwimmeri*, Preston, Shirley, Proc. Roy. Soc., 2., Vol. 23, 1911, p. 96.

Family TURBINIDÆ.

Genus TURBO, Linnæus.

TURBO MILITARIS, *Reeve*. Hedley, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 282.

s. *T. imperialis*, Angas *non* Gmelin, Hedley's list, No. 680.

Family RISSOIDÆ.

Genus SCALIOLA, A. Adams.

SCALIOLA BELLA, *A. Adams*, Hedley's list, No. 788.

s. *S. lapillifera*, Hedley, Moll. Funafuti, Mem. Aust. Mus. III., Pt. 7, p. 415.

Family HYDROBIIDÆ.

Genus IRAVADIA, Blandford.

IRAVADIA CLATHRATA, *A. Adams*, Hedley, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 284.

s. *Pyrgula clathrata*, A. Adams, Hedley's list, No. 825.

Family CAPULIDÆ.

Genus CALYPTRÆA, Lamarck.

CALYPTRÆA TENUIS, *Gray*, Hedley. Stud. Aust. Moll., P.L.S. N.S.W., 1913, p. 289.

s. *C. pellucida*, Tate. *non C. pellucida*, Reeve, Hedley's list. No. 832.

Family CERITHIIDÆ.

Genus CERITHIUM. Adanson.

CERITHIUM PIPERITUM, *Sowerby*. Hedley's list, No. 858.

s. *C. strictum*, Hedley, Moll. Funafuti, Mem. Aust. Mus., III., Pt. 7, p. 433. A young shell differing only in the colour and smaller number of granulations.

CERITHIUM LACTEUM, *Kiener*, Shirley, Proc. Roy. Soc. Q'land, Vol. 23, p. 149.

s. *C. spiculum*, Hedley. Moll. Funafuti, Mem. Aust. Mus., III., Pt. 7. p. 433. A variable shell in the relation of its two major axes. The figure 21 is typical.

Genus CLAVA, Humphries.

CLAVA NODULOSA, *Bruguière*, Hedley's list, No. 879.

s. *Contumax decollatus*. Hedley. Moll. Funafuti, Mem. Aust. Mus., III., Pt. 7, p. 437.

s. *Cerithium polygonum*, Sowerby. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 290.

Family TRITONIDÆ.

Genus CYMATIUM.

CYMATIUM DOLIARIUM. *Linnæus*. Shirley. Proc. Roy. Soc. Q'land, 23, 1911, p. 98.

Hedley, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 297, says. "All the specimens in the British Museum collection are from South Africa. There can be no doubt that these Australian records are fictitious." This kind of reasoning seems decidedly puerile. All the British Museum specimens of *Pyrene filmeræ*, Sowerby, were African, until

Queensland specimens were sent by me to Mr. E. A. Smith. It might as well be argued that the finding of *Cardita calyculata*, L, at Teneriffe, Voy. of Chall., XIII., pp. 10, 210, proves that it cannot exist in Australia ; and the same with such shells as *Pecten limatula*, Reeve, at Tristan da Cunha, loc. cit., pp. 12, 297 ; *Verticordia deshayesiana*, Fisher, at Pernambuco, loc. cit., pp. 4, 165, 167 ; *Arca imbricata*, Bruguière, from the West Indies, loc. cit., pp. 4, 259 ; and *Arca corpulenta*, Smith, from Juan Fernandez, pp. 5, 263.

Family TEREBRIDÆ.

Genus TEREBRA, Adanson.

TEREBRA FENESTRATA, *Hinds*, Proc. Zool. Soc., 1843, p. 153 ; Thes. Conch., I., 1844, p. 176, Pl. 44, f. 86.

T. cælata, Adams and Reeve. Hedley's Stud. Aust. Moll., XI., P.L.S. N.S.W., 1913, Vol. 38, Pt. 2, p. 305 ; Hedley's list, No. 1271.

TEREBRA POLYGYRATA, *Deshayes*, Hedley's Stud. Aus. Moll., XI., P.L.S. N.S.W., Pt. 2, 1913, p. 305 ; Hedley's list, No. 1286.

s. T. subtextilis, Smith. Shirley, Proc. Roy. Soc., Q., Vol. 23, 1911, p. 100.

TEREBRA TEXTILIS, *Hinds*, Proc. Zool. Soc., 1843, p. 156.

s. T. turrita, Smith. Hedley, Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 305. Hedley's list, No. 1293.

Family CONIDÆ.

Genus CONUS, Linnæus.

CONUS CYANOSTOMA, *A. Adams*. Hedley, Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 309.

s. C. Coxeni, Brazier. Hedley, No. 1304, Marine Mollusca of Queensland, loc. cit., p. 364.

Family MITRIDÆ.

Genus MITRA, Lamarck.

MITRA SCULPTILIS, *Reeve*. Hedley's list of Marine Mollusca of Queensland, No. 1492.

s. M. delicata, A. Adams, loc. cit., No. 1456.

Mitra Cookii, *Sowerby*. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 314.

s. *M. variabilis*, Angas *non* Reeve. Hedley's list, No. 1498.

Family COLUMBELLIDÆ.

Genus PYRENE, Bolten.

Pyrene acleonta, *Duclos*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W., 1913, Vol. 38, Pt. 2, p. 321.

s. *P. jaspidea*, Sowerby. Shirley, Proc. Roy. Soc., Q., Vol. 23, 1911, p. 101.

Family MURICIDÆ.

Genus TROPHON, Montfort.

Trophon recurvus, *Philippi*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 329.

s. *Trophon paivae*, Crosse. Hedley's list, No. 1624.

Family EULIMIDÆ.

Genus EULIMA, Risso.

Eulima constellata, *Melville*. Hedley. Stud. Aust. Moll., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 295.

s. *E. piperita*, Hedley, P.L.S. N.S.W., Vol. 34, 1909, p. 451, Pl. 43, f. 85.

Order Opisthobranchiata.

Family RINGICULIDÆ.

Genus RINGICULA, Deshayes.

Ringicula doliaris, *Gould*. Hedley, Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 336.

s. *Ringicula arctata*. Angas *non* Gould. Hedley's list, No. 1709.

RINGICULA DENTICULATA, *Gould*. Hedley. Stud. Aust. Moll., XI., P.L.S. N.S.W., Vol. 38, Pt. 2., 1913, p. 336.

s. *Ringicula caron*, Angas *non* Hinds. Hedley's list, No. 1711.

Family TORNATINIDÆ.

Genus RETUSA, Brown.

RETUSA DECUSSATA, *A. Adams*. Hedley, P.L.S. N.S.W., Vol. 38, Pt. 2, 1913, p. 337.

s. *R. impasta*, Hedley, No. 1904. Marine Mollusca of Queensland.

SOME OIL-BEARING SEEDS INDIGENOUS TO QUEENSLAND.

By FRANK SMITH, B.Sc., F.I.C.

(*Read before the Royal Society of Queensland, August 14th,* 1914.)

II.—THE OIL OF CALLOPHYLLUM INOPHYLLUM (Domba Nut).

Callophyllum inophyllum (N. O. Guttiferæ), widely distributed over East Africa, the East Indies and Polynesia, occurs plentifully in Queensland on the northern seaboard. The tree is an evergreen, commonly referred to in literature as the Alexandrian Laurel, the fruits as Laurel or Domba Nuts, under which latter name they were submitted to me through the courtesy of Howard Newport, Esq., Instructor in Tropical Agriculture. The examination of their oil is interesting in comparison with Callophyllum inophyllum oil elsewhere reported.

An account of the oil appears in the Agricultural Ledger (1911-12, No. 5) "Oils and Fats of India" (Dictionary of Economic Products), and its commercial examination has recently been conducted at the Imperial Institute. (Bull. Imp. Inst., Vol. XI., No. 4, Oct.-Dec., 1913.)

The Domba nut examined by the author agreed in general characteristics with Indian specimens. The average weight, enclosed in the dried pericarp, was 16.7 grams, of which the pericarp weighed 2.7 grams. The shell is soft, woody, and easily broken : the kernel yellowish-white, oval, and averages 7.2 grams in weight. The sample here described would appear somewhat larger than those elsewhere reported. Examination of the ground kernel showed a moisture content of 21.7 per cent., and of oil extracted by low boiling-point petrol of 54.7 per cent.

The oil is viscous, yellow in colour with a slight greenish tinge, and of slight bitter taste and faint aromatic odour. A bulk extraction was made by compression in a screw press, and a quantity of oil obtained possessing a deep blue colour and depositing some amount of crystalline substance on standing.

The blue colour given by Callophyllum oils by contact with iron has already been noticed (Bull. Imp. Inst. loc. cit.), and was due in the present case to use of an iron press. The blue colouration was also obtained by treatment with a small amount of alcoholic ferric chloride and is ascribable to the presence of a resino-tannol hereafter noticed. The deposited crystals were ascertained to be stearic acid.

ANALYTICAL CONSTANTS OF THE OIL.

	Queensland Sample.	Indian* Sample.	Indian† Sample.	Fiji† Sample.
Sp. gr. at $\frac{15.5°C.}{15.5°C.}$ ..	.9394	.9415		
Acid Value ..	73.8	67.5	77.5	16.2
Hehner No.	95.5		92.9	91.9
Sapon. Value	187.5	198.7	194.9	204.0
Iodine Value	100.0	95.3	93.1	92.2
Unsap. Matter	1.0%	.35%	1.4%	1.4%

THE CONSTANTS OF THE SEPARATED ACIDS.

	Queensland Sample.‡	Indian Sample.*
Neutralisation value	193.7	192.3
Iodine value ..	92.0	94.8

* Agr. Ledger loc. cit.

† Bull. Imp. Inst., loc. cit.

‡ Contains 6.7 per cent. of resin acid.

The Resin of Callophyllum inophyllum Oil.

The Indian oil is stated to contain 18.26 per cent of saponifiable resin which is separable by solution in hot dilute alcohol.

This treatment, however, removes a portion of free fatty acid and the separation was effected by the esterification method of Twitchell; 6.7 per cent of resin acid was obtained by this method as a dark viscid oil with a bitter taste. Its potash salt was soluble in excess of alcoholic potash, and it evidently possesses a high iodine absorption. It strikes an intense blue-black colouration with alcoholic ferric chloride.

The Composition of Callophyllum inophyllum Oil.

Fendler, quoted in the Agricultural Ledger (loc. cit), states this oil to contain palmitin, stearin and olein.

The fatty acids free from resin were found to have a neutralisation value of 199.8 corresponding to a mean molecular weight of 281.0. The iodine value is 78.0.

Separation of the liquid and solid fatty acids showed 73 per cent liquid and 27 per cent solid acids.

The iodine value of the liquid acids is 86.0 and precludes the presence of acids of higher degree of unsaturation than oleic acid. Fractional crystallisation of the solid acids from alcohol gave the following fractions : (1) incompletely melted at 85°C. ; (2) M. Pt. 69.5° C. ; (3) M. Pt. 68° C. ; (4) M. Pt. 62° C. Further fractionation of (1) gave a small proportion of a crystalline substance melting at 110° - 112° C., which was not identified and probably s not a fatty acid.

Fractions (2) and (3) comprised the major portion and are stearic acid. Fraction (4) coincides in melting point with palmitic acid.

Hence the glycerides of Callophyllum oil are composed principally of olein and stearin with a smaller proportion of palmitin. The high acid number is due to the presence in the normal oil of a considerable proportion of free fatty acid, notably stearic acid.

The Commercial Value of the Oil.

It is interesting to note that Callophyllum kernels are quoted by the Imperial Institute as worth £16 per ton, basing the valuation on an oil content of 71 per cent., the kernels being notably drier than those examined in the present instance. The oil is undoubtedly, from its non-drying property, best adapted for soap-making purposes. Its bitter taste is detrimental to its edible property. It is stated to be used as a burning oil by natives in India. Examination of a press-cake containing 15 per cent of oil showed it to contain .32 per cent P_2O_5, .68 per cent K_2O, 1.40 per cent N. Its manurial and nutritive value is, therefore, low.

Summary.

(1) Queensland Callophyllum inophyllum kernels are rich in a non-drying oil closely agreeing in properties with the oil described elsewhere.

(2) The oil is associated with a resino-tannol.

(3) It consists of olein, stearin and palmitin, as stated by another investigator, and a considerable proportion of free fatty acid.

III.—THE OIL OF THE SEED OF HERNANDIA BIVALVIS (Grease Nut.)

Hernandia bivalvis (N. O. Laurinæ) is a fair sized tree, evergreen and with a spreading head. It occurs widely distributed in the scrubs of Southern Queensland, though nowhere abundantly.

Mr. C. T. White supplies the following description of the fruit which matures in quantity in summer :—

" Fruit enclosed in an involucle which is nearly two inches broad, much inflated, scarlet in colour, fleshy when fresh, almost membraneous and distinctly verticulate when dry ; divided at the base into two valves. Fruit black, about 10 ribbed, with a small terminal umbo. Seed hard."

K. T. Staiger* dealing with the fruit and oil of the seed writes :—

"The shells of the fruit contain a dye soluble in soda, but not in ether, alcohol or water. The kernel contains 64.8 per cent of oil, which is similar to common laurel oil, is of the same consistency, and has, also, the same stearine and narcotic smell."

I have confirmed this observation with regard to the black pigment of the "shell" and as to the general properties of the oil, which extracted from the seed proper has a greenish tinge.

A quantity of fruit was obtained in February from a tree at Kelvin Grove, Brisbane.

As it was impracticable to remove the investing pericarp from the seed, the extraction of the oil was made from the ground whole fruit, and the oil obtained was dark brown in colour, due to removal of portion of the colouring matter of the "shell."

With regard to the percentage of oil present, extraction with low boiling-point petrol yielded 28.0 per cent. Since the "shell" constitutes approximately 35 per cent by weight of the entire fruit, the percentage calculated upon the seed proper or kernel to which its occurrence is confined, is 43.0 per cent, a figure appreciably lower than that given by Staiger.

The obviously oily nature of the seed, to which the popular name is attributable, has led to the chemical examination of the oil.

The seed is intensely bitter, and extraction of the oil with solvents removes also the bitter principle.

The Oil.

The oil was extracted in bulk with ether, and is dark brown in colour, slightly viscid, and of very bitter taste. It possesses an oily and curious narcotic odour.

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* Quoted in "The Queensland Flora," p. 1316.

Determination of its constants was made with the following results :—

Sp. gr. at $\frac{26°C.}{26°C.}$	.932
Acid Value	18.0
Hehner No (Insol. acids and unsaponifiable matter)	95.2
Unsaponifiable Matter	8.0 per cent.
Sapon. Value	186.0
Iodine Value	108.0
Reichert-Meissl Value	2.5

The Bitter Principle, Resin Acid, and Unsaponifiable Matter.

The bitter principle present in the oil is soluble in water and alcohol and is removable by washing with these solvents. It is non-alkaloidal.

Saponification of the oil with alcoholic potash showed an amount of insoluble deposit which proved to be the potash salt of a resin acid. Solution in water and acidification gave a brown resinous material, taken to be a resin-acid anhydride.

The resin acid present is dissolvable in alcohol and was obtained as a white non-crystalline resinous substance insoluble in petroleum spirit. It amounted to 4.0 per cent on the weight of the oil.

The unsaponifiable matter is a brown resinous oil.

The Insoluble Fatty Acids* were principally liquid and had the following constants :—

Neutralisation Value, 200.6, equivalent to Mean Molecular Weight, 279.5.

Iodine Value, 110.0.

Separated into their components, after removal of resin acid as potash salt insoluble in excess of alcoholic potash, there was obtained : liquid acids, 87 per cent ; solid acids, 13 per cent.

The Liquid Fatty Acids. Iodine value, 119.0.

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* Containing 4 per cent. of resin acid.

The comparatively high iodine value points to the presence of linoleic or linolenic acids.

In the products of oxidation by alkaline permanganate were identified dioxystearic acid (M. Pt. 130° C.) and a tetrahydroxy-stearic acid (sativic acid) (M. Pt. 156°-160° C). No linolenic hexabromide was yielded in the hexabromide test.

The liquid fatty acids are, therefore, oleic and linoleic acids.

THE SOLID FATTY ACIDS were fractionally crystallised from alcohol and were obtained in successive portions melting from 60-62° C., approximating to the melting point of palmitic acid, which is, therefore, the solid fatty acid present.

No indication was obtained of the presence of lauric acid, the glyceride of which constitutes a large portion of other oils of the N. O. LAURINÆ described, such as oils of *Laurus nobilis* (common laurel oil), *Litsœa sebifera*, *L. Stocksii* and *L. zeylanica*.

SUMMARY.

(1) The oil of the seeds of *Hernandia bivalvis* is associated with a bitter principle, a resin acid, and a resin oil.

(2) It consists of olein, linolein and palmitin; laurin, which is a constituent of other oils of N. O. LAURINÆ, is not present.

IV.—NOTE ON QUEENSLAND CANDLE-NUT OIL.

THE CANDLE NUT (*Aleurites moluccana* or *A. triloba* is widely distributed over the tropics of the Eastern Hemisphere, and is exceedingly common in the northern scrubs of coastal Queensland.

The oil contained in the nut is of recognised value for a variety of purposes. It belongs to the class of drying oils typified by linseed oil, and besides being adapted for burning and soap-making, is suitable for the preparation of oil-varnishes, paints and linoleum, in the manufacture of which linseed oil is largely utilised.

The cathartic properties that are generally recognised as pertaining to both kernels and oil mitigate against dietetic use. The nuts, however, were a common article of diet among the Queensland aboriginal tribes, being principally utilised after roasting, the action of heat minimising the deleterious effect.

The oil has been frequently described* but it has been deemed worth while to make a brief examination of that of Queensland origin from nuts kindly supplied by C. E. Wood, Esq., of the Kamerunga State Nursery.

Extraction with petroleum ether gave 70 per cent of pale yellow, limpid oil, a higher figure than generally reported.

Lewkowitsch gave 58.6 per cent ; Guthrie and Ramsay found 59.93 per cent in a sample of Pacific Island nuts ; and Wilcox and Thompson report a maximum of 66.25 per cent.

The following constants were determined :—

Saponification Value	187.0
Iodine Value	161.8
Hexabromides	13.2 per cent.

The iodine value agrees closely with the value given by Lewkowitsch, viz., 163.7, and the yield of hexabromides is markedly higher than the 7.28 - 8.21 per cent obtained by Walker and Warburton†, but below the value for linseed oil (23 per cent).

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* Lewkowitsch, "Oils, Fats, and Waxes." 3rd Edition, Vol. II., p. 468.

Guthrie and Ramsay. Agric. Gazette, N.S.W., 17 (1906), p. 859.

Wilcox and Thompson. Hawaii Agric. Exp. Stat. Bull 39 (1913).

† Analyst, 1902, 237.

Its drying power is undoubtedly high and but little inferior to that of some qualities of linseed oil.

The assertion is warranted that the candle-nut in Queensland constitutes an asset of considerable potential value.

I desire to acknowledge the facilities kindly placed at my disposal by the Agricultural Chemist, that have made the prosecution of this work possible.

A NOTE ON THE PRECAVAL SYSTEM OF *HYLA CÆRULEA*, *White*.

By C. D. GILLIES, B.Sc.

BIOLOGICAL LABORATORY, UNIVERSITY, BRISBANE.

(PLATE VIII.)

(*Read before the Royal Society of Queensland, August 14th, 1914.*)

ON account of its suitability for dissection, considerable numbers of *Hyla cærulea* are used in the Biology Department of the University of Queensland. Most of the text books on the anatomy of the frog (1), (2), (3), (4), describe species of *Rana*, and *H. cærulea* is found to differ in some respects from these. Considerable differences are shewn in the arrangement of the precaval blood vessels, and as this system had apparently not been previously described in *H. cærulea*, Miss Freda Bage, M.Sc., while Acting Lecturer in Biology at the University, suggested that I should undertake this investigation.

A number of frogs were examined, but no appreciable variations amongst the precaval systems of these was observed, and both the right and the left were found to be similar.

The precaval is formed by the union of three veins :—

A. LINGUAL.—This vein is the most anterior, and runs parallel to the long axis of the body, returning blood from the tongue.

B. Innominate.—The innominate is the median vein, and is formed by the following :—

(1) External jugular. This opens into the origin of the innominate, a short distance from the junction of the latter with the precaval. It is formed by :—

(*a*) Internal jugular, which returns blood from the head ; and the

(*b*) Mandibular, which comes from the lower jaw and into which, near the suspensorium, runs the maxillary vein from the upper jaw.

(2) Subscapular. This vessel runs from the muscles of the shoulder, and receives a vein which returns blood from the muscles of the shoulder and the skin. It is proposed to term this vessel *the somatic vein.*

C. Subclavian.—The subclavian is the most posterior vein, and is formed by the following :—

(1) Brachial, which comes from the arm ;

(2) Musculo-cutaneous, which returns blood from the walls of the abdomen and the skin ; and the

(3) Coracoid, a small vein running into the subclavian, from the coracoid region.

In Southern Universities an allied species, *H. aurea*, is used in teaching anatomy. On comparison of the precaval system of *H. cærulea* with that of *H. aurea*, it is found that both agree in the possession of a coracoid vein, though Dr. Sweet (5) says that in *H. aurea* it is not always present, and two may occur. Another point of resemblance is the possession in both forms of a branch from the skin, running into the mandibular vein at the angle of the jaw. The points of difference may be tabulated as follows :—

Vein. ..	*H. cærulea.*	*H. aurea.*
Lingual ..	Flows directly into the pre-caval	Unites with the mandibular.
	Only one present.	Generally a number of smaller veins open in front of the main vessel.
External ..	Runs into the innominate.	Runs into the precaval.
Jugular ..	Formed by the mandibular and the internal jugular.	Formed by the mandibular and the lingual.
Innominate	Formed by the union of the subscapular and the external jugular.	Formed by the union of the subscapular and the internal jugular.
Somatic ..	Present.	Absent.

The presence of the somatic vein in *H. cærulea* and its absence in *H. aurea* is an important difference.

My thanks are due to Miss Freda Bage, M.Sc., and Dr. T. Harvey Johnston for their kind assistance.

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(1) Marshall, "The Frog."

(2) Parker and Haswell, "Textbook of Zoology," Vol. II.

(3) Thomson, "Outlines of Zoology."

(4) Wells and Davies, "A Textbook of Zoology."

(5) Sweet, G., Proc. Roy. Soc., Victoria, XXI., 1908, p. 349.

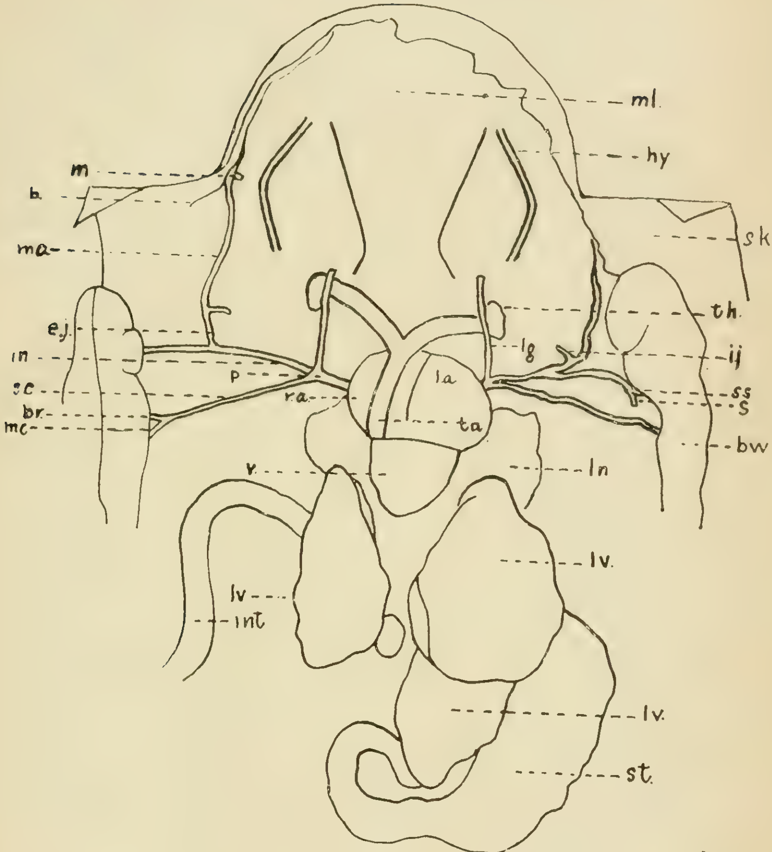
PLATE VIII.

FIG. 1.—Sketch of a dissection of *Hyla cærulea* from the ventral surface, shewing the precaval system.

FIG. 2.—Diagrammatic representation of the precaval system of *Hyla cærulea.*

REFERENCE TO LETTERING.

b. vein from the skin
br. brachial vein
bw. body wall
c. coracoid vein
ej. external jugular vein
hy. hyoid bone
ij. internal jugular vein
in. innominate vein
int. intestine
lg. lingual vein
ln. lung
lv. liver
l.a. left auricle
m. maxillary vein
ma. mandibular vein
ml. muscle
mc. musculo-cutaneous vein
p. precaval vein
r.a. right auricle
s. somatic vein
s.c. subclavian vein
sk. skin
st. stomach
ss. subscapular vein
sv. sinus venosus
t.a. truncus arteriosus
th. thyroid gland
v. ventricle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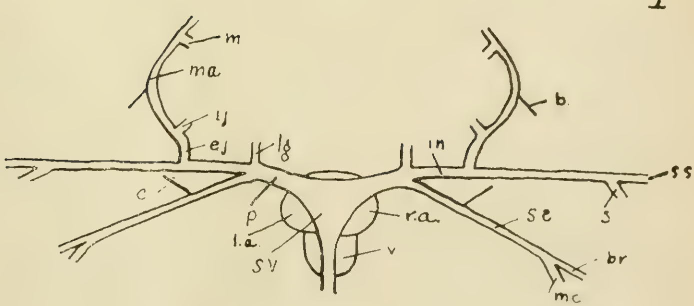
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NOTES AND EXHIBITS.

(*Before the Royal Society of Queensland, August 14th, 1914*).

ENDOPARASITES (TREMATODA).

Dr. T. Harvey Johnston exhibited specimens of a trematode, *Dolichosaccus ischyrus*, J. S. Jnstn, which he had collected from the intestine of the common green frog, *Hyla cærulea*, in the Brisbane district. This species was described by Dr. S. J. Johnston (Proc. Linn. Soc., N.S. Wales, 36, 1912, p. 313, pl. 17), whose material was obtained from the same species of frog as well as from another in the neighbourhood of Sydney, N.S. Wales. The parasite is here recorded for the first time as occurring in Queensland.

He also exhibited specimens of a large trematode taken by Mr. A. C. Bligh, from the swim-bladder of a fresh-water catfish (Siluroid), *Copidoglanis tandanus*, caught in the Condamine River, near Warwick, Queensland. These parasites, which were obtained in February, 1911, through the kindness of the Government Entomologist, Mr. Henry Tryon, have proved to be a species of *Isoparorchis*. This genus was recently established by Southwell (Rec. Indian Museum 9 (2), 1913, pp. 91-95), for the reception of a species, *I. trisimilitubis*, Southwell, which was taken from the air-bladder of a fresh-water siluroid, *Wallago attu*, at Bankipur, in Northern India. It is of interest to find very closely related species of this genus occurring in freshwater catfish in two such widely-separated localities as India and Queensland. A full description of the Queensland species will be published by Dr. S. J. Johnston, of the Sydney University.

ADDITIONS TO THE ROTIFERA OF QUEENSLAND.

By W. R. COLLEDGE.

(*Read before the Royal Society of Queensland, September 28th*, 1914.

THE present paper brings before the Society a few additions I have made to the known Rotifera of our State. In the year 1889, Surgeon Gunson Thorpe visited Brisbane, and subsequently gave to this Society two papers containing a list of 23 of these interesting microscopic animals. Four years ago I gave a paper extending the number to 102, I am now able to add 32, thus bringing the total up to 134 species. There are probably about 1,000 species which have been identified. These are distributed over all parts of the world. No country can claim exclusively any particular species. Some of the same kinds, found in Africa and Australia, were found on Ross Island in the Antarctic regions by Mr. James Murray. Some specimens were got from the bottom of a lake which had been solidly frozen for an unknown number of years. Fifteen feet of solid ice were bored before the layer of mud was reached in which they lay, but they recovered, and came to life immediately they were placed in water. At Padua, in Italy, ten species were found living in the hot springs at a temperature from 35° to 45° Centigrade. Thus, though of remarkably delicate and complicated organisation, they are capable of existing under a wide range of temperature.

LIST OF QUEENSLAND ROTIFERA.

The additions now made are marked with an asterisk, while those originally contributed by Gunson Thorpe are marked thus†.

Order I.—RHIZOTA.

Family 1.—Flosculariadæ.

† *Floscularia coronetta.* Cubitt.
,, *longicaudata.* Hudson.
† ,, *ornata.* Ehrenberg.
,, *campanulata.* Dobie.
* ,, *trilobata.* Collins.
Stephanoceros eichornii. Ehrenberg.

Family 2.—Melicertadæ.

† *Melicerta conifera.* Hudson.
† ,, *ringens.* Schrank.
* ,, *tubicola.* Ehrenberg.
† *Limnias annulatus.* Bailey.
† ,, *ceratophylli.* Schrank.
* *Cephalosiphon limnias.* Ehrenberg.
Œcistes brachiatus. Hudson.
,, *crystallinus.* Ehrenberg.
* *Lacinularia elliptica.* Shepherd.
* ,, *racemovata.*
* ,, *socialis.* Ehrenberg.
* *Megalotrocha alboflavicans.* Ehrenberg.
* ,, *semibulla.* Thorpe.
* ,, *spinoza.* Thorpe.
Conochilus dossuaris. Hudson.
,, *unicornis.* Rousselet.
,, *volvox.* Ehrenberg.

Order II.—BDELLOIDA.

Family. Philodinadæ.

† *Philodina citrina.* Ehrenberg.
* ,, *megalotrocha.* Ehrenberg.
† *Rotifer vulgaris.* Schrank.
† *Actinurus neptunius.* Ehrenberg.

Order III.—PLOIMA.

Sub-Order. *Illoricata.*

Family. Microdidæ.

Microdida chlæna.

Family. Asplanchnadæ.

Asplanchna amphora. Hudson.
,, *amphora,* male.
,, *brightwellii.*
* ,, *intermedia.* Hudson.
* *Asplanchnopus myrmelio.*
* ,, ,, male.
Sacculus viridis. Gosse.
Syncheta ovalis.
,, *stylata.* Wierz.
,, *tremula.* Ehrenberg.

Family. Triarthradæ.

† *Polyarthra platyptera.* Ehrenberg.
Triarthra longiseta. Ehrenberg.
Cyrtonia tuba. Rousselet.

Family. Hydatinadæ

Notops brachionus. Ehrenberg.
,, *clavulatus.* Ehrenberg.
* *Triphylus lacustris.* Ehrenberg.
,, ,, male.

Family. Notammatadæ.

Taphrocampa annulosa. Gosse.
Notammata aurita. Ehrenberg.
,, *clavulata.* Ehrenberg.
,, *brachionus.* Ehrenberg.
Copeus copeus. Ehrenberg.
,, *cerberis.* Gosse.
,, *pachyurus.* Gosse.
Cœlopus brachyurus.
Diglena forcipata.
,, *grandis.*
Eosphora aurita. Ehrenberg.
,, *digitata.*

Furcularia longiseta. Ehrenberg.
,, *equales.* Ehrenberg.
* ,, *forficula.* Ehrenberg.
* ,, *melandicus.*
* ,, *microphus.*
* *Proales parasitica.* Ehrenberg.
,, *sordida.* Gosse.
Triopthalmus dorsualis. Ehrenberg.

Sub-Order. *Loricata.*

Family. RATTULIDÆ.

Rattulis bicornis. Ehrenberg.
,, *bicristata.*
,, *birostris.*
,, *carinatus.* Ehrenberg.
,, *elongata.* Gosse.
,, *mucosus.* Ehrenberg.
,, *tigris.* Müller.
Diurella porcellus. Gosse.

Family. DINOCHARIDÆ.

Dinocharis tetractis. Ehrenberg.
,, *collinsii.* Gosse.
Scaridium eudactylotum. Gosse.
† ,, *longicaudum.* Ehrenberg.
* *Stephanops intermedius.* Burn.

Family. SALPINADÆ.

* *Diachiza cœca.* Gosse.
,, *paeta.* Gosse.
,, *semiaperta.* Gosse.
Salpina brevispina. Ehrenberg.
* ,, *cortina.*
† ,, *eustala.* Gosse.
,, *macracantha.* Gosse.
* ,, *ventralis.*
Diplax trigona. Gosse.
† *Diplois daviesiæ.* Gosse.

Family. EUCHLANADÆ.

Euchlanis dilatata. Ehrenberg.
,, *oropha.*
† ,, *triquetra.* Ehrenberg.

Family. CATHYPNADÆ.

* *Cathypna brachydactyla.* Stenross.
,, *leontina.*
† ,, *luna.* Ehrenberg
* ,, *ungulata.*
Monostyla bulla. Gosse.
,, *cornuta.* Ehrenberg.
† ,, *lunaris.* Ehrenberg.
,, *quadridentata.* Ehrenberg.

Family. COLURIDÆ.

† *Colurus amblytelus.* Gosse.
,, *dactylotus.* Gosse.
,, *deflexus.* Ehrenberg.
Metopidia acuminata. Ehrenberg.
,, *lepadella.* Ehrenberg.
,, *oblonga.*
* ,, *ovalis.*
* ,, *ohioensis.*
,, *oxysternum.* Gosse.
,, *solidus.* Gosse.
,, *triptera.* Ehrenberg.
Cochleave turbo.

Family. PTERODINADÆ.

* *Pterodina incisa.* Ternety.
* ,, *reflexa.* Gosse.
† ,, *patina.* Ehrenberg.

Family. BRACHIONIDÆ.

Brachionus angularis. Gosse.
† ,, *bakerii.* Ehrenberg.
,, *falcatus.* Zacharius.
† ,, *militaris.* Ehrenberg.
,, *pala.* Ehrenberg.
,, ,, var. *amphiceros.*
,, *rubens.* Ehrenberg.
,, *urceolus.* Ehrenberg.
Noteus quadricornis. Ehrenberg.

Family. ANURÆADÆ.

† *Anuræa aculeata.* Ehrenberg.

,, ,, no ventral spines.

,, *cochlearis.* Gosse.

,, *tecta.* Gosse.

Family. PLEOSOMADÆ.

Pleosoma lenticulares. Vorce and Herrick.

Gastropus minor.

,, *stylifer.*

Anapus ovalis.

ORDER. SCIRTOPODA.

Family. PEDALIONIDÆ.

† *Pedalion mirum.* Hudson.

† *Trochosphæra æquatorialis.* Semper.

† ,, ,, male.

SOME NEW QUEENSLAND ENDOPARASITES.*

By **T. HARVEY JOHNSTON, M.A., D.Sc., F.L.S.**
BIOLOGY DEPARTMENT, UNIVERSITY, BRISBANE.

(PLATES IX. & X.)

(*Read before the Royal Society of Queensland November 9th*, 1914.)

Sphæruterina punctata n. sp.

(Pl. IX., figs 1-13.)

FROM the intestine of a "thickhead" or "whistler," *Pachycephala rufiventris* Lath. shot at Caloundra, August, 1914, there were collected numerous pale translucent cestodes reaching about 4 cm in length, and about .65 mm in maximum breadth. The posterior segments readily separated off from the rest of the strobila owing to the presence of very deep constrictions. Each ripe proglottid was seen to contain in its anterior half a dark or brownish rounded egg capsule, this "spotted" appearance suggesting its specific name.

Scolex.—The scolex, whose breadth is .31 mm, bears prominent suckers and rostellum, capable of being withdrawn into a powerful muscular rostellar sac. The rostellum is provided with two series of hooks, those in the anterior circlet being larger than those forming the second row, with which they alternate. There are ten or twelve in each series. The hooks of the first circlet are rather wide and

*The types of the new species described in this paper as well as in a former paper, "Notes on some Entozoa," Proc. Roy. Soc. Queensland, XXIV., 1912, pp. 63-91, have been deposited in the Queensland Museum, Brisbane.

measure .07 mm from the tip of the claw to the dorsal root. Those of the other set are .45 mm long, and have a different shape, the claw being shorter and more strongly curved. They more closely resemble those described from species of *Biuterina* than do the anterior hooks. The dorsal and ventral roots are considerably thickened in both sets.

Strobila.—An unsegmented neck is absent. Immediately behind the scolex, proglottids measure nearly .2 mm in width, and though short, are quite distinct. Sexually mature joints are about .13 mm in length and .3 mm in maximum breadth. They gradually become relatively longer, until their dimensions are about .4 mm and .5 mm respectively. Mature segments, found free in the intestine, were about .75 mm long and .7 mm wide, their shape being that of a triangle with the apex removed. The large egg capsule occupies the apical region, unless it has been already extruded. The postero-lateral edges of older segments project freely. The amount of overlapping is small.

Genital pores alternate irregularly and lie marginally just in front of the middle of the proglottid. There is a genital cloaca. Only rarely can a genital papilla be seen.

Calcareous corpuscles of at least two kinds, large and small, are to be found in the cortex. The former, which are rare, are somewhat disc-shaped with radiating depressions on the surface, and may measure as much as .02 mm. The smaller ones are fairly common and possess the usual rounded or elliptical outline. They measure about .007-.008 mm by .005-.004 mm.

The longitudinal musculature is arranged in two concentric series of rather large bundles, the individual bundles, as well as the series, being close to one another. Transverse fibres are to be seen occasionally in sections, their position being internal to the longitudinal series.

The ventral excretory canal is relatively very wide, the small dorsal vessel being directly above it. The latter has a more sinuous course than the former. A wide transverse vessel connects the ventral canals near the posterior end of each segment. The main longitudinal nerve is situated immediately dorso-laterally to the ventral canal of the corresponding side. The sexducts pass between the excretory vessels and dorsally to the nerve.

Male genitalia :—There are about eight testes each 30-40 μ in diameter, lying behind the ovary and uterus, but above the vitellarium. Occasionally some occur in the medulla between, and laterally from, the excretory canals.

The vas deferens becomes considerably coiled on the pore side of the uterus and paruterine organ. It lies above and close to the vagina, its course being approximately parallel to it. Both of these ducts pass outwards just dorsally to the nerve and ventral vessel, the vas deferens entering the small cirrus sac within whose inner portion it becomes coiled. The cirrus sac is a pyriform structure, 25-30 μ in maximum width and 50-60 μ in length. Its musculature is weak. The organ does not extend inwardly as far as the excretory canals. It contains a small cirrus. The male pore lies at the bottom of a genital cloaca, its position being immediately dorsal or antero-dorsal to the female aperture.

Female organs :—The small bilobed ovary lies in the anterior part of the segment, in front of the testes. It is not median but is situated in an oblique position nearer the pore-bearing edge. The vitellarium is placed posteriorly below the testes.

From the female aperture which lies just below the male pore, the vagina travels inwards below and beside the vas deferens and immediately above the nerve and ventral excretory canal. A small receptaculum seminis may be recognisable. The vagina bends slightly backwards.

The uterus appears near the centre of the segment but rather towards the aporal side, just in front of, and ventrally to the testes, but behind the ovary. It is a simple spherical sac. As it develops the testes and ovary soon disappear. A mass of altered parenchyma makes its appearance antero-ventrally from the uterus, this paruterine organ developing rapidly. At first it is a short, narrow, longitudinally-placed, more or less median, mass of tissue, becoming tubular. The position of the uterus undergoes alteration, this organ being gradually displaced so as to lie in the posterior part of the proglottid, though occasionally it remains in the middle of the segment as a very large simple sac with numerous ripe eggs within it. The anterior part of the paruterine organ undergoes differentiation to form an expanded rounded capsule, the tubular portion becoming wider and more sinuous. This capsule is sharply marked off from the surrounding tissues, especially laterally and anteriorly. It increases in size and ultimately occupies most of the medulla of the anterior part of the segment. Its dimensions while within the proglottis vary from .22 by .14 mm to .30 by .24 mm. Some which had been extruded from the segment measured .4 by .3 mm.

The capsule consists of an outer coarse layer which stains very deeply with eosin and of an inner zone which retains the hæmatoxylin dye. It is within the latter that the eggs come to lie imbedded. The outer layer does not cover the posterior face of the capsule, the egg-containing tissues being in continuity with the paruterine organ, through which the eggs have travelled from the uterus to the capsule. The peripheral region of the inner zone of the capsule possesses numerous rod-like structures resembling crystalloids, but they do not polarise light. Eggs may occur in this peripheral area. A few fusiform granular bodies were seen in this layer in several capsules.

The paruterine organ has a vacuolate appearance and has what seems to be an axial series of nuclei. The contents of the tube appear to be albuminous.

Ripe eggs are to be found in the capsule and more or less commonly in the uterus.

They measure from .035 by .030 mm to .040 by .035 mm., the contained oncosphere being about .024 mm. in diameter. The embryonal hooklets are .010-.012 mm long, with a long claw whose length is equal to the distance between the dorsal and ventral roots.

Systematic :—The parasite belongs to the Paruterinidæ, but differs from the armed genera, *Biuterina*, *Paruterina* and *Culcitella*. The arrangement of the excretory canals is characteristic in the last named. The uterus is simple in our form whereas it is more or less completely bilobed in *Biuterina* and crescentic or else rather broader than long in *Paruterina*. Besides, the testes are numerous in the last named two genera whereas they are few in the cestode from *Pachycephala*. It appears to resemble *Rhabdometra* in many ways, but the latter has an unarmed scolex.

The new genus for which the name *Sphæruterina* is proposed, may be characterised as follows :—Paruterinidæ ; rostellum armed with two rows of hooks ; genital pores alternating irregularly ; genital ducts passing between the excretory canals and dorsally to the longitudinal nerve ; testes few, situated behind the female organs ; uterus rounded and simple ; paruterine organ terminating in an anteriorly-situated capsule—near *Paruterina* and *Biuterina*. In birds.

Type : *Sphæruterina punctata* Jnstn from *Pachycephala rufiventris* Lath.

Thelastomum alatum n. sp. (Oxyuridæ.)

(Pl. X., figs. 3-7.)

From the intestine of the larva of a Cetonid beetle, *Cacachroa decorticata* Macl, from Cairns, North Queensland, collected by Mr A. A. Girault, and forwarded through the Director of the Queensland Museum, Brisbane.

Female :—Total length 2.9 mm ; the tail, *i.e.*, from the anus to the posterior end of the parasite, being .9 mm. (figs. 3, 5.) The female is rather a stout worm whose anterior end is gradually narrowed. The posterior region becomes strongly constricted to form a long, almost straight, sabre-like tail of fairly uniform width except at the end, where it is pointed. The greatest breadth is the region of the vagina (about .20 mm). This organ terminates on a relatively large, backwardly projecting prominence situated in the posterior half of the body, about .6 mm in front of the anus.

The mouth is borne on a small, projecting ring well marked off from the rest of the body. The pharynx, including the gizzard, has a length of .50 mm. Just prior to entering the latter, it narrows somewhat. The pyriform gizzard has a diameter of .09 mm, and is marked off from the rest of the pharynx by a constriction. The intestine is wide and croplike in its anterior portion, with a diameter of .15 mm, soon becoming narrowed to about half this. The nerve ring lies at .2 mm behind the mouth, while the excretory pore is situated in the region of the gizzard at about .4 mm behind the mouth. The short common excretory duct has a somewhat sinuous course.

The ovary can be traced from the dorsal region near the anus, where it may form a loop, forwards almost to the gizzard. Here it turns back almost to the anus in a more ventral position than before. Fertilisation occurs in this region and the duct travels anteriorly as a wide uterus crowded with eggs, commonly arranged in two rows, terminating at the female genital pore, which, as already stated, lies on an eminence. Ripe eggs measure about .08 by .05 mm.

Male:—The male is very small, measuring from .97 to 1.17 mm. in length, the maximum breadth being about .09 mm. (Figs. 4, 6, 7.) The anus projects strongly, and behind it the body is narrowed rapidly to form a short tail .06 mm long, whose anterior half is much broader than the posterior half. The latter terminates in a fine point. The former is arched dorsally and at its junction with the posterior part is a pair of tail papillæ. At each side of the hind portion of body is a prominent ala, which, just in front of the anal region, is somewhat arched and expanded. It becomes narrowed and then again widened to form a rather thin rounded lobe lying above the anus and terminating at the base of the tail. The nerve ring is situated at about .09 mm, and the excretory aperture at about .17 mm from the anterior end. The testis is relatively large. The male spiculum measures .045 mm and is clubshaped and slightly curved, its point being sharp. There appear to be a pair of small papillæ in the neighbourhood of the anus.

Spiroptera megastoma Rud.

From a tumour in the stomach of a horse, Eidsvold, Burnett River, collected by Dr. T. L. Bancroft. This species, though probably not uncommon, is apparently now recorded for the first time as occurring in Queensland.

Agamonema sp.

(Pl. X., figs. 1, 2.)

A small number of white ellipsoid cysts were taken recently from *Hyla cærulea* caught in Brisbane (Oct, 1914). They were lying more or less loosely in the wall of the stomach, just below the peritoneum. Each contained a single nematode, probably a *Spiroptera*, lying in its central area, surrounded by a tough fibrous coat, the "worm area" being about half the diameter of the cyst. The largest cyst measured .9 mm by nearly .7 mm and the smallest .65 by .47 mm.

By teasing out the capsule, the contained worm was liberated. The following account is based upon the largest parasite obtained.

Length 3.10 mm; breadth .010 mm. The body is finely annulate, the rings being, however, scarcely recognisable anteriorly. The anterior end is rounded and only slightly attenuated while the posterior extremity is pointed, there being a short tail, .010 mm, in front of whose end lies the anus. The three lips each bear a small labial papilla, not readily detected. Delicate longitudinal striæ are recognisable on the cuticle of the body.

There is a relatively long tubular pharynx, .43 mm in length, terminating in a slight swollen portion. The anterior end of the intestine is rounded, a deep constriction separating it from the pharynx. The cloaca extends inwards for .075 mm from the anus and is lined by a thick cuticle which is so disposed that it has the appearance of two approximately equal spicules with rounded or clublike inner ends separated from each other, and with sharp outer extremities. It is possible that these may be two male spicules or a single deeply-grooved seta with a bifurcate end.

The nerve ring lies at a distance of .015 mm behind the mouth, and immediately in front of the ring is the excretory aperture.

This larval parasite appears to belong to the Spiropteridæ and is included for the present under the collective generic name, *Agamonema*.

Echinorhynchus h·lœ n sp.

(Pl. X., figs. 8, 9.)

A solitary specimen of this species was found recently, encysted just below the peritoneal surface of the liver of a frog, *Hyla cœrulea*, caught near Brisbane. The white cylindrical cyst measured 1.4 mm in length and about .5 mm in width.

Though the parasite was in a larval stage, yet enough of its anatomy was recognised to justify naming it. I have compared it with an Echinorhynch which was described by me in 1912.* from a *Hyla aurea* caught near Sydney some years ago and am satisfied that the two belong to the same species. They have the same size and general appearance. The characters of the rostellum are described there. In our present specimen this organ is not fully everted but the hooks on its base correspond in shape, size and arrangement with those similarly placed in the case of the former parasite (fig.9).

The rostellar sac with the introverted rostellum measured .9 mm in length. One giant nucleus was distinctly seen, and there appeared to be a second one present. Each lemniscus measured .5 mm, being of about the same length as the introverted proboscis. They were rather shorter than those present in the specimen from *Hyla aurea*. The suspensory ligament and associated organs were considerably coiled and consequently the details of structure were not satisfactorily made out. Sex glands were not recognised, though the vas deferens, vesicula, and the relatively large copulatory bursa were to be seen. The walls of the bursa were thick and much folded internally. The general anatomy is shown in pl. X. fig. 8.

*Proc Roy. Soc. Queensland, XXIV., 1912, pp. 84-85, pl. II. figs. 9, 10

PLATE, IX.

Sphæruterina punctata n. sp.

Fig. 1. Eggs.
Fig. 2. Ripe proglottis, showing capsule; also eggs in uterus.
Fig. 3. Free segment showing capsule almost extruded.
Fig 4. Scolex.
Fig. 5. Hooks of first series.
Fig. 6. Hooks of second series.
Fig. 7. Segment showing genitalia.
Fig. 8, 9. Segments showing developing paruterine organ.
Fig. 10. Longit. horiz. sect. of segment.
Fig. 11. Part of fig. 10, more highly magnified.
Fig. 12. Trans. sect. segment, showing capsule.
Fig. 13. Trans. sect. segment, showing genital pore.

PLATE. X.

Agamonema sp. from *Hyla cærulea.*

Fig. 1. Anterior end.
Fig. 2. Posterior end.

Thelastomum alatum n. sp.

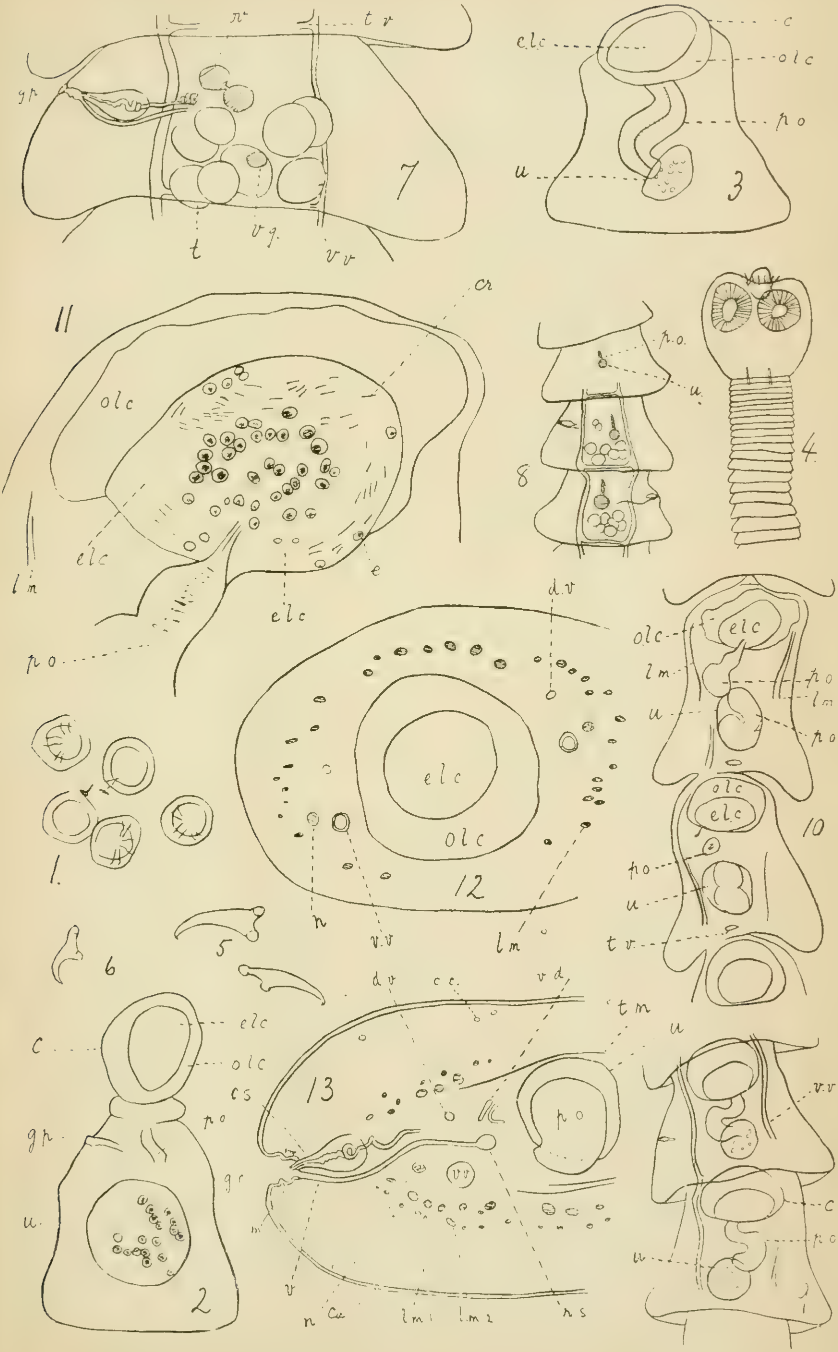
Fig. 3. Female worm.
Fig. 4. Male worm—same magnification as fig. 3.
Fig. 5. Female, anterior end.
Fig. 6. Male, anterior end, same magnification as fig. 5.
Fig. 7. Male, posterior end, same magnification as fig. 6.

Echinorhynchus hylæ n. sp.

Fig. 8. Entire specimen.
Fig. 9. Hooks from base of rostellum—seen from various positions.

REFERENCE TO LETTERING.

a, anus; al., ala; b., bursa; c., capsule; c.c., calcareous corpuscle; cr., ? crystalloids; c.s., cirrus sac; cu., cuticle; d.v., dorsal excretory vessel; e., egg; e.l.c., egg-containing layer of capsule; e.p., excretory pore; g., gizzard; g.n., giant nucleus; g.c., genital cloaca; g.p., genital pore; i., intestine; l., lip; lem., lemniscus; l.m., l.m. 1., l.m. 2., longitudinal muscle bundles; m., muscle; n., nerve; n.r., nerve ring; o.l.c., outer layer of capsule; ov., ovary; p., pharynx; p.s., proboscis sheath; p.o., paruterine organ; r., rostellum; r.s., receptaculum seminis; s., sucker; s.l., suspensory ligament; sp., spicule; t., testis; t.m., transverse muscle; t.p., tail papillæ; t.v., transverse excretory vessel; u., uterus; v., vagina; v.d., vas deferens; v.g., vitelline gland; v.s., vesicula seminalis; v.v., ventral excretory vessel.



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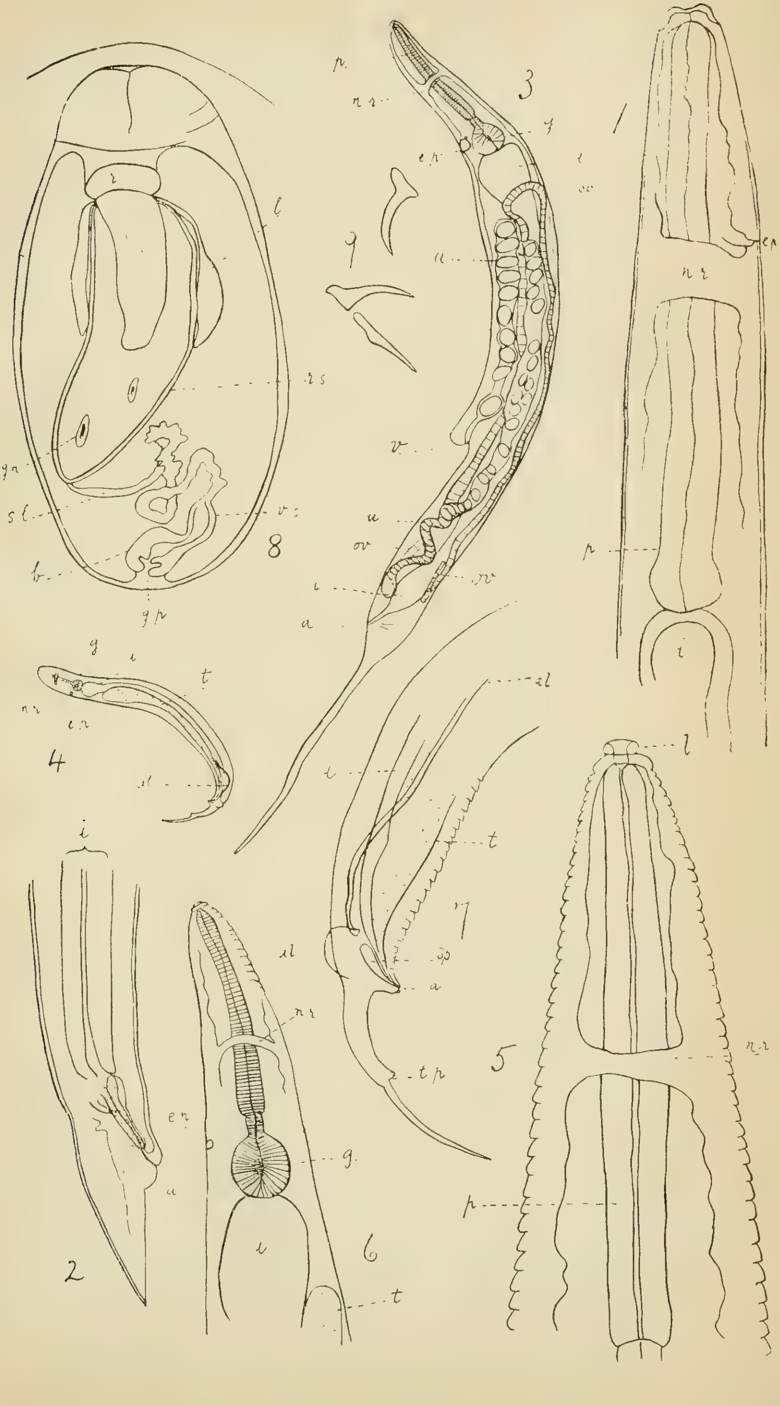

THE FREEZING POINT OF SOME ABNORMAL MILKS.

By J. B. HENDERSON, F.I.C., and
L. A. MESTON.

(*Read before the Royal Society of Queensland, November 9th, 1914.*)

On the 15th May, 1914, among several samples of milk submitted for analysis in the Government Chemical Laboratory, Brisbane, by a Food Inspector, were two, from different sources, which gave the following results on analysis :—

	No. 4349. (6 cows)	No. 4353 (2 cows)
Total Solids	11.60 per cent	11.69 per cent
Fat	3.86 per cent	3.90 per cent
Solids not fat	7.74 per cent	7.79 per cent
Ash	0.80 per cent	0.78 per cent
Nitrogen	0.49 per cent	0.47 per cent
Chlorine in Ash	22.6 per cent	22.6 per cent
Chlorine in Ash as NaCl	37.2 per cent	37.2 per cent
Ratio $\frac{\text{Ash}}{\text{NaCl}}$	2.68	2.68
Ratio $\frac{\text{Ash}}{\text{S.N.F.}}$	10.3	10.0
Freezing Point	0.55°C	0.54°C
Composition of *Solids not fat* :—		
Milk Sugar	49.2 per cent	51.4 per cent
Proteids	40.3 per cent	38.4 per cent
Ash	10.3 per cent	10.0 per cent

The fat, solids not fat, and nitrogen are all low, while the ash is just a shade above normal and the proportion of chlorine in the ash much above normal. The freezing point is however in each case practically normal.

At first glance the analytical results seem to indicate that each milk is a milk which has been watered, and a little common salt added to lower the freezing point again to normal. Added water, if calculated on the basis of a normal solids not fat of 8.9 per cent., in sample " A " would reach 13 per cent. The excess of salt present in the sample would lower the freezing point to cover an addition of 12.5 per cent. of added water. Similarly added water in sample " B " if calculated on the 8.9 solids not fat standard would reach 12.5 per cent., while the excess of salt present would lower the freezing point to cover 12 per cent. of added water. In each case there is a remarkable agreement between the deduction made from the solids not fat standard and that from the excess of salt.

As against the weight of analytical evidence for adulteration there stands the fact that the freezing point was in each case normal and that it would probably be beyond the skill of any dairyman to exactly adjust the freezing point of the mixture of water and milk.

The attention of the Commissioner of Public Health was called to the peculiar facts of these two cases, and it was decided to investigate each case further.

It was found that the samples were from the same district, sample " A " being the mixed milk from six cows, and " B " the mixed milk from two cows.

Twelve days after the legal samples were taken, a food inspector familiar with the milking of cows attended in the afternoon at each dairy, saw each cow milked and "stripped," and measured and sampled the milk from each cow. The mixed milk in each herd was unfortunately not sampled, the results given for the mixed milk in the following table being calculated from the individual yield.

HERD A.—(6 COWS.)

Cows.	1	2	3	4	5	6	Mixed Milk.	Normal Milk.
Yield (Quarts)	2	2	1	4	3	3	15	
Total Solids	12.9	12.8	9.2	11.9	13.8	12.1	12.4	12.9 per cent
Fat	5.0	4.0	2.8	3.7	4.6	3.7	4.0	4.0 per cent
Solids not fat ..	7.9	8.8	6.4	8.2	9.2	8.4	8.4	8.9 per cent
Ash	0.88	0.70	0.89	0.69	0.77	0.74	0.76	0.75 per cent
Nitrogen	0.62	0.50	0.48	0.47	0.58	0.50	0.52	0.52 per cent
Chlorine in Ash ..	22.2	14.4	28.7	19.0	17.2	19.7	19.2	14.0 per cent
Chlorine Calc. as NaCl	36.5	23.7	47.3	31.3	28.3	32.4	31.6	23.0 per cent
Ratio $\frac{\text{Ash}}{\text{NaCl}}$	2.7	4.2	2.1	3.1	3.2	3.0	3.1	4.6
Ratio $\frac{\text{Ash x 100}}{\text{S.N.F.}}$ ..	11.1	7.9	13.9	8.4	8.3	8.8	9.0	8.3
Freezing Point ..	−0.545°C	−0.545°C	−0.560°C	−0.552°C	−0.550°C	−0.550°C	−0.550°C	−0.555°C
Composition of S.N.F.								
Milk Sugar ..	38.8	55.8	35.2	55.0	51.4	53.2	51.4	52.8 per cent
Proteids ..	50.0	36.2	47.8	36.5	40.2	37.9	39.5	37.8 per cent
Ash	11.1	7.9	13.9	8.4	8.3	8.8	9.0	8.3 per cent

HERD B.—(2 COWS.)

Cows.	1	2	Mixed Milk.	Normal Milk.
Yield.	2 quarts.	1.5 pint.		
Total Solids ..	12.4	10.9	12.2	12.9 per cent
Fat	4.0	3.8	4.0	4.0 per cent
Solids not fat ..	8.4	7.1	8.2	8.9 per cent
Ash	0.73	0.75	0.73	0.75 per cent
Nitrogen	0.48	0.55	0.49	0.52 per cent
Chlorine in Ash ..	19.0	31.0	21.0	14.0 per cent
Chlorine Calc. as NaCl	31.3	51.1	34.6	23.0 per cent
Ratio $\frac{\text{Ash}}{\text{NaCl}}$ ..	3.1	1.9	2.8	4.6
Ratio $\frac{\text{Ash x 100}}{\text{S.N.F.}}$	8.7	10.5	8.9	8.3
Freezing Point ..	–0.54°C	–0.54°C	–0.54°C	–0.555°C
Composition of S.N.F.				
Milk Sugar ..	54.8	40.0	52.9	52.8 per cent
Proteids ..	36.4	49.4	38.1	37.8 per cent
Ash	8.3	10.5	8.9	8.3 per cent

These results clearly show that the samples originally received, while below the legal minimum standard at which milk may be sold, had not been adulterated by the addition of added water.

The causes of the abnormality seem to have been similar in each case. In each, the cows got most of their food by grazing on the roads and vacant lands in their vicinity, and although the dairies were nearly two miles apart. the soil in the district is very poor, and the grass, therefore, probably poor in both quantity and quality. The food supply of the cows may therefore be safely taken as having been below normal.

Most of the cows were nearing the end of their period of lactation which is recorded as the period when "salty" milk is generally noted.

The inspector reported that cow No. 3 in Herd "A" was obviously sick.

The only cow giving milk which could be classed as normal was No. 2 of Herd "A."

The striking feature of these results is that from eight cows, seven of them being apparently in good health, only one cow gives milk which is normal. All the others are abnormal, particularly in the high proportion of chlorine present. But by far the most striking feature of these results is that although the milks vary so far from the normal in chemical composition, the freezing point is practically normal throughout. The mammary glands of the cow, when unable to obtain the correct proportion of milk, sugar and other foodstuffs, adjust the osmotic pressure by adding an extra proportion of common salt from the blood.

It is evident from the amount of work which has been done by many workers in this direction, and the cases quoted give further proof, that certain organs of secretion work at definite osmotic pressures. This pressure is practically a constant, the variation being within extremely narrow limits. In the case of milk from the cow, the variation measured by the well known Freezing Point method lies between –0.54°C. and –0.56°C. This is the first case in many tests where we have found the Freezing Point of an undoubtedly genuine milk to be higher than –0.55°C. Still an extremely rare variation of 0.01°C. from the normal is not serious in the use of the Freezing Point as a factor in milk analysis.

It cannot be too strongly impressed on milk analysts that the mammary glands of the cow work almost entirely to a constant osmotic pressure, the constituents which produce the pressure varying according to the nature and amount of the food supply and also according to the period of lactation. So far as it is at present known there is no other constant controlling factor. We found exactly the same osmotic pressure (measured by the Freezing Point) in genuine milks which varied between 6.4 per cent solids not fat with 2.8 per cent fat and 9.7 per cent solids not fat with 5.6 per cent fat. The fact of the osmotic pressure being the one steady controlling factor in milk production having been definitely established, it is obviously absurd to continue judging the purity of a milk from the determination of factors which are variant and not constants. As the determination of the Freezing Point gives an easy and accurate method of measuring the osmotic pressure, the Freezing Point is obviously the constant factor which should be used in judging the purity of milk.

Fortunately in Australia we not only insist on purity of milk but on quality, and milk is not allowed to be sold from a cow which has to adjust the osmotic pressure with an extra proportion of common salt or to keep itself warm in the absence of sufficient food or shelter by consuming fat which should have gone into the milk. It is therefore necessary to determine the ordinary factors, fat, solids not fat, etc., but these are not used and should not be used in determining the purity of the milk.

We put these analyses on record to once more emphasise the fact which we have previously noted (Proceedings of the Australasian Association for the Advancement of Science, Vol. XII., page 160 and Vol. XIII., page 88, and the Proceedings of the Royal Society of Queensland, Vol. XXIV., page 165), that the determination of the Freezing Point of a milk is not only the most important factor to determine in milk analysis, but is the only factor which definitely settles whether or not water has been added to the milk, and is the only one which gives a close approximation to the proportion of water which has been added.

In the case of the two samples recorded the sellers, if judged by the old solids-not-fat standard, would certainly have been convicted for selling milk adulterated with water. As it was they were not prosecuted but action was taken by the Health Department to prevent the further sale of these abnormal milks to the general public.

FURTHER NEW GENERA AND SPECIES OF AUSTRALIAN PROCTOTRYPOIDEA

By ALAN P. DODD.

(*Read before the Royal Society of Queensland, November 9th*, 1914.)

During the present year, I have been enabled to collect Micro-Hymenoptera in various parts of Queensland and New South Wales, and have thus acquired numerous new species, besides extending the known range of many other species. I have also a small collection kindly given by Mr. W. W. Froggatt, Government Entomologist of New South Wales. While in Sydney I had the pleasure of looking through the collections of the Macleay Museum, describing a few species from its material. I have to thank the Curator, Mr. J. Shewan, for his kindness in assisting me with my work.

Still further species have been added from the well-worked locality of Gordonvale (late Nelson), North Queensland, by Mr. A. A. Girault and myself.

Unless otherwise specified, the magnification used was ⅔ inch objective, 1 inch ocular, Bausch and Lomb.

Family SCELIONIDÆ.

Subfamily Scelioninæ.

Genus MALLATELEIA, *Dodd.*

MALLATELEIA FŒRSTERI, *sp. nov.*

♂ Length, 1.70 mm.

Brownish yellow, the head black, the scutum, scutellum, and abdomen (except 3rd segment), dusky black, the femora slightly dusky.

Structure very similar to *ashmeadi* Dodd, but the punctures on the scutum and scutellum, are smaller and more dense. First abdominal segment striate, the rest smooth. Forewings somewhat infuscated, the margins distinctly not equally inclined. Antennæ as in *ashmeadi*.

Hab: New South Wales (Upper Tweed River). Described from one male caught by sweeping in open forest, 1000 feet, 17th May, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

Dedicated to Arnold Fœrster.

MALLATELEIA WESTWOODI, *sp., nov.*

♂ Length, 1.95 mm.

Black; femora, tibiæ and antennal scape, fuscous; tarsi yellow. Head transverse, with fine scaly sculpture and moderately dense, not large, thimble punctures, also short fine white pubescence; eyes large, bare. Thorax slightly longer than wide; scutum and scutellum with similar sculpture to the head; parapsidal furrows distinct and complete. Abdomen a little longer than the head and thorax united, a little wider than the thorax; the segments all more or less wider than long; 1st striate; the 2nd with striæ far laterad smooth and glabrous mesad; 3rd as long as following united, practically smooth mesad, then with very fine scaly sculpture; the remaining segments wholly finely sculptured. Forewings long; rather broad; almost hyaline; cephalic and caudal margins about equally inclined; discal cilia fine, exceedingly dense. Pedicel short, a little longer than wide; 1st funicle joint a little longer, the 2nd quadrate, the 3rd longer than 2nd, but shorter than 1st; 3-9 subequal.

Hab: North Queensland (Pentland, 200 miles west of Townsville). Described from one male caught by sweeping in forest, September, 1914 (A. A. Girault).

Type: In the Queensland Museum, Brisbane, a ♂ on a tag, antennæ and forewings on a slide.

Dedicated to John Obadiah Westwood.

AUSTROSCELIO. New genus.

♂ ♀ Of stout form, very much resembling *Hadronotus* Fœrster, but more especiallly *Hadronotoides* Dodd.

Head very transverse; eyes large, hairy; ocelli very wide apart, the lateral ones touching the eye margins; viewed from in front the head is somewhat wider than long; antennal depression very profound, occupying almost all lower two-thirds of face. Thorax scarcely longer than wide; convex; scutum large, without furrows; scutellum very large, projecting over and hiding the metanotum, bidentately emarginate at apex: postscutellum with a blunt tooth. Abdomen broadly sessile; a little longer than the head and thorax united; one-half longer than wide; pointed at apex; slightly convex above, straight beneath; first segment very transverse, the second much the longest, occupying nearly one-half of surface. Forewings reaching apex of abdomen; broad; submarginal vein rather distant from the costa which it joins about middle of wing; marginal vein very short, the stigmal moderately long and oblique; postmarginal not developed. Antennæ 12-jointed in both sexes, in the female with a 6-jointed club, in the male filiform, the joints all longer than wide.

Type: AUSTROSCELIO NIGRICOXA (*Dodd*).

s. *Sparasion australicum* Dodd, Entomological News, Philadelphia, U.S.A., Vol. XXV, June, 1914, p. 255-6.

Sparasion nigricoxa, Dodd. Trans. Royal Soc. of S.A., Vol. XXXVIII, May, 1914, p. 123.

Originally described as a species of *Sparasion*; the description was misleading, since there is no frontal ledge on the face, and the general structure of the species excluded it. The specific characters given for *nigricoxa* do not hold, hence one name must fall. The female has not been recorded, but two have been found, one from the type locality of Gordonvale, the other being caught by sweeping in forest, Pentland, 200 miles west of Townsville, N.Q., September, 1914. (A. A. Girault).

♀ Antennal funicle suffused red, rest of antennæ black; scape slender, as long as next six joints combined; pedicel nearly twice as long as wide; first funicle joint a little narrower than pedicel, twice as long as wide, 2nd quadrate, 3rd and 4th transverse; club joints 1-5 transverse, 1st small, 2nd the largest.

AUSTROSCELIO ROBUSTUS, *sp. nov.*

♀ Length, 2.50 mm.

Coal black; legs (except coxæ) reddish yellow; scape and pedicel almost black; next four joints golden yellow.

Head coarsely rugulose; ocelli wide apart, the lateral pair almost touching the eye margins; eyes rather densely pubescent. Thorax scarcely longer than wide; scutum and scutellum rather coarsely rugulose; parapsidal furrows not evident. Abdomen no wider than thorax, one-half longer than wide, 2nd segment occupying about one-half of surface; abdomen wholly longitudinally rugose. Forewings reaching apex of abdomen; broad; somewhat infuscated; submarginal vein attaining costa about middle of wing; stigmal rather short, rather oblique; venation yellowish. Antennæ 12-jointed; scape moderately long and slender; pedicel almost twice as long as wide; 1st funicle joint slightly shorter and narrower than pedicel; 2-4 wider than long; club plainly 6-jointed, joints 1-5 distinctly wider than long, 2nd slightly the widest.

Hab: New South Wales. Described from two females in the collection of the Macleay Museum.

Type: Macleay Museum, Sydney; Hymenoptera 2D, a ♀ on a tag, the antennæ on a slide.

Very similar to the type species, *nigrocoxa* Dodd.

Genus PLASTOGRYON, *Kieffer.*

PLASTOGRYON UNICOLOR, *Dodd.*

One female sweeping in forest, Childers, South Queensland, 25th June, 1914 (A. P. Dodd).

PLASTOGRYON ELEGANS, *sp. nov.*

♀ Length, 1.10 mm. Of slender form.

Black, the basal two-thirds of abdomen orange yellow; and antennal scape golden yellow.

Head quadrate. Thorax distinctly longer than wide; finely polygonally sculptured. Abdomen as long as head and thorax united, over twice as long as wide: 1st segment striate; 2nd occupying one-half of surface, polygonally reticulate. Pedicel over twice as long as wide: 1st funicle joint much shorter and narrower than pedicel, nearly twice as long as wide. Forewings reaching well beyond apex of abdomen; moderately broad, hyaline: discal cilia moderately coarse and dense; marginal vein no longer than the stigmal, the latter curved caudad somewhat at apex; postmarginal twice as long as the marginal.

Hab: South Queensland (Childers). Described from one female caught by sweeping in forest, June 25th, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a slide.

Genus Hoploteleia, *Ashmead.*

Hoploteleia nigricornis *Dodd.*

A male and female caught on foliage of plants, etc., round canefields, Halifax, Herbert River, North Queensland, 29th March, 1914 (A. P. Dodd). The male antennæ agree with those of *australica*, Dodd.

Hoploteleia sculpturata, *sp, nov.*

♀ Length, 4.10 mm.

Coal black; legs (including coxæ), and first three funicle joints of antennæ, bright reddish yellow.

Head and thorax coarsely rugulose, the rugosity of the scutum shallower, the scutum also densely, finely granulate. Lateral ocelli separated from each other by twice their own diameter. Thorax no wider than the head, distinctly longer than wide. Abdomen as long as head and thorax united, its apex truncate, with two very short spines; first two segments striate, the rest longitudinally rugulose, the 3rd distinctly the longest. Body pubescent, the hairs rather coarse. Forewings and antennæ as described for *australica* Dodd.

Hab: New South Wales (Chindera, Tweed River). Described from one female caught by sweeping in forest, 12th May, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

HOPLOTELEIA AUSTRALICA OCCIDENTALIS, *new variety*.

♂ Length, 2.65 mm.

Similar to *australica* Dodd but the scape is bright yellow, the pedicel and basal funicle joints suffused with yellow.

Hab: West Queensland (Cloncurry). Described from one male caught by sweeping in open forest, 18th April, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♂ on a tag.

HOPLOTELEIA PERSIMILIS, *sp., nov.*

♂ Length, 2.65 mm.

Very similar to *australica* but the antennal scape is red at base; the funicle joints are longer, all distinctly longer than wide; the marginal vein is over one-third as long as the stigmal, the latter slightly curved caudad at apex; and the hind tarsi are very long, as in *nigricornis*.

Hab: North Queensland (Halifax, Herbert River). Described from one male captured with the above mentioned specimens of *nigricornis*.

Type: South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

HOPLOTELEIA AUREISCAPUS, *sp. nov.*

♀ Length, 2.90 mm.

Very similar to *australica* but the coxæ yellow, also the antennal scape, the pedicel and funicle slightly suffused yellowish; the abdomen pointed at apex; scutum and scutellum with only very scattered pubescence (in *australica* rather dense on scutellum and caudal portion of scutum); marginal vein almost one-half as long as the stigmal, which is rather more oblique; hind tarsi long and slender.

Hab: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping on edge of jungle, January, 1914 (A. P. Dodd).

Type : In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

HOPLOTELEIA AUSTRALICA, *Dodd.*

Four females, one male, sweeping in forest, Pentland, 200 miles west of Townsville, September, 1914 (A. A. Girault).

HOPLOTELEIA GRACILICORNIS, *sp. nov.*

♀ Length, 3.30 mm.

Very similar to *sculpturata* Dodd but smaller ; the abdomen acute at apex ; the thorax with only scattered pubescense, all pubescense much finer ; antennæ wholly black, more slender than in *sculpturata*, the 1st funicle joint over twice as long as wide (not twice as long as wide in *sculpturata*). Otherwise the same, or nearly.

Hab : New South Wales (Glen Innes, 4,500 feet). Described from one female received from Mr. W. W. Froggatt and labelled " Glen Innes, A. M. Lea."

Type : In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a female on a tag, the antennæ and forewings on a slide.

Genus TRICHOTELEIA, *Kieffer.*

TRICHOTELEIA ARGENTIPES, *sp. nov.*

♀ Length, 4.25 mm.

Black ; abdomen brownish in centre ; legs (including coxæ) and antennal scape, silvery yellow.

Head transverse-quadrate ; eyes large, bare ; ocelli large, the lateral ones further from each other than from the median ocellus, and almost touching the eye margins. Vertex caudad of lateral ocelli irregularly subtransversely striate ; in front of lateral ocelli, longitudinally foveate ; lower half of frons, transversely striate ; antennæ separated by a distinct carina ; the head (except lower half of face) with scattered small punctures ; occiput concave. Thorax nearly one-half longer than wide. Pronotum not visible ; scutum finely granulate, and with numerous setigerous thimble-punctures ; parapsidal furrows deep and distinct, wide apart, almost parallel; scutellum smooth except for a few minute punctures; metathoracic caudal angles acute, the metanotum laterally with a patch of white pubescence. Abdomen twice as long as head and thorax united; 1st segment almost twice as long as wide, longitudinally striate, with a blunt horn projecting over and against centre of metanotum, the horn transversely striate at apex; 2nd segment somewhat longer than 1st, longitudinally striate, except near the carinated margins, where dense setigerous thimble-punctures prevail; 3rd shorter than 2nd, granulate in centre, laterad of this striate, and the lateral area of punctures wider; 4th one-half length of 3rd, granulate in centre, then with the dense thimble punctures; 5th as long as 4th, wholly granulate, except for scattered punctures; 6th forming a straight projection, a little longer than two preceding segments united, granulate, and with numerous setigerous punctures. Forewings reaching to apex of 6th abdominal segment; broad; somewhat infuscated; discal cilia moderately fine, very dense; submarginal vein attaining costa about middle of wing; marginal one-half as long as the stigmal, which is long, very oblique, its apex slightly curved caudad; postmarginal very long, several times as long as the stigmal; basal vein very distinct, very oblique, over one-half longer than the stigmal; median not indicated. Pedicel nearly twice as long as wide; 1st funicle joint twice as long as pedicel; 2nd slightly longer than 1st; 3rd a little shorter; 4th distinctly shorter than 3rd; 5th shorter than 4th; but distinctly longer than wide; club slender, 5-jointed; 1st the longest and widest, longer than wide, 2-4 quadrate.

Hab: North Queensland (Halifax, Herbert River). Described from numerous females captured on a decayed log in jungle, 6th April, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

TRICHOTELEIA ACUTIVENTRIS, *sp. nov.*

♀ Length, 3.20 mm.

Very similar to *nigricincta* Dodd, but the orange coloration of the body is much deeper, the abdomen not being noticeably margined with black, only darker along the margins; medium lobe of scutum almost wholly black; antennal pedicel and funicle slightly suffused yellowish; head more transverse, the ocelli further apart, the lateral ones further distant from each other than from the median one; head, scutum and scutellum almost smooth, with only a very few scattered pin-punctures (punctures larger and much more dense in *nigricincta*); thorax stouter, the parapsidal furrows distant at posterior margin of scutum by half their own length (distinctly less than half their own length in *nigricincta*); 1st abdominal segment shorter than either 2nd or 3rd, the 7th pointed and longer than two preceding, in both species; segments 5-7 with thimble-punctures; forewings with a more or less obscure median longitudinal band, the rest slightly infuscated; marginal vein fully one-half as long as the stigmal, the postmarginal twice as long as stigmal; funicle joints somewhat stouter, the 1st a little longer than pedicel; abdomen over twice as long as head and thorax united.

Hab: North Queensland (Harvey's Creek, near Cairns). Described from one female caught by sweeping in jungle, 2nd August, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

Genus MACROTELEIA, *Westwood.*

MACROTELEIA APICALIS, *sp. nov.*

♀ Length, 4.25 mm. Long and slender.

Golden or orange yellow, the eyes and ocelli black; vertex of head, horn on basal abdominal segment, and apical fourth of abdomen, sooty black; antennal club black.

Head no wider than thorax, with scattered circular punctures; eyes large, bare; lateral ocelli touching the eye margins. Thorax nearly twice as long as wide; scutum and scutellum sculptured like the head, the punctures setigerous; pronotum distinctly visible on the sides; parapsidal furrows deep and distinct. Abdomen over twice as long as head and thorax united; sessile, the apical segments compressed laterally; wholly striate; the segments all longer than wide, the 3rd slightly longer than

2nd or 4th, the 1st segment with a blunt horn at base. Forewings barely reaching apex of 4th abdominal segment; slightly infuscated; discal cilia moderately fine and dense; submarginal vein attaining costa about middle of wing; marginal vein over one-half longer than the stigmal, the latter short, scarcely oblique; postmarginal nearly twice as long as marginal; venation thick and distinct. Pedicel long, over twice as long as greatest width, the 1st funicle joint slightly longer and narrower, nearly four times as long as wide; 2nd not twice as long as wide, the 4th wider than long; club rather slender, 6-jointed, 1st joint largest, almost as long as wide.

Hab: North Queensland (Halifax, Herbert River). Described from one female caught on foliage of plants round canefield, 29th March, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

MACROTELEIA DISTINCTA *sp. nov.*

♀ Length, 3.75 mm.

Black; legs (including the coxæ) and first six antennal joints golden yellow.

Head subquadrate; densely punctate; eyes large, bare; ocelli large, the lateral ones almost touching the eye margins. Thorax one-half longer than wide; scutum and scutellum densely confluently punctate, the punctures moderately small; parapsidal furrows distinct; *post-scutellum with a rather large bidentate spine mesad.* Abdomen one half longer than the head and thorax united; sessile, slightly fusiform; 2nd and 3rd segments largest; wholly longitudinally striate and pubescent. Thorax also densely pubescent. Forewings reaching almost to apex of abdomen; broad; almost hyaline; marginal vein slightly longer than the stigmal, which is moderately short and oblique, straight; postmarginal twice as long as the marginal; venation clear golden yellow. Pedicel fully twice as long as wide; first funicle joint two-thirds longer than pedicel; 2nd slightly longer than pedicel; 3rd shorter; 4th quadrate; club 6-jointed.

♂ Scape yellow, rest of antennæ black; pedicel slightly longer than wide: 1st funicle joint longer, almost twice as long as wide: 2nd and 3rd shorter: 4-9 quadrate.

Hab: New South Wales. Described from one pair in the Macleay Museum and labelled "New South Wales."

Types: In the Macleay Museum, Sydney. Hymenoptera 6D', the above specimens on two tags, antennæ and forewings on a slide.

Genus PLATYTELEIA, *Dodd.*

PLATYTELEIA LATIPENNIS, *Dodd.*

One female captured from foliage of plants around canefields, Halifax, Herbert River, N.Q., 29th March, 1914 (A. P. Dodd).

Genus HADRONOTOIDES, *Dodd.*

HADRONOTOIDES PENTATOMUS, Dodd.

In the collections of the Government Entomologist of Queensland, Mr. Henry Tryon, there are several specimens of this species, bred from pentatomid eggs, Kelvin Grove, Brisbane. Formerly the species had been known from several North Queensland localities.

HADRONOTOIDES MERIDIANUS, *sp. nov.*

♀ Length, 2.25 mm.

Coal black; legs (except cephalic coxæ) clear golden yellow; antennal scape yellow at base, dusky at apex.

Head transverse, slightly wider than thorax; rugose punctate: eyes large: ocelli wide apart, the lateral ones distant from the eye margins by nearly their own diameter. Thorax scarcely longer than wide; coarsely rugulose; scutellum large, rather deeply bidentate. Abdomen as wide as thorax, no longer than wide: 1st segment striate, rest longitudinally rugose: first three segments subequal. Forewings extending well beyond apex of abdomen; broad: hyaline; discal cilia rather coarse and dense; submarginal vein attaining costa about middle of wing; marginal vein fully one-half as long as stigmal, which is moderately long, rather oblique: postmarginal fully twice as long as stigmal. Antennæ 12-jointed: pedicel long and slender, almost twice as long as wide: 1st funicle joint slightly longer than pedicel: 2nd as wide as long: 3rd wider than long: club probably 6-jointed (the 3rd and 4th funicle joints appear to form part of club, as in *pentatomus*), joints 1-5 distinctly wider than long, 2nd the largest.

♂ Pedicel short and stout; 1st funicle joint twice as long as pedicel, fully twice as long as wide; 2nd shorter; but distinctly longer than wide: 4-9 subquadrate, gradually narrowing towards apex.

Hab: South Australia. Described from two males, one female in the Macleay Museum, and labelled "South Australia."

Types: In the Macleay Museum, Sydney, Hymenoptera 3D, the above specimens on a tag. ♂ and ♀ antennæ and forewings on a slide.

HADRONOTOIDES RETICULATUS, *sp. nov.*

♀ Length, 1.55 mm.

Coal black; the legs (except the coxæ), reddish yellow.

In general appearance and structure very similar to *pentatomus*.

Head, scutum and scutellum rather coarsely rugulose and with fine pubescence; eyes hairy; scutellum not so large as in the two other species, almost semicircular, not so deeply bidentate at apex. Abdomen somewhat longer than wide; first segment striate; the second with a row of deep foveæ at base: rest of abdomen with fine, rather dense, irregularly longitudinal reticulation. Pedicel one-half longer than wide, the first funicle joint as long and slightly narrower, the second a little wider than long: 4th distinctly widened to form part of club. Marginal vein one-half as long as the long stigmal. Otherwise about as in *pentatomus*.

Hab: North Queensland (Pentland, 200 miles west of Townsville). Described from two females caught by sweeping in forest, September, 1914 (A. A. Girault).

Types: In the Queensland Museum, Brisbane, two ♀s on a tag, antennæ and forewings on a slide.

Genus HADRONOTUS. *Færster.*

HADRONOTUS NIGRICOXA, *Dodd.*

Two females captured from foliage of plants around canefields, Halifax, Herbert River, N.Q., 29th March, 1914 (A. P. Dodd.)

HADRONOTUS AQUATICUS, *Dodd.*

One male caught by sweeping in forest, Gordonvale, N.Q., 13th August, 1914 (A. A. Girault).

Genus SCELIOMORPHA. *Ashmead.*

SCELIOMORPHA MAGNICLAVA, *sp. nov.*

♀ Length, 3.75 mm.

Coal black; legs golden yellow, including the coxæ; first five antennal joints slightly suffused with yellow.

Head no wider than thorax; rugose-punctate, the punctures of moderate size; ocelli in an equilateral triangle, the lateral pair distant from the eye margins by nearly their own diameter. Thorax scarcely longer than wide; scutum with rather large, circular punctures, rather dense, the spaces between the punctures finely scaly; scutellum with large scattered punctures, the surface otherwise glabrous; parapsidal furrows complete; scutellum large. Abdomen sessile, scarcely as wide as the thorax; as long as the head and thorax combined; 2nd segment slightly the largest; 1st segment with six strong striæ centrally, rest of abdomen densely longitudinally rugose. Forewings reaching apex of abdomen; broad; infuscated; discal cilia rather fine, very dense; submarginal vein attaining costa about middle of wing; stigmal vein moderately long, not very oblique, straight; venation golden yellow. Antennæ 12-jointed; scape equal to next five joints combined; pedicel nearly twice as long as wide; funicle joints slightly narrower than pedicel; 1st one-half longer than wide; 2nd and 3rd wider than long; 4th widened, and probably forming part of club; club 6-jointed, 1st joint the longest and widest, as long as wide, 2-5 twice as wide as long.

Hab: New South Wales. Described from one female in the collections of the Macleay Museum.

Type: Macleay Museum, Sydney; Hymenoptera 1D. a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA NIGRICLAVA, *sp. nov.*

♀ Length, 4.75 mm.

Like *magniclava* but considerably larger; thorax one-half longer than wide: abdomen longer, somewhat longer than head and thorax combined: lateral ocelli almost touching the eye margins: scutum with larger punctures, the spaces between glabrous: scutellum sculptured like the scutum, but with an area centrally smooth except for a few pin-punctures: first six antennal joints golden yellow, the 1st funicle joint as long and as wide as the pedicel; club not so wide, the 1st club joint a little wider than long; forewings rather less infuscated.

Hab: New South Wales. Described from one female with *magniclava*.

Type: Macleay Museum, Sydney; Hymenoptera 8D· a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA CONCOLORIPES, *sp. nov.*

♀ Length, 3.25 mm.

Very similar to *magniclava*, but the coxæ, femora, and tibiæ are black (except at the knees): the scutellum has the fine, scaly sculpture, as well as the punctures, the venation is rather darker: pedicel only one-half longer than wide: 1st funicle joint as long and as wide as pedicel; club narrower, as in *nigriclava*.

Hab: New South Wales. Described from one female with the two preceding species.

Type: Macleay Museum, Sydney; Hymenoptera 9D; a ♀ on a tag, the antennæ and forewings on a slide.

SCELIOMORPHA ATRICOXA, *sp. nov.*

♂ Length, 4.40 mm. With the habitus of the genus *Scelio*.

Very similar to *nigriclava* but thorax not one-half longer than wide: abdomen distinctly longer than head and thorax united; scutum and scutellum wholly densely punctate, and with fine, scaly sculpture; abdomen rugose punctate (except 1st segment): coxæ black; apex of stigmal vein curved distinctly caudad. Scape and pedicel yellow, rest of antennæ black; pedicel twice as long as wide; subequal to 2nd funicle joint, the 1st distinctly longer.

Hab: New South Wales (Elizabeth Bay, Sydney). Described from one male with the preceding species.

Type: Macleay Museum, Sydney; Hymenoptera 11D, a ♂ on a tag, the antennæ and forewings on a slide.

Genus DICROTELEIA, *Kieffer*.

DICROTELEIA SOLITARIA, *sp. nov.*

♀ Length, 4.40 mm.

Shining black; legs (including coxæ) and antennal scape, golden yellow.

Head subquadrate, with large circular punctures, the surface with a dull opaqueness; eyes large, bare; ocelli large, in an equilateral triangle, the lateral ones touching the eye margins; on the occiput, the punctures form transverse rugose punctation. Thorax nearly twice as long as wide, the pronotum not visible from above; scutum sculptured like the head, the punctures in irregular transverse rows separated by ridges; punctures less dense on scutellum. Parapsidal furrows deep, distinct, the median carina of scutum conspicuous and corresponding to a median carina on the scutellum; postscutellum almost square. Abdomen one-half longer than the head and thorax united; no wider than thorax; sessile, the apex pointed; 1st segment with a blunt prominence; first four segments longitudinally rugose; the apical two with scattered punctures; 2nd and 3rd the longest, subequal, distinctly longer than wide. Body with inconspicuous pubescence. Forewings reaching to middle of 5th abdominal segment; broad; infuscated; discal cilia rather coarse and dense; venation fuscous, as in the Australian species of *Sceliomorpha* Ashmead, the stigmal vein long and oblique; marginal punctiform; submarginal rather remote from costa; no other veins. Pedicel one-half longer than wide; 1st funicle joint distinctly longer; 2nd as long as pedicel, 3rd shorter; 4th as wide as long; club 6-jointed, 1st joint largest, as long as wide; 2-5 wider than long.

Hab: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 20th June, 1914 (A. A. Girault).

Type: South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

This species appears to agree with Kieffer's diagnosis of the genus (subgenus of Kieffer). In general appearance and structure it resembles the Australian species of *Hoploteleia* Ashmead. The type and only other species of the genus, *Oryscelio (Dicroteleia) rugosa* Kieffer comes from Java.

DICROTELEIA GLABRISCUTELLUM, *sp. nov.*

♀ Length, 2.95 mm.

Coal black; legs (including coxæ) bright golden yellow, also the pedicel and first three funicle joints, the scape distinctly darker.

Head transverse; the face with large, not very close, shallow punctures, some of these on the vertex joining and forming irregular transverse rugosity; no wider than the thorax; eyes very large, bare; ocelli large, separated from the eye margins by half their own diameter. Thorax somewhat longer than wide; scutum large, with large, rather close, shallow punctures, these setigerous; parapsidal furrows distinct, also a distinct median carina present; scutellum large, smooth, shining, except for a few scattered indefinite pin-punctures, these more distinct laterad; postscutellum small, quadrate; metanotum very short at meson. Abdomen broadly sessile; as long as the head and thorax combined, slightly narrower than the thorax; the segments all more or less wider than long, the 2nd the largest, a little longer than the 3rd; 1st striate, the 2nd and 3rd with large, shallow, rather close punctures divided into rows by longitudinal striæ, the 4th and 5th without the striæ and with the punctures setigerous. Forewings reaching apex of abdomen, broad; infuscate; submarginal vein attaining costa about middle of wing; stigmal vein very long and oblique, its apex curved slightly caudad; venation golden yellow. Antennæ 12-jointed; scape long and slender; pedicel over twice as long as wide, the first funicle joint slightly shorter: 2-4 wider than long, the 4th somewhat widened: club rather compact, first joint as long as wide, 2-5 much wider than long.

Hab: North Queensland (Harvey's Creek, near Cairns). Described from two females caught on foliage of plants in jungle country, 12th October, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

The species *Sceliomorpha rugulosa*, Dodd, *S. hyalinipennis*, Dodd, *S. montana*, Dodd, and *S. nigricoxa*, Dodd, must be included here, since they possess the median carina on the scutum, and the quadrate postscutellum. These four and *glabriscutellum* are closely related, but *solitaria* is very distinct. The species of *Sceliomorpha* described in this paper, will probably fall here, but at present the types are not accessible to me.

Genus BARYCONUS, *Færster.*

BARYCONUS DELICATULUS, *sp. nov.*

♀ Length, 1.75 mm. Slender.

Black; the trochanters, knees, tibiæ and tarsi testaceous.

Head subquadrate, quite smooth. Thorax distinctly longer than wide; narrowed anteriorly; scutum as long as wide, the parapsidal furrows well defined; scutum and scutellum with polygonal scaly sculpture, not very fine. Abdomen twice as long as head and thorax united; distinctly petiolate; the apical two segments produced into a narrow point; 1st segment with a distinct horn, longer than wide; 2nd and 3rd segments longest; 1st and 2nd striate, the rest longitudinally reticulate. Forewings reaching almost to apex of abdomen; moderately narrow; hyaline, with an obscure band covering apical portion of submarginal, and all marginal veins, and a second obscure band covering almost apical third of wing; discal cilia fine, rather dense; submarginal vein attaining costa about middle of wing; marginal vein two-thirds as long as the stigmal, the latter moderately long, oblique, quite straight; postmarginal over thrice as long as the stigmal; basal vein not indicated. Antennæ 12-jointed; pedicel twice as long as wide ; 1st and 2nd funicle joints each subequal to pedicel ; 3rd a little longer than wide ; 4th quadrate ; club rather compact, 6-jointed, joints 1-5 about equal in length, 3rd slightly the widest.

Hab : South Queensland (Burnett Heads, Bundaberg). Described from one female caught by sweeping in forest, 20th June, 1914 (A. P. Dodd).

Type : South Australian Museum, a ♀ on a tag. antennæ and forewings on a slide.

BARYCONUS DULCIS, *Dodd*.

Numerous specimens caught on foliage of plants round canefields, Halifax, Herbert River, North Queensland, March, 1914 (A. P. Dodd).

BARYCONUS VARIIPES, *sp. nov.*

♀ Length, 1.55 mm. Of very slender form.

Bright golden or orange yellow ; eyes, ocelli, femora, tibiæ (except the knees), horn on abdomen, a rather broad band at caudal half of second segment, and apical two-fifths of abdomen (from caudal thirds of third segment), black ; scutellum somewhat dusky.

Head subquadrate ; eyes moderate ; ocelli in a very obtuse-angled triangle. Thorax slender, twice as long as greatest width ; parapsidal furrows present for caudal two-thirds of scutum, approaching rather close together caudad ; scutellum with a line of fine foveæ across its base. Abdomen slender ; somewhat longer than the head and thorax united ; no wider than the thorax ; 1st segment about twice as long as wide, with a blunt horn ; 2nd and 3rd also somewhat longer than wide, the 3rd a little the larger, the following segments combined about equal to length of 3rd. Head, scutum and scutellum with very fine polygonal scaly sculpture ; the abdomen wholly longitudinally striate. Legs long and slender. Antennæ 12 jointed ; scape barely longer than next two joints united ; pedicel slender, fully two and a half times as long as wide ; first funicle joint a little shorter and narrower than the pedicel, nearly thrice as long as wide ; the others shortening, the 4th quadrate ; club 6-jointed, 3-5 slightly the largest, all transverse. Forewings very narrow, with two dark bands about as in *fasciatus*, the wing apex more lightly infuscate, and thus more or less hyaline; discal cilia very fine and dense; marginal cilia short.

Hab: North Queensland (Pentland, 200 miles west of Townsville). Described from one female caught by sweeping in forest, September, 1914 (A. A. Girault).

Type: In the Queensland Museum, Brisbane, a ♀ on a tag, the antennæ and forewings on a slide.

This species comes nearest to *fasciatus* Dodd, and *maculatus* Dodd, but is at once distinguished by having much more black on the abdomen and legs. Of similar slender build to *fasciatus*, which is more slender than *maculatus*.

Baryconus citreus, *sp. nov.*

♀ Length, 1.60 mm. Stout and robust.

In my table of species (1914) running near *gloriosus* Dodd.

Golden yellow; eyes, ocelli, segments 2 and 4-8 of abdomen, and the antennæ (except the scape), black; scutellum and centre of scutum, brownish.

Head and thorax with fine polygonal scaly sculpture, pubescent. Lateral ocelli touching the eye margins. Thorax no longer than wide, the scutum large, the parapsidal furrows well defined, wide apart; postscutellum unarmed. Abdomen no longer than head and thorax combined, no wider than thorax, 1st and base of 2nd segments striate, the rest smooth; 3rd segment somewhat the longest; all segments wider than long; 1st segment without a horn. Forewings reaching apex of abdomen; rather broad; infuscated; discal cilia fine, very dense; submarginal vein attaining the costa about middle of wing; marginal vein almost one-half as long as the stigmal, the latter long, straight, scarcely oblique; postmarginal twice as long as the stigmal; basal vein rather distinct, oblique. Pedicel one-half longer than wide; 1st funicle joint slightly longer than pedicel; 2-4 shortening, the 4th transverse; club 6-jointed, compact, large, joints 1-5 transverse and of equal length, the 3rd slightly the widest.

Hab: South Queensland (Childers). Described from one female caught by sweeping in the open forest, 2nd July, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the head and forewings on a slide.

Genus CREMASTOSCELIO, *Dodd.*

CREMASTOSCELIO FLAVIVENTRIS, *sp. nov.*

♀ Length, 1.35 mm.

Head and thorax black; abdomen golden yellow, like the legs, its apex black: first four antennal joints yellow, next four slightly suffused with yellow, the club black.

Very similar in structure to the three other species in the genus, but the abdomen is more slender, distinctly longer than the head and thorax united. Mandibles 4 dentate; discal cilia not very fine, dense, in about 30 rows.

Hab: New South Wales (Upper Tweed River). Described from one female caught by sweeping foliage and grass in forest, 1,000 feet, 17th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a slide. Later another female was found labelled "Sweepng forest on hills, Maclean, Clarence River, N.S.W., 30th May, 1914 (A. P. Dodd.)"

Genus SCELIO *Latreille.*

Table of Australian Species.

Males; females.

(1) Body wholly black .. .. = (4)
Body more or less bright reddish or yellowish.. .. .. = (2)
(2) Abdomen black .. .. = (3)
Thorax and abdomen wholly red; female .. .. ..
= *cruentatus* sp. nov. (West Queensland)
(3) Scutellum black; abdomen wholly striate .. .. ..
= *nigriscutellum* Dodd (North Queensland)
Thorax uniformly red; 1st, 2nd, and 5th abdominal segments striate, 3rd and 4th polygonally reticulate; female
= *semisanguineus*, Girault (Northern Territory)
(4) Vertex of head with scattered punctures .. .. .. = (5)
Vertex of head with large dense punctures .. .. .. = (9)
Vertex of head reticulately rugose .. .. = (11)

(5) Coxae and at least first three antennal joints yellow ; females = (6)
Coxae and all antennæ black .. .. = (7)

(6) Scutum and scutellum coarsely reticulately rugose ; 1st and 2nd segments striate, 3rd reticulate, apex of 4th and all remaining segments hardly sculptured
= *pulchellus* Crawford (New South Wales)
Scutum and scutellum with large circular punctures ; abdomen finely longitudinally striate = *fulgidus*, Crawford (New S. Wales)

(7) Scutum and scutellum with large scattered punctures ; legs almost wholly black ; parapsidal furrows not indicated ; female
= *varipunctatus*, Dodd (North Queensland)
Scutum and scutellum confluently or rugose punctate ; legs (except coxæ) not black ; parapsidal furrows indicated or distinct .. .. = (8)

(8) Scutum and scutellum rugose punctate ; segments after 1st and 2nd finely longitudinally reticulate ; male, female ..
= *parvicornis* sp. nov. (South Austr.)
Scutum and scutellum confluently punctate, the punctures varying in size ; abdomen wholly striate, except for smooth median areas on segments 3-5 ; female .. .. ..
= *diemenensis* sp. nov. (Tasmania)

(9) Coxæ yellow ; antennal scape and pedicel yellow ; female..
= *punctaticeps*, Dodd (North Queensland)
Coxæ black ; antennæ wholly black .. .. = (10)

(10) Lower half of face striate ; parapsidal furrows deep and distinct ; abdominal segments 3-6 finely striate, the cross-striæ distinct ; female .. ..
= *striatifacies* sp. nov. (New South Wales)
Striæ on face only below insertion of antennæ ; parapsidal furrows very faintly indicated ; abdomen strongly striate, the cross-striæ not visible ; male .. ..
= *nigricoxa* Dodd (North Queensland)

(11) Abdomen wholly longitudinally rugose or striate, except sometimes for smooth median areas .. .. = (13)
Abdomen with most of the segments not longitudinally rugose or striate .. .. = (12)

(12) Coxæ and femora black, also the antennæ ; wings hyaline ; segments after first finely reticulately rugose ; male ..
= *nigricornis* Dodd (North Queensland)
All legs yellow, also antennal scape and pedicel ; wings not hyaline ; segments 3-5 with fine close shallow punctures ; female .. .. .. = *chortoicetes* Froggatt (N. S. Wales)

(13) Abdomen longitudinally rugose ; male ; female .. ..
= *froggatti* Crawford (East Q'land)
Abdomen longitudinally striate .. .. = (14)

(14) Coxæ black .. .. = (15)
Coxæ yellow .. .. = (18)

(15) Femora black; rugosity of thorax with a distinct tendency to become longitudinal; scutellum with a median carina; female .. .. .. = *locustæ* sp. nov. (North Queensland)
Femora not black; rugosity of thorax reticulate; scutellum without a median carina .. .. = (16)

(16) Head, pronotum and sides of thorax with long, white pubescence; rugosity of head not very coarse; female = *pilosiceps* sp. nov. (New South Wales)
Pubescence not long or very distinct; rugosity of head very coarse; males .. .. = (17)

(17) Wings hyaline; abdomen finely striate, the 2nd and 3rd segments with median areas not striate, 4th distinctly longer than 3rd .. .. .. = *flavicornis* Dodd (N. Q'land)
Wings not hyaline; a smooth area present at caudal two-thirds of 3rd segment mesad, 3rd distinctly longer than 4th.. . = *perplexus* sp. nov. (N. Q'land)

(18) Head, pronotum, and sides of thorax with long whitish pubescence; female .. = *pilosus* Dodd (North Queensland)
Pubescence not distinct or long .. .. = (19)

(19) Third funicle joint of male antennæ much enlarged, longer than wide .. .. = (21)
Third funicle joint of male antennæ not much enlarged, wider than long .. .. = (20)

(20) Male; antennæ black; funicle joints 4-7 not or barely wider than long; stigmal vein as in *ovi*, the stigmal spot on the distal side of stigmal and marginal veins .. .. .. = *orientalis* Dodd (North Queensland)
Male; scape red, the antennæ becoming black towards apex; funicle joints 4-7 distinctly wider than long; stigmal vein straight, as in *australis*, the stigmal spot on both sides of marginal and stigmal veins = *affinis* sp. nov. (North Queensland)

(21) Female antennæ wholly black; stigmal vein straight .. = *australis* Froggatt (East Q'land and N.S.W.)
Female antennæ with at least first two joints yellow; stigmal vein slightly convexly curved .. .. = *ovi* Girault (East Q'land and N.S.W.; West Q'land).

SCELIO CRUENTATUS, *sp. nov.*

♀ Length, 4.15 mm.

Bright red; head, apex of abdomen and last seven antennal joints, black.

Head and thorax coarsely rugose, the metanotum with longitudinal carinæ or striæ, the abdomen wholly longitudinally striate. Head transverse, no wider than the thorax, the occiput concave; eyes bare. Thorax distinctly longer than wide, the parapsidal furrows deep and distinct. Abdomen a little longer than head and thorax united, fusiform no wider than thorax, the 3rd segment slightly the longest. Forewings reaching almost to apex of abdomen; broad; rather darkly infuscated; venation not very distinct, the stigmal vein moderately long, scarcely oblique, straight; stigmal spot rather distinct, irregularly circular. Antennæ short and stout, the joints beyond the third all much wider than long; pedicel over twice as long as wide, slightly longer than 1st funicle joint. Metanotum with white pubescence laterally.

Hab: West Queensland (Cloncurry). Described from one female caught on ground, 18th April, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

Scelio parvicornis, *sp. nov.*

♀ Length, 3.75 mm.

Black; legs reddish yellow, the coxæ black, the femora dusky, antennæ wholly black.

Head with scattered moderately large punctures. Thorax rugose-punctate; parapsidal furrows distinct. Abdomen fully as long as head and thorax united, fully twice as long as its greatest width; 1st and 2nd segments striate, the rest finely longitudinally reticulate, 3rd and 4th segments a little the largest. Forewings reaching apex of abdomen; moderately broad; not much infuscated; discal cilia dense, rather fine; venation pale yellow; stigmal vein moderately long, not very oblique, straight; stigmal spot not well defined. Antennæ short and stout; pedicel one-half longer than wide; 1st funicle joint a little shorter and narrower than pedicel; remaining joints much wider than long, the last six forming a stout club.

♂ Forewings practically hyaline. Antennæ black at base, becoming suffused with brown towards apex, scape slightly thickened; pedicel short and stout; 1st funicle joint a little longer than wide; 2-7 distinctly wider than long, 3rd the widest but not much enlarged.

Hab: South Australia. Described from one pair in the collections of the Macleay Museum.

Types: Macleay Museum, Sydney; Hymenoptera 4D, the above specimens on a tag, ♂ and ♀ antennæ and forewings on a slide.

Scelio nigricoxa, *Dodd.*

"(Archiv für Naturgeschichte," Berlin, February, 1914, p. 78.)

♂ Antennæ wholly black; 1st funicle joint one-half longer than wide; 2nd as wide as long; 3rd only slightly dilated, wider than long; 4-7 much wider than long.

One male caught by sweeping in forest, Gordonvale, 28th July, 1914 (A. A. Girault).

Scelio ovi *Girault.* (Proc. Ent. Soc. of Washington, Vol. XV, No. 1, 1913. pp. 4-5).

Taken in company with *australis*, Froggatt, on roadways at Chindera, Tweed River, and Harwood, Clarence River, N.S.W., May, 1914, also from egg beds of *Locusta danica*, Halifax, Herbert River, N.Q., March, 1914; also one male caught on ground, Cloncurry, West Queensland, 16th April, 1914 (A. P. Dodd).

Scelio diemenensis, *sp. nov.*

♀ Length, 3.40 mm.

Black; legs (except the coxæ) golden yellow, the femora slightly dusky; antennæ wholly black.

Head transverse, with scattered moderately small punctures; ocelli wide apart, the lateral ones touching the eye margins. Thorax one-half longer than wide; scutum and scutellum densely confluently punctate, the punctures not of uniform size, some very large, others very small; punctures not setigerous. Parapsidal furrows indicated. Metanotum rugose. Abdomen as long as head and thorax united, no wider than thorax; wholly longitudinally striate, the striæ after the 2nd segment not regularly straight; apex of 3rd segment mesad, and a median area on segments 4-5, smooth, except for a very few scattered pin-punctures (dorsal aspect); segments after 5, irregularly rugulose; 3rd segment slightly the longest. Forewings as in *parvicornis* Dodd. Pedicel nearly as long as wide; 1st funicle joint as long and as wide as pedicel; club not distinctly 6-jointed, at least 7-jointed. Occiput somewhat transversely rugose. Lower half of face striate, the antennal depression smooth. Abdomen ventrad like dorsal but segments after 3 almost wholly smooth, and with a few scattered punctures. Punctures on head denser on upper portion of face.

Hab: Tasmania (Hobart). Described from two females received from Mr. W. W. Froggatt and labelled "Hobart; A. M. Lea."

Type: In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

Cotype: In the collections of Mr. W. W. Froggatt, Government Entomologist, Sydney, a ♀ on a tag.

SCELIO AUSTRALIS, *Froggatt* (1910, Farmer's Bulletin No. 29, Department of Agriculture, N.S.W.)

Taken on roadsides at Harwood, Clarence River, N.S.W., in company with *ovi* Girault, *pilosiceps* Dodd, and *striatifacies* Dodd, May, 1914 (A. P. Dodd); on roadsides Chindera, Tweed River, N.S.W., May, 1914, in company with *ovi* (A. P. Dodd); on roadway, Childers, South Queensland, 1st July, 1914 (A. P. Dodd); and many hundreds around egg beds of *Locusta danica*, Halifax, Herbert River, N.Q., March, 1914 (A. P. Dodd). On warm, clear days it was noticed that during the middle of the day, the *Scelios* remained inactive. In searching for host eggs, the female, with the antennæ held quivering in front of her head, digs obliquely in the earth with the forelegs, which are kept in constant motion the while.

SCELIO STRIATIFACIES, *sp. nov.*

♀ Length, 4.05 mm.

Very similar to *nigricoxa* Dodd, but somewhat stouter, the abdomen distinctly so; parapsidal furrows very distinct (not or only faintly indicated in *nigricoxa*); metanotum finely rugose (very coarsely so in *nigricoxa*); abdominal segments after the 2nd finely striate, the cross-striæ distinct, the longitudinal ones hence irregular (in *nigricoxa* abdomen strongly striate, the cross-striæ not showing, the longitudinal ones hence without irregularities); face round antennal depression circularly striate, the striæ converging toward the mouth (in *nigricoxa*, face round antennal depression rugose, the striæ only present *below* insertion of antennæ); antennal depression smooth in both species. Antennæ wholly black; 1st funicle joint distinctly larger than pedicel, one-half longer than greatest width; others very transverse.

Hab: New South Wales (Harwood, Clarence River). Described from one female taken in company with *ovi*, *australis* and *pilosiceps*, 26th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Scelio pilosiceps, *sp. nov.*

♀ Length, 4.00 mm.

Very similar to *australis* Froggatt but the coxæ are black: the head, pronotum and sides of thorax have the dense long white pubescence of *pilosus* Dodd; the head in *australis* is uniformly rugose, in this species the rugosity is less coarse and the caudal portion of the vertex and the occiput are transversely rugose; the parapsidal furrows are not indicated; the striæ on the abdominal segments are finer, disappearing in extreme meson of the 4th segment, all the segments with short cross-striæ joining the longitudinal ones (these striæ much less distinct in *australis* and not present on segment 4-6); segments 4-5 in *australis* have a median longitudinal carina more or less distinct, this is absent in *pilosiceps*; also the legs are of a deeper color; otherwise the same or nearly so.

Hab: New South Wales (Harwood, Clarence River). Described from one female taken with the preceding species.

Type: In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

Scelio affinis, *sp. nov.*

♂ Length, 3.70 mm.

Very similar to *australis* but differs as follows:— in *australis* the striæ on the 3rd segment are irregular, this being caused by the short cross-striæ, in this species the striæ are uniform without any irregularities: the antennal depression in *affinis* is rugose immediately above the insertion of the antennæ, the upper part of the depression smooth, in *australis* the upper portion of the depression is finely rugose, below this smooth, also there is a distinct median carina running from vertex of this depression to the elevation on which the antennæ are inserted : the 3rd funicle joint is not so much enlarged, wider than long, no longer than 2nd (distinctly so in *australis*), and distinctly shorter than 1st (as long as 1st in *australis*), also the antennæ are colored differently, the scape being red, next four joints slightly suffused with red, apical five joints black. Compared with ♂ *australis*.

Hab: North Queensland (Gordonvale, near Cairns). Described from one male caught by sweeping in forest, 26th May, 1914 (A. A. Girault).

Type: In the South Australian Museum, a ♂ on a tag, antennæ and forewings on a slide.

Scelio locustæ, *sp. nov.*

♀ Length, 3.10 mm.

Very similar to *pilosiceps*, Dodd, but the femora also black, the pubescence not nearly so distinct, the head more quadrate, the rugosity on the head still finer and not transverse caudad, the rugosity on scutum and scutellum having a distinct tendency to become longitudnial, scutellum with a median longitudinal carina, the meson of 4th abdominal segment not smooth, the pedicel and funicle joints distinctly shorter.

Hab: North Queensland (Halifax, Herbert River). Described from one female taken with *ovi*, *australis*, and *perplexus* from egg bed of *Locusta danica*, March, 1914 (A. P. Dodd).

Type: South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Scelio perplexus, *sp. nov.*

♂ Length, 3.95 mm.

Very similar to *australis* but the coxæ are black ; the funicle joints are more yellowish, the joints after the 1st wider than long, the 3rd not much enlarged ; sculpture of abdomen as in *orientalis* Dodd.

Hab.: North Queensland (Halifax, Herbert River). Described from one male taken in egg bed of *Locusta danica* in company with *locustæ, ovi* and *australis*, March, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

SCELIO FROGGATTI, *Crawford*.

I am not able to reconcile the male specimen identified by Girault (Ent. Soc. of Washington, D.C., Vol. XV, No. 1. 1913, pp. 6-7) and myself (Trans. Royal Soc. of South Australia, Vol. XXXVII, 1913, p. 13") with Crawford's species. Crawford had only female specimens but in Mr. W. W. Froggatt's collection there are males labelled "*Scelio froggatti*," and said to have been bred with the female type material. These males have the antennæ colored as in *australis*. Moreover it does not seem likely that a female with dark brown (*i.e.* black) antennæ should have a male with the antennæ wholly honey yellow. The antennæ of this male specimen differ from those of *ovi* and *australis* in that the third funicle joint is not much enlarged.

SCELIO FULGIDUS, *Crawford*.

Crawford's description gives the color of the abdomen as dark brown, but in the Froggatt collection are specimens of the type material with the abdomen jet black. It is possible that Crawford's specimens had the abdomen discolored in some way, perhaps from remaining long in alcohol. *Fulgidus* has a broader type of abdomen than the species related to *australis*, as have also *pulchellus* Crawford and *chortoicetes* Froggatt, of which I have seen specimens.

SCELIO, *sp.* ?

In March, 1914, in company with other *Scelios* on egg-beds of *Locusta danica* Halifax, Herbert River, N.Q., five specimens were observed with a reddish thorax, but unfortunately were not captured.

Scelio punctaticeps, *Dodd.*

"Archiv für Naturgeschichte," Berlin, 79, February, 1914, pp. 77-8.

Abdominal segments after the first, finely striate; head densely confluently punctate, except for transverse area (very narrow) between the lateral ocelli, which is practically smooth; stigmal vein not curved. Type re-examined, also one female caught by sweeping in forest, Pentland, 200 miles west of Townsville, September, 1914 (A. A. Girault).

Genus Encyrtoscelio, *new genus.*

♀ Vertex of head extraordinarily lengthened, being as long cephalo-caudad as its greatest width, and as long as the thorax, but no wider, its cephalic margin convex, and with a rim or carina following the cephalic margin from eye to eye; eyes moderately large, but not half as long as the head, bare, situated far down on the sides of the face; ocelli absent; viewed from the side, the head is conical, the apex of the cone cephalad, and almost pointed. Antennæ inserted in a deep depression, near the mouth, and right against the vertex of the thorax; 12-jointed, with five funicle and five club joints. Mandibles extraordinarily long and slender, straight, several times as long as wide, and nearly as long as the long scape, with three small teeth. Legs normal. Thorax stout, as long as wide, as in *Hadronotus* Fœrster, the pronotum not visible, the scutum large but wider than long; scutellum semicircular, projecting over and completely hiding the short metanotum. Abdomen broadly sessile, short and stout, as in *Hadronotus*, no wider or longer than the thorax; 2nd segment the longest, occupying nearly one-half of the surface. Forewings narrowed at base, the caudal margin straight (*i.e.* when the wing is outstretched the caudal margin runs at right angles to the body), and not at all curved, the cephalic margin much inclined cephalad, so that the wing is nearly hemispherical, the caudal margin forming the base, the distal margin broadly rounded, but cut sharply off at the caudal margin; the proximo-cephalad margin of the hemisphere prolonged and narrowed towards the caudal margin at base, the cephalic and distal margins of the wing shaped like a section of a balloon; marginal cilia absent on both the cephalic and caudal margins, the distal margin serrated and with extremely dense, long, curved cilia, quite as long as the greatest wing width, and appearing like plumes; discal cilia apparently absent, or so fine as not to be seen: wings just reaching apex of abdomen, and not much longer than their greatest width; totally without venation.

This genus is utterly unlike any other *Scelionid* genus known. Its thoracic and abdominal characters suggest its relationship with the genus *Hadronotus*, but its extraordinarily shaped head, the absence of ocelli, and the peculiar wings make it unique for the family. It is undoubtedly the most remarkable *Scelionid* genus at present known to science.

Type: ENCYRTOSCELIO MIRISSIMUS described herewith.

ENCYRTOSCELIO MIRISSIMUS, *sp. nov.*

♀ Length, 1.15 mm.

Coal black; the legs (except the coxæ) and first seven antennal joints golden yellow, the funicle joints a little dusky.

Head and thorax with fine, polygonal, scaly sculpture, the head also with small scattered punctures, the punctures not setigerous. Abdomen with close polygonal reticulation, the reticulation in raised lines. Antennæ 12-jointed; scape long and slender; pedicel one-half longer than wide, fully as long as first two funicle joints combined; funicle joints transverse, the 1st narrower than the others; club 5-jointed, joints 1-4 distinctly wider than long, 2nd slightly the widest. Forewings somewhat infuscated, opaque.

Hab: North Queensland (Gordonvale, near Cairns). Described from one ♀ caught by sweeping in forest, 3rd January, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Subfamily Telenominæ.

Genus Paratelenomus, *new genus.*

♀ Agreeing with the description of *Dissolcus* Ashmead but the occiput of the head is distinctly concave; the scutum is distinctly wider than long; the parapsidal furrows are complete, and distinct; and the abdomen is broadly oval, scarcely as long as the head and thorax united, only slightly longer than wide, the 2nd segment much wider than long. Like *Telenomus* Haliday but differing in bearing complete parapsidal furrows.

Type: Telenomus bicolor, *Dodd.*

Ent. News, Philadelphia, U.S.A., Vol XXV, June, 1914, pp. 251-2.

Genus Phanuromyia, *new genus.*

♀ Like *Telenomus* Haliday but the ovipositor and its valves exserted for a length equal to that of the abdomen.

I have not previously seen, nor have I come across record of, any *Scelionid* with a truly exserted ovipositor, that is with the valves exserted, and thus, I think that character alone all sufficient to form a quite distinct new genus.

Type: the following species.

Pharunomyia rufobasalis, *sp. nov.*

♀ Length, 0.95 mm.

Black; legs (including coxæ) and antennal scape golden yellow; pedicel and funicle suffused yellowish; first abdominal segment bright reddish.

Head transverse, no wider than the thorax, dorsal aspect, its cephalic margin convex, the occiput concave; eyes rather large; ocelli wide apart, small, the lateral ones situated against the eye margins. Thorax no longer than wide; scutum large, without furrows; postscutellum faintly emargined at meson; metanotum very short, its caudo-lateral angles sub-acute. Abdomen distinctly narrower than the thorax; one-half longer than wide;

1st segment short, striate; 2nd occupying almost all surface, striate at base, smooth for the rest; the abdomen squarely truncate at apex. Forewings reaching a little beyond apex of wing; moderately broad; hyaline; marginal cilia not long; discal cilia fine and dense; submarginal vein attaining costa somewhat before middle of wing; marginal vein one-half as long as the stigmal, which is not long, rather oblique; postmarginal about twice as long as the stigmal. Antennæ 11-jointed; scape rather short, as long as next three joints combined; pedicel one-half longer than wide; first funicle joint about subequal to pedicel; 2nd quadrate; 3rd and 4th distinctly narrower than preceding, transverse; club 5-jointed, joints 1-4 distinctly wider than long; 1st small, 2nd slightly the largest.

Hab: South Queensland (Childers). Described from one female caught by sweeping in forest, 2nd July, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a slide.

Genus TELENOMUS, *Haliday.*

TELENOMUS ŒCLEOIDES, *sp. nov.*

♀ Length, 1.15 mm.

Very similar to *œcleus* Dodd but smaller; pedicel not twice as long as wide, the first funicle joint a little shorter and narrower than pedicel, the 2nd wider than long; the club joints shorter, all distinctly wider than long. Compared with *œcleus*.

Hab: North Queensland (Halifax, Herbert River). Described from one female caught by sweeping miscellaneous vegetation, 20th March, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

TELENOMUS OBLITERATUS, *sp. nov.*

♀ Length, 1.20 mm.

Like *œcleus* but smaller; femora also black; striæ on 2nd abdominal segment so feeble as to be hardly discernible; only first five antennal joints yellow, the pedicel only one-half longer than wide, first funicle joint as long and as wide as pedicel, the 2nd a little longer than wide, club joints all distinctly wider than long ; abdomen shaped as in *acleus* but the 2nd segment shorter, the following more than half its length.

Hab : North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 26th March, 1914 (A, A. Girault).

Type : In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

TELENOMUS EUANDER, *Dodd.*

One female sweeping in forest, Burnett Heads, Bundaberg, S.Q., 20th June, 1914 (A. P. Dodd) ; also several females sweeping in forest, Pentland, 200 miles west of Townsville, N.Q., September, 1914 (A. A. Girault).

TELENOMUS DIEMENENSIS, *sp. nov.*

♀ Length, 1.70 mm.

Coal black ; the tibiæ and tarsi reddish yellow.

Head very transverse, wider than the thorax ; ocelli large, the lateral ones touching the eye margins. Thorax a little longer than wide. Abdomen a little longer and wider than the thorax, the second segment occupying nearly two-thirds of surface. Head, scutum and scutellum finely rugulose and pubescent ; 1st and basal two-thirds of 2nd abdominal segment, striate, the rest smooth, the remaining segments with setigerous pin-punctures Forewings long and broad ; infuscated, this deepest around knob of stigmal vein ; base of wing, and caudal and disto-caudal margins almost hyaline ; discal cilia fine, very dense ; venation fuscous ; submarginal vein attaining the costa about middle of wing ; marginal vein one-fourth as long as the stigmal, which is very long, oblique, with a distinct knob, postmarginal twice as long as the stigmal. Scape long; pedicel nearly twice as long as greatest width ; first funicle joint very long, nearly twice as long as pedicel, over one-half as long as the scape, and as long as three following joints united ; 2nd a little longer than wide ; 3rd quadrate club 6-jointed, joints 1-5 distinctly wider than long, 2nd the longest and widest.

Hab: Tasmania (Hobart). Described from three females received from Mr. W. W. Froggatt, and labelled "Hobart, A. M. Lea."

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Cotypes: In the collection of Mr. W. W. Froggatt, Government Entomologist, Sydney, two ♀s on a tag.

TELENOMUS ÆGEUS, *sp. nov.*

♀ Length, 1.00 mm.

Shining black; legs (except cephalic coxæ) golden yellow also the antennal scape, the next six antennal joints yellow suffused dusky.

Head viewed from above, not twice as wide as long, the vertex and frons a little convex, a little wider than the thorax; with fine polygonal scaly sculpture. Thorax scarcely longer than wide, the scutum with the same scaly sculpture and also with fine setigerous pin-punctures, the scutellum practically smooth and glabrous. Abdomen as long as the head and thorax united; as wide as the thorax; twice as long as wide; almost pointed at apex; 1st segment short, striate, the 2nd occupying one-half of surface, faintly striate at base, then with fine, scaly sculpture, its apical margin smooth; remaining segments with fine pin-punctures. Scape as long as next four joints combined; pedicel one-half longer than wide; funicle joints a little narrower than pedicel, first one-half longer than wide; 2nd barely longer than wide; 3rd quadrate; 4th transverse; club 5-jointed, first joint very small, the 2nd abruptly larger, 1-4 transverse, the 3rd slightly the largest. Forewings reaching apex of abdomen; not very broad; hyaline; discal cilia fine and dense; submarginal vein attaining costa about middle of wing; marginal vein one-third as long as the stigmal, which is moderately long and oblique; postmarginal over twice the length of the stigmal; venation indistinct.

Hab: North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in jungle, 30th July, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a slide.

Telenomus ajax, *sp. nov.*

♀ Length, 0.90 mm.

Similar to *ægeus* but the head, viewed from above, is distinctly more than twice as wide as long, the vertex and frons not convex; the thorax distinctly wider than the abdomen; the 2nd segment with the polygonal sculpture not so distinct, the segment almost wholly finely striate, and occupying over two-thirds of the surface, the remaining segments smooth, without punctures; antennæ more yellow, the 2nd club joint brownish, the first funicle joint scarcely longer than wide, the second wider than long.

Hab: North Queensland (Gordonvale, near Cairns). Described from one female captured with the preceding species.

Type: In the South Australian Museum, a ♀ on a slide.

Subfamily Bæinæ.

Genus Ceratobæoides, *Dodd.*

The type and second species of this genus, have been re-examined finding the following additional generic characters:—Postscutellum with a long, erect spine; head viewed from in front, triangular, distinctly longer (dorso-ventrad) than greatest width.

Ceratobæoides spinosus, *sp. nov.*

♀ Length, 1.60 mm.

Golden yellow; eyes, ocelli, a square patch against cephalic margin of scutum mesad and adjacent border of occiput, and horn on basal abdominal segment, black; apical club joints dusky black.

Head viewed from above, transverse, somewhat wider than the thorax; the latter as wide as long; head and thorax finely densely reticulate and pubescent. *Parapsidal furrows present on posterior half of scutum.* Abdomen somewhat longer than head and thorax united; 1st segment as wide as long, with a blunt horn; 3rd a little longer than 2nd, the remaining segments very short; 1st and 2nd segments striate, the 3rd finely densely granulate. Forewings long and broad ; almost hyaline, with a dark spot round the marginal vein ; discal cilia moderately fine, very dense ; marginal vein barely one-half as long as the stigmal, which is long, rather oblique, straight ; venation yellowish. Scape long and slender ; pedicel over twice as long as wide ; funicle joints narrower than the pedicel, 1st almost twice as long as wide, 2-4 somewhat wider than long ; club slender, over twice as long as wide, 4-jointed, divided obliquely.

Hab : South Queensland (Childers). Described from one female caught by sweeping in forest, 2nd July, 1914 (A. P. Dodd).

Type : In the South Australian Museum, a ♀ on a tag, antennæ and forewings on a slide.

Genus CERATOBÆUS, *Ashmead.*

CERATOBÆUS FLAVIVENTRIS, *sp. nov.*

♀ Length, 1.15 mm.

Head, thorax and horn on abdomen, black ; abdomen, legs, and antennæ, bright golden yellow.

Antennæ 7-jointed ; scape as long as next four joints combined ; pedicel over twice as long as wide ; funicle joints narrower than the pedicel, 1st twice as long as wide, 2-4 wider than long ; club as long as the scape. Forewings almost reaching apex of abdomen ; hyaline ; moderately broad ; venation very pale, indistinct ; marginal vein one-half as long as the stigmal, which is rather long, almost perpendicular ; basal vein perpendicular, indistinct. Head transverse, a little wider than the thorax, the latter quadrate, both finely densely granulate. Abdomen distinctly longer than the head and thorax combined ; somewhat narrower than the thorax ; pointed at apex ; first two segments striate, the remaining segments finely polygonally scaly ; horn on basal segment reaching apex of scutellum ; 3rd segment occupying over one-third of surface, as long as wide.

Hab : North Queensland (Gordonvale, near Cairns). Described from one female caught by sweeping in forest, 14th August, 1914 (A. A. Girault).

Type : In the South Australian Museum, a ♀ on a slide.

Genus ACOLUS, *Fœrster.*

ACOLUS BIDENTATUS, *sp. nov.*

♀ Length, 1.75 mm.

Black; abdomen dark brown; coxæ black; rest of legs and the antennæ golden yellow, slightly suffused dusky.

Head, viewed from above, transverse, distinctly wider than the thorax; the frons convex; viewed from in front, much wider than long; eyes large, pubescent; ocelli very wide apart, the lateral ones touching the eye margins. Thorax somewhat longer than wide, the scutum and scutellum large; posterior angles of the metanotum, acute; postscutellum with two short teeth mesad. Abdomen as long as the head and thorax united, no wider than the head; broadly rounded behind; 1st and 2nd segments striate, the 3rd and 4th finely, densely, irregularly transversely rugulose; the 3rd occupying one-half of surface. Head, scutum and scutellum, finely densely punctate. Forewings just reaching apex of abdomen; moderately broad; hyaline; discal cilia fine, very dense; venation dark and distinct; submarginal vein attaining the costa at fully one-half wing length; marginal vein not one-third as long as the stigmal, which is moderately long, wholly gently convexly curved, the convexity *proximad*; basal vein not indicated. Antennæ 7-jointed; scape long and slender; pedicel one-half longer than wide; funicle joints narrower than the pedicel, 1st a little longer than wide, 2-4 very transverse; club large, one-half longer than wide.

Hab: North Queensland (Pentland, 200 miles west of Townsville). Described from one female caught by sweeping in forest, 8th January, 1913 (A. A. Girault).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Subfamily Teleasinæ.

Genus HOPLOGRYON, *Ashmead.*

HOPLOGRYON NIGRIVENTRIS, *sp. nov.*

♂ Length, 1.90 mm.

Black; scutum (except a large square patch mesad and cephalad, reaching almost to posterior margin), postscutellum, and extreme sides of scutellum, bright red-brown; antennal scape, pedicel and the legs, golden yellow, the coxæ, apex of femora, apical third of the tibiæ, and the tarsi, dusky.

Head transverse, no wider than the thorax; ocelli close together, in an equilateral triangle; face striate, the striæ converging towards the mouth; the vertex also longitudinally striate. Thorax somewhat longer than wide; scutum and scutellum reticulately rugulose; spine on postscutellum, large, blunt; caudo-lateral angles of metanotum acute. Abdomen about as long as the head and thorax united; 1st segment longer than wide; 1st and 2nd segments striate, the 3rd (except laterad and distad) finely longitudinally rugulose; rest of abdomen smooth, except for scattered pin-punctures, these dense at cephalic margin of segments 4-6 where the surface is also finely granulate; venter of 1st and 2nd segments striate, remaining segments with scattered setigerous pin punctures. Forewings reaching beyond apex of abdomen; broad, the apex truncately rounded; infuscated; discal cilia rather coarse, very dense; marginal vein much shorter than the submarginal; the stigmal vein long for the genus and with a distinct knob, a fourth as long as the marginal; basal vein indicated; venation fuscous. Antennæ not much longer than the body; 1st funicle joint longest of funicle, slightly longer than 2nd, the latter slightly longer than 3rd; 3-9 subequal, the 10th as long as 1st; pedicel very short.

Hab: New South Wales (Upper Tweed River). Described from one male caught by sweeping foliage of jungle plants, 1,000 feet, 17th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

Genus PENTACANTHA, *Ashmead.*

PENTACANTHA NIGRINOTUM, *sp. nov.*

♀ Length, 1.45 mm.

Black; thorax (except scutum and scutellum), and first abdominal segment (except its horn) reddish brown; legs (including the coxæ) golden yellow; antennæ wholly black.

Head transverse, a little wider than the thorax. Thorax somewhat longer than wide. Head, scutum and scutellum pubescent, and with raised reticulation. Spines on post-scutellum and metanotum, short. Abdomen no longer than the head and thorax united; no wider than the thorax; 1st segment as long as wide, with a blunt distinct horn; 3rd segment occupying nearly one-half of surface; 1st and most of 2nd segments striate, the rest smooth. Forewings reaching apex of abdomen; moderately broad; somewhat infuscated; discal cilia fine, very dense; venation fuscous, the stigmal vein almost perpendicular and with a slight knob. Pedicel one-half longer than wide, subequal to 2nd funicle joint, the 1st a little longer, 3rd and 4th very transverse; club 6-jointed, joints 1-5 of almost equal length, 2nd slightly the widest.

Hab: North Queensland (Halifax, Herbert River). Described from one female caught on foliage of plants around canefields, 30th March, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Genus TRIMORUS, *Fœrster.*

TRIMORUS NIGRELLUS, *Dodd.*

Two males taken from foliage of custard-apple in garden, Townsville, N.Q., 21st April, 1914 (A. P. Dodd).

Family DRYINIDÆ.

Subfamily Dryininæ.

Genus NEODRYINUS, *Perkins.*

NEODRYINUS TRILINEATUS, *sp. nov.*

♀ Length, about 5 mm.

Black; anterior coxæ (more or less), anterior trochanters, all tarsi (except claw joint on two hind pair of legs), basal third of posterior tibiæ, mandibles, and antennæ, clear golden yellow; anterior tibiæ brown; head, reddish-brown, the eyes, ocelli, and a large area occupying centre of face, black.

Vertex of head, scutum, scutellum, and postscutellum very finely granulate-rugose, and with silvery white pubescence: face finely longitudinally rugulose-striate: pronotum very finely, subconcentrically rugulose. Parapsidal furrows very feebly indicated. Metanotum with raised irregularly longitudinal reticulation and finely densely granulate. Abdomen minutely microscopically sculptured, not shining. Forewings with *three* smoky bands: base of wing hyaline: the 1st band much wider than the 2nd which is quite narrow and covers apex of basal cells; 3rd band much broader than the others, commencing at half length of stigma, its distal margin somewhat convex: apex of wing hyaline. Antennæ slender, the flagellum gently incrassate, the 1st funicle joint very long, almost as long as three following joints united.

Hab: New South Wales (Chindera, Tweed River). Described from one female caught by sweeping foliage and grass in a swamp, 14th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag. This species will be easily distinguished from the three other Australian species, *koebelei* Perkins, *nelsoni* Perkins, and *raptor*, Perkins, by the trifasciate wing.

Subfamily Anteoninæ.

Genus ANTEON, *Jurine.*

ANTEON PARVULUS, *Perkins.*

One female sweeping in forest on hills, Maclean, Clarence River, New South Wales, 27th May, 1914 (A. P. Dodd).

Family PLATYGASTERIDÆ.

Genus PLATYGASTOIDES, *Dodd.*

PLATYGASTOIDES NITIDUS, *sp. nov.*

♀ Length, 2.65 mm.

Black; the legs concolorous, except proximal third of the tibiæ, and tarsi, which are ferruginous, also the antennal pedicel and first funicle joint.

Vertex of head rather thin, the frons twice as wide as long (cephalic view), the eyes and ocelli large, the latter rather close together. Head with fine polygonal scaly sculpture and scattered circular punctures, the latter more dense toward the mouth. Antennæ 10-jointed; scape with an enormous leaf like expansion; pedicel normal, nearly twice as long as wide; 1st funicle joint very short, transverse; 2nd much wider than first and over twice as long as greatest width; 3rd and 4th as long as greatest width, 2-4 dilated at middle; club 4-jointed, joints 1-3 distinctly longer than wide, last as long as previous two united. Forewings very long, reaching well beyond apex of abdomen; broad; darkly infuscated; discal cilia rather sparse; submarginal vein present. Scutum and scutellum with very fine scaly sculpture; parapsidal furrows deep, widening caudad and forming a deep sulcus; near lateral margin, a deep groove runs half way from caudal margin cephalad; scutellum transverse, with a median carina, and with a deep sulcus running from centre caudad diagonally to cephalo-laterad angles, the area caudad of this smooth. Abdomen rather flattened; as long as the head and thorax united, fully twice as long as wide; 2nd segment occupying nearly one-half of surface; striate laterad, the first three segments otherwise smooth, the rest smooth mesad, then finely rather densely, punctate.

Hab: South Queensland (Childers). Described from one female caught by sweeping in strip of jungle, 27th June, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the head and forewings on a slide.

Platygastoides nitens, *sp. nov.*

♀ Length, 2.35 mm.

Very similar to the foregoing but the first funicle joint though small is longer than wide; the first three club joints are wider than long (the last is missing); the parapsidal furrows, though widening caudad, do not form the wide sulcus as in *nitidus*; and the median carina of the scutellum is obscure (distinct in *nitidus*).; tibiæ almost wholly black. Metanotum in both species with a distinct median carina; also at cephalic ends of parapsidal furrows is a circular fovea.

Hab: New South Wales (Tweed Heads, Tweed River). Described from one female caught by sweeping in jungle, 4th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Family CERAPHRONIDÆ.

Genus DENDROCERUS, *Ratzeburg*.

DENDROCERUS VARIEGATUS, *sp. nov.*

♀ Length, 3.25 mm.

Varnished brown; legs (including coxæ), and first three antennal joints, golden yellow; rest of antennæ brown.

Vertex of head rather flattened; eyes very large; ocelli large, the lateral pair almost touching the eye margins and each other; a row of small foveæ runs from cephalic ocellus to posterior margin of the vertex. Thorax over one-half longer than wide; finely scaly, and with scattered punctures; median groove of scutum deep and distinct; scutellum longer than wide. Abdomen slightly longer than head and thorax united. Forewings long; moderately broad; almost hyaline, with a dark blotch beneath all of stigma and stigmal vein, continued nearly to caudal margin; discal cilia moderately fine, dense; stigma twice as long as wide; stigmal vein twice as long as the stigma; venation clear honey yellow. Antennæ slender; slightly widening toward the apex; scape slender; pedicel thrice as long as wide; first funicle joint one-fourth longer than pedicel; second a little shorter than pedicel; 4-8 all distinctly longer than wide; last joint as long as the pedicel.

Hab: New South Wales. Described from one female in the collection of the Macleay Musuem.

Type: Macleay Museum, Sydney; Hymenoptera, 7D, a ♀ on a tag, the antennæ and forewings on a slide.

Dendrocerus variipes, *sp. nov.*

♀ Length, 1.10 mm.

Dark dull brown, the head and scutum lighter; eyes and ocelli, black; legs (including the coxæ), pale silvery yellow, the posterior femora, and apical third of posterior tibiæ black; pedicel and first three funicle joints silvery white, contrasting with the fuscous remaining antennal joints.

Head somewhat wider than the thorax; transverse. Thorax over one-half longer than wide; densely finely granulate, except the metanotum, which is smooth and shining; scutum with a median groove not very distinct; scutellum longer than wide, convex. Abdomen conic-ovate; pointed at apex; no longer or wider than the thorax; convex above and beneath, almost as high as long. Forewings reaching apex of abdomen; moderately broad base and apex hyaline, the rest deeply clouded; discal cilia fine, very dense; stigma semicircular, the stigmal vein scarcely longer and almost straight. Antennæ slightly widest in centre, the joints all longer than wide; pedicel one half longer than wide, a little shorter than first funicle joint which is a little longer than the second or third, the fourth slightly the longest.

Hab: New South Wales (Upper Tweed River). Described from one female caught by sweeping in open forest, 1,000 feet, 17th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

Genus Megaspilus, *Westwood.*

Megaspilus conspicuus, *sp. nov.*

♀ Length, 2.10 mm.

Black; legs (including coxæ), and antennal scape, pedicel, and first funicle joint more or less, bright golden yellow.

Head and thorax with circular punctures, not large or confluent, the punctures absent on a mesal path of scutellum, this path quite smooth, the propodeum rugulose. All punctures setigerous. Thorax longer than wide;

median and parapsidal furrows of scutum, distinct; scutellum longer than wide; postscutellum produced into a triangular blunt spine; posterior angles of the metanotum, acute. Abdomen as long as the head and thorax united; first segment occupying two-thirds of surface, striate for its basal third, smooth for the rest; the remaining segments pubescent. Forewings reaching apex of abdomen; broad; somewhat infuscate; stigma semicircular; stigmal vein scarcely curved, twice as long as the stigma; venation fuscous. Scape long and slender; pedicel almost twice as long as wide; first funicle joint a little longer than pedicel; second shorter; the remainder slightly and gradually widening; 4-8 a little wider than long.

Hab: South Queensland (Burnett Heads, Bundaberg). Described from two females caught by sweeping in forest, 20th June, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

MEGASPILUS PUNCTATIVENTRIS, *sp. nov.*

♀ Length, 1.90 mm.

Coal black; legs and antennal scape, golden yellow, the coxæ black.

Head not very transverse; lenticular, the frons and vertex gently convex; finely rugulose; eyes very large, pubescent. Thorax one-half longer than wide; scutum and scutellum with rather coarse, dense scaly sculpture and whitish pubescence; median and parapsidal furrows of scutum distinct; scutellum longer than wide; postscutellum with a short, stout spine. Abdomen no longer or wider than the thorax; pointed at apex; convex beneath, straight above, the apex somewhat upturned; second segment occupying over two thirds of surface, striate at its base, then with dense longitudinal rows of rather small oval punctures. Forewings reaching apex of abdomen; broad, the apex squarely rounded; hyaline; discal cilia moderately coarse, rather dense, venation pale fuscous, the stigma pale yellow; stigma semicircular, the stigmal vein no longer than the stigma. Antennæ 11-jointed; scape longer than next four joints combined; pedicel over twice as long as wide ; first funicle joint as long as the pedicel ; 2nd and 3rd wider than long ; 4th the widest of the funicle, rather abruptly larger than the preceding, a little longer than wide ; the others slightly decreasing in width, all a little longer than wide. Femora (especially the posterior pair) distinctly swollen.

Hab : New South Wales (Chindera, Tweed River). Described from one female caught by sweeping foliage of mangrove and other bushes, 14th May, 1914 (A. P. Dodd).

Type : In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

A species close to *australicus* Dodd.

MEGASPILUS FLAVICINCTUS, *sp. nov.*

♀ Length, 2.10 mm. Of stout form.

Golden brown ; the eyes, ocelli, metanotum, and all centre of abdomen, black ; legs golden yellow, also the first two antennal joints, the third brownish, the remainder black.

Head transverse ; no wider than the thorax, with dense thimble punctures, these with rather long whitish pubescence ; eyes not large, pubescent. Thorax barely longer than wide, the scutum and scutellum with rather dense, thimble punctures and long whitish pubescence ; scutellum no longer than wide ; median and parapsidal furrows of scutum deep and distinct ; postscutellum with a stout spine ; projecting a little over the abdomen ; metanotum very short at meson. Abdomen a little longer than the head and thorax united, a little wider than the thorax ; second segment occupying over one-half of surface, striate at its base, the rest smooth. Forewings reaching a little short of apex of abdomen ; broad, the apex rather squarely rounded ; somewhat infuscate, this deepest beneath stigma and stigmal vein ; discal cilia moderately coarse and dense ; venation fuscous ; stigma semicircular ; stigmal vein scarcely curved, over twice as long as the stigma. Antennæ 11-jointed ; scape as long as next five joints combined ; pedicel stout, a little longer than wide; first funicle joint as wide as pedicel and longer, almost twice as long as wide; 2-8 transverse, distinctly increasing in width, last joint over twice as long as wide, longer than two preceding joints united.

Hab: Tasmania (Hobart). Described from one female received from Mr. W. W. Froggatt and labelled "Hobart, A. M. Lea."

Type: In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a ♀ on a tag, the antennæ and forewings on a slide.

Genus CONOSTIGMUS, *Dahlbom.*

CONOSTIGMUS FLAVIBASALIS, *Dodd.*

Head and thorax black; abdomen sometimes almost wholly pale, with the caudal half dorsad, dusky. Head densely finely punctate and pubescent, the thorax with scattered pubescence and pin-punctures. Abdomen stout, distinctly convex above and below.

Several females sweeping miscellaneous vegetation, chiefly jungle, Grafton, Clarence River, New South Wales, 3rd June, 1914 (A. P. Dodd).

CONOSTIGMUS RUFINOTUM, *Dodd.*

Head, scutum and scutellum, smooth and shining except for indefinite punctuation. Eyes occupying whole side of face, pubescent. First funicle joint distinctly shorter and narrower than pedicel.

Two females sweeping forest, sand ridges near coast, Chindera, Tweed River, New South Wales, 13th May, 1914 (A. P. Dodd).

CONOSTIGMUS CONCOLORIPES, *sp. nov.*

♀ Length, 1.80 mm.

Coal black; the legs and basal antennal joints, fuscous; tarsi yellowish.

Head transverse; somewhat wider than the thorax; densely polygonally scaly; eyes large, pubescent. Thorax one-half longer than wide; scutum and scutellum with rather coarse dense scaly sculpture; scutellum longer than wide; parapsidal and median furrows of scutum distinct; metanotum rather long, more or less finely reticulately rugulose, with several irregularly longitudinal carinæ. Abdomen rather slender, no longer than the head and thorax united. Head densely pubescent, the thorax with only scattered pubescence. Forewings rather long; broad, the apex squarely rounded; infuscate, this deepest beneath stigma and stigmal veins; discal cilia rather fine and dense; venation fuscous; stigma semicircular; stigmal vein scarcely curved, twice as long as the stigma. Antennæ slender, only very slightly increasing in width toward apex; pedicel over twice as long as greatest width; first funicle joint somewhat longer; 2nd two-thirds as long as preceding; 3-8 subequal, all slightly shorter than 2nd, twice as long as wide, the last joint longer.

Hab: Tasmania (Hobart). Described from one female received from Mr. W. W. Froggatt and labelled "Hobart, A. M. Lea."

Type: In the collections of Mr. W. W. Froggatt, Government Entomologist of New South Wales, a ♀ on a tag, the antennæ and forewings on a slide.

CONOSTIGMUS VARICOLOR, *sp. nov.*

♂ Length, 2.45 mm. Of stout form.

Black; lateral lobes of scutum and cephalic margin of median lobe, sides of metanotum and its apex, base of abdomen, and the head, reddish brown; legs and antennal scape golden yellow, the intermediate coxæ and base of posterior pair, black; upper third of face black.

Head granulate, and with rather dense setigerous thimble punctures; lower half of face finely transversely rugulose; transverse, a little wider than the thorax. Scutum, scutellum and axillæ, granulate, and with numerous scattered thimble punctures, these only present on extreme laterad of the scutellum. Parapsidal and median furrows of scutum deep and distinct. Thorax one-half longer than wide; scutellum as wide as long; metanotum finely longitudinally rugulose. Abdomen no longer or wider than the thorax; convex beneath, almost straight above;

second segment occupying a little more than half of surface, striate at its base, then shining and with fine scaly sculpture, and a few scattered pin-punctures. Anterior and posterior femora much swollen. Forewings reaching apex of abdomen; very broad, truncately rounded at apex; with a large dark area beneath stigmal, stigma, and apex of submarginal veins, and occupying almost all centre of wing; base, apex, and margins nearly hyaline; discal cilia fine, very dense; stigmal vein scarcely curved, nearly twice as long as the semicircular stigma; venation fuscous, scape swollen; pedicel short; funicle joints long and cylindrical, the first longest, nearly thrice as long as its width at apex.

Hab: New South Wales (Upper Tweed River). Described from one male caught by sweeping in open forest, 1,000 feet, 17th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

Conostigmus unicolor, *sp. nov.*

♀ Length, 2.05 mm.

Black; tibiæ (except posterior pair), and all tarsi, golden yellow; femora and posterior tibiæ, fuscous; antennæ scape suffused red.

Head, viewed from above, much wider than long, the vertex not thin; densely scaly, this not very fine; eyes occupying whole side of head, pubescent. Thorax one-half longer than wide; scutum and scutellum with scattered pubescence, and polygonal scaly sculpture, this latter very fine except around margins of scutellum where it is distinctly coarse; scutellum longer than wide; metanotum very short; median and parapsidal furrows of scutum, deep and distinct. Abdomen pointed conic-ovate; no longer than the head and thorax united, no wider than the thorax; straight above, convex beneath; second segment occupying barely half of surface, with several strong and numerous fine striæ at its base; the abdomen otherwise smooth, except for scattered pubescence on apical segments. Forewings reaching apex of abdomen; broad; lightly infuscate, this deepest beneath marginal and stigmal veins; discal cilia fine and dense; stigma semicircular; stigmal vein about twice length of stigma. Antennæ not much increasing in width toward apex, the joints all distinctly longer than wide; first funicle joint as long as pedicel, about thrice as long as greatest width.

Hab: North Queensland (Pentland, 200 miles west of Townsville). Described from two females caught by sweeping in forest, September, 1914 (A. A. Girault).

Type: In the Queensland Museum, a ♀ on a tag, antennæ and forewing on a slide.

Genus LYGOCERUS, *Færster.*

LYGOCERUS ATERRIMUS, *sp. nov.*

♀ Length, 1.75 mm.

Coal black, the antennæ and coxæ concolorous; femora and tibiæ fuscous, the tarsi yellow.

Head transverse, slightly wider than the thorax; eyes large. Thorax somewhat longer than wide, almost squarely truncate anteriorly; median and parapsidal furrows of scutum, distinct; scutellum longer than wide; head, scutum, and scutellum with dense scaly sculpture. Abdomen as long as the head and thorax united; no wider than the thorax; almost straight above, convex beneath, its apex upturned; smooth, except for striæ at its base, the second segment occupying slightly over one-half of surface. Forewings reaching apex of abdomen; broad; somewhat infuscate, this deepest beneath stigma and stigmal vein; discal cilia dense, rather fine; stigma semicircular; stigmal vein almost twice as long as stigma; venation fuscous. Antennæ 11-jointed; *filiform, not at all widening*; scape somewhat thickened, as long as next three joints combined; pedicel two and a-half times long as wide; first funicle joint subequal to the pedicel; remaining joints shorter, all longer than wide; the last joint as long as the pedicel.

Hab: New South Wales (Maclean, Clarence River). Described from one female caught by sweeping forest on hills, 30th May, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♀ on a tag, the antennæ and forewings on a slide.

LYGOCERUS ORNATUS, *sp. nov.*

♂ Length, 1.70 mm.

Coal black; legs (except the black coxæ) fuscous, the knees and tarsi yellow, the antennæ, scape and pedicel suffused red.

Head lenticular; viewed from above, transverse, somewhat wider than the thorax; eyes large, pubescent. Thorax one-half longer than wide; parapsidal and median furrows of scutum distinct; scutellum longer than wide. Head, scutum, and scutellum with rather coarse, dense scaly sculpture and rather sparse pubescence. Abdomen somewhat shorter and narrower than the thorax; convex beneath, straight above, its apex distinctly upturned; second segment occupying nearly three-fourths of surface, striate at its base, then smooth, the apical third with rather dense, fine punctures; remaining segments with scattered fine punctures and pubescence. Forewings attaining apex of abdomen, very broad; hyaline; discal cilia not very fine, rather dense; stigma large, the stigmal vein only slightly longer; venation fuscous, the stigmal vein pale. Antennæ ramose, the first five funicle joints each bearing a very long slender branch, that on the third slightly the longest; scape rather stout; pedicel stout; first funicle joint a little longer than pedicel, a little longer than wide; 2-6 lengthening, the 5th over twice length of 1st, the 6th one half longer than 5th; 7th slightly more than half length of 6th.

Hab: North Queensland (Harvey's Creek, near Cairns) Described from one male caught on foliage of plants in jungle country, 12th October, 1914 (A. P. Dodd).

Type: In the South Australian Museum, a ♂ on a tag, the antennæ and forewings on a slide.

GEOLOGY AND PETROLOGY OF THE ENOGGERA GRANITE AND THE ALLIED INTRUSIVES.

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PART I.—GENERAL GEOLOGY.
(PLATES XI.-XII.)

(*Read before the Royal Society of Queensland, November 30th,* 1914.)

i.—INTRODUCTORY.

THE following paper aims at a general description of the so-called "Enoggera Granite" and the intrusive rocks lying to the immediate west of the city of Brisbane. The relation of these to the other rocks of the area is pointed out, and a suggestion made as to the probable age of the igneous injections; while the phenomena accompanying such injections are discussed, and the nature of the controlling forces indicated.

Further, the writer endeavours to correlate the granites and other igneous rocks under consideration with those of the New England district of New South Wales, and the Stanthorpe district of Queensland, by means of frequent comparisons. Unfortunately, here the important work of correlation must end since the granites of Queensland—with the sole exception of those of the Stanthorpe area – have received only very meagre attention at the hands of geologists.

In addition to the above, a short description of the physiographical and topographical features of the area is given, and their relation to the igneous rocks demonstrated. This phase of the work is illustrated by a sketch map, showing the chief elements in the topography of the district.

ii.—General and Historical.

The rocks to be described occur principally in the parishes of Enoggera and Indooroopilly. The area lies to the west of Brisbane, between Kedron Brook on the north, and a line from the mouth of Moggill Creek to Corinda railway station on the south, while to the west it is bounded by Moggill Creek, the Enoggera Reservoir and Cedar Creek.

The earliest reference to the geology of this area which the writer has been able to discover was in the year 1887, when in his "Report to Accompany a Geological Map of the City of Brisbane and its Environs"[1], Mr. W. H. Rands referred to a "'boss' of granite intruded into the schists to the west of Brisbane." "It is," he continued, "but a small patch about three miles in diameter, extending west as far as the Enoggera Reservoir." In his map, Mr. Rands shows a portion of the main outcrop of the Enoggera granite, and also several dykes crossing the track along Taylor Range. In 1897 Mr. R. L. Jack, at that time Government Geologist, reported having passed over granite "from the middle of selection 166 to the western boundary of 682 (Enoggera)"[2] when on a visit to the Enoggera Goldfield. Two years

1. Qld. Geol. Survey, Pub. 34.
2. Annual Progress Report Qld. Geol. Survey, 1897.

later—in 1899—the Geological Survey of Queensland published a map of the "Ipswich Beds, showing their junction with the Gympie Beds along the Brisbane River."[1] This map accompanied a report on the Ipswich Coal Field by Walter E. Cameron, B.A., and included in its scope the area under discussion.

iii.—Physiography.

The chief physiographical and topographical features of the area are shown in the accompanying sketch-map (Plate XII.). The dominating elements are two ranges of hills roughly about seven hundred feet in height which rise abruptly out of the surrounding foot-hills. These are known as Taylor Range and Enoggera Range.

Taylor Range, starting from Mt. Cootha (746ft.), runs in a direction N. 60° W., through Mt. Constitution (844ft.) —the highest point of the range—towards the Enoggera Reservoir. At Mirror Point, in the north-western corner of Mt. Cootha Reserve, it bifurcates, one branch swinging round to the north-east towards the Enoggera Range, from which it is separated by a very marked depression—known locally as The Gap—through which flows Enoggera Creek. The other arm, which is a considerably more important divide, sweeps round to the south of the Enoggera Reservoir until it runs almost due east and west, when it becomes a spur of the D'Aguilar Range. It thus forms the divide between the waters of Moggill Creek on the south and those of Enoggera Creek on the north.

The Enoggera Range, which lies to the north of Taylor Range, forms an open curve concave to the east, with its highest point Mt. Enoggera (1,000ft.) near the middle of the curve. This range, too, is connected to the D'Aguilar Range by a long ridge, which, in this case, has a west-north-west direction, and passes to the north of the Enoggera Reservoir, thus forming the divide between Cedar Creek (which is a tributary of Kedron Brook) and Enoggera Creek. This latter creek flows then betweeen two almost parallel spurs, and it is just above the point where these begin to

1. W. E. Cameron, Qld. Geol. Survey, Pub. 147.

diverge that the Enoggera Reservoir is constructed. From both Taylor Range and Enoggera Range spurs are sent out to the east, north-east, and south-east, but these soon merge into rounded and semi-isolated hills. Further away to the east, north and south these in their turn gradually fade into gently-undulating country. This topographical sequence from steep ridges to rounded spurs and foot-hills, to undulating plain can easily be interpreted in terms of the varying resistance to erosion of the different rock formations met with. The granites, and the schists where they have been reinforced by intrusions, weather into steep ridges which, though occasionally precipitous, generally present rather rounded profiles. This description applies equally well to both these rock types since their modes of weathering are so similar that, from a consideration of topography alone, it would be well nigh impossible to tell, when looking from a distance on, say, Taylor Range, where the granite ended and the schist began.

The schists, on the other hand, which have not been strengthened by intrusions are shaped by erosion into semi-detached rounded hills.

The undulating plains which—though they do not occur within the area mapped—succeed these hills of schists, are the result of weathering of the Trias-Jura sediments. The Tertiary gravels where met with form sub-horizontal outcrops, while the recent alluviums are found as typical river flood-plains.

These different modes of weathering are reflected in the courses of such streams as Cubberla Creek, which, rising in a miniature gorge in the heart of the Taylor Range, flows rapidly through its narrow channels into the foot-hills, among which it winds its way in a more leisurely manner, coming at last to the recent alluvium, through which it wanders in typical meandrine fashion before it finally flows sluggishly into the Brisbane River. Another, and perhaps better, example is instanced in Ithaca Creek.

The question has been raised as to whether the Taylor and Enoggera Ranges are to be explained as residuals, or as the result of faulting. Cameron[1] has suggested that

1. W. E. Cameron, Op. Cit. p. 3.

the Brisbane River—or rather that part of it above Oxley Creek—which follows approximately the line of junction between the Brisbane schists and the Ipswich measures, really marks a series of fault-lines. A number of facts seem at first rather to support such an idea ; for example, the abrupt way in which the ranges rise out of the surrounding country and the fairly level summits of these ranges. The writer, however, has found several objections to such an hypothesis, and believes that the various phenomena can be better explained as the result of differential erosion.

At a point on the right bank of the Brisbane River near Corinda, a section can be seen well exposed at low-water showing the Trias-Jura beds resting unconformably on the Brisbane schist, and moreover, this section lies in the line of supposed faulting. The very gentle dips of the Ipswich beds in close proximity to the supposed lines of faulting seem also to militate against such an idea, at least for the area under discussion. The chief points in favour of the hypothesis that Taylor Range and Enoggera Range are residuals resulting from differential erosion are, first, the fact that these Ranges are composed of very resistant rocks—the granites, and schists strengthened by large intrusions—and second, the marked parallelism of the strike of the intrusives and the axis of granitic intrusion with the directions of the ranges and chief spurs. In this connection it is interesting to compare the Geological Map (Plate XI.). with that of the Physiographical features (Plate XII.)

iv.—The Rocks of the Area.—General.

In the geological formations of the area, rocks of both igneous, sedimentary and metamorphic origin occur. The first are represented (1) by rocks of a granitic type—the Enoggera granites ; (2) by intrusive bodies—mostly of a rhyolitic facies, but in part made up of a more truly hypabyssal type ; and (3) by flows and sills of a basaltic nature. It is with the first and second of these classes—which are probably closely related—that this paper is chiefly concerned, while such examples of the third class as occur in the area dealt with are dismissed with this brief notice.

The oldest unaltered sediments occurring in the vicinity of these igneous rocks, are the series known as the Ipswich beds. These, although they are not actually shown on the geological map accompanying this paper, occur almost immediately outside it, good sections being shown on the Brisbane River near the mouth of Oxley Creek and at Corinda. They are made of sandstones, conglomerates, and grits, interspersed with layers of shale, while almost at the base of the series is the extensive deposit of volcanic ash, known as the Brisbane Tuff. The basal beds of the system are to be seen in a number of sections in and around Brisbane resting unconformably on the Brisbane schists. They contain a rich fossil flora of mesozoic forms, a consideration of which indicates a Trias-Jura age for the formation.

Above the mesozoic sediments are a series of conglomerates, grits and clays. These beds, in which a number of fossils of dicotyledonous plants have been found, are well displayed around Sherwood, and are generally assigned to the Tertiary period.

The most recent deposits are river alluvials which are to be seen at a number of points along the banks of the Brisbane River and Kedron Brook, and to a less extent those of Enoggera and Cubberla Creeks.

The metamorphic rocks are represented by a very extensive series of altered sediments known as the Brisbane schists. These schists are extremely important in the present connection, in that it is with them that the igneous masses here dealt with are almost invariably associated. They are undoubtedly the oldest rocks in this portion of Queensland, and occupy the major part of the area under discussion. The series is made up of mica schists, slates, and shales, which have undergone a varying amount of secondary alteration by silicification. They are markedly schistose, and generally exhibit very noticeable contortion. Jensen, in speaking of these Brisbane schists, remarks that they "are so crushed, folded, foliated and faulted that they must be assigned to the middle zone"[1] in

1. H. I. Jensen, A.A.A.S., 1909 p. 262.

Grubenmann's classification.[1] Their general strike is north-west, with a varying dip to the north-east. The age of the schists has long been a matter for considerable speculation, as even where not highly foliated, they appear to be entirely unfossiliferous. The series has at different times been assigned to the following periods:—Pre-Cambrian,[2] Cambrian-Devonian,[3] Silurian,[4] Devonian[5] and Permo-Carboniferous,[6] while at present it is classified by the Queensland Geological Survey as Devonian.[7] This classification is, however, admittedly only provisional, no conclusive evidence having as yet come to light.

V.—The Granites.

Location, etc.—The rocks considered under this heading form three distinct outcrops. The largest of these is roughly oval in plan, and lies between Kedron Brook on the north. Mt. Cootha Reserve on the south, the Enoggera Reservoir on the west, and the Enoggera Rifle Range on the east. The longer axis of the oval lies in a direction N. 12° W. —S. 12° E., and measures four and a quarter miles, while the shorter axis is about two and three-quarter miles long. This principal outcrop is spoken of throughout the paper as "the Enoggera Area." About one and a quarter miles south of this occurrence, and roughly one and a-half miles west-north-west of Indooroopilly railway station, lies the second outcrop. This is sub-circular in shape, with an average diameter of about 750 yards. This may be conveniently termed the "Green Hill Area" since it lies adjacent to a hill of that name. Lying to the north-north-east of the Enoggera Area, and distant from it one half-mile, and one and a-half miles respectively, are two further outcrops of granitic rock. They are

1. U. Grubenmann, Die Kristallinen Schiefer.
2. R. A. Wearne, A.A.A.S., 1911.
3. H. I. Jensen, Proc. Royal Soc. of Qld. XXIII, p.154.
4. William H. Rands, Op. cit. p. 1.
5. Sir A. C. Gregory, Report on Geological Features of S.E. Districts of Qld., 1879.
6. Q'land Geological Survey Map.
7. B. Dunstan, Queensland Mineral Index, Geological Survey, Queensland, Pub. No. 241, p. 144.

separated by recent alluvium merely, and there is every reason for considering them as parts of one common mass with its major axis approximately meridional, and about one and a-quarter miles in length.

If the major axis of the Enoggera Area be continued to the south, it will be seen to pass through the centre of the smaller Green Hill outcrop. Thus this direction may be considered a true axis of igneous intrusion. The Kedron Brook outcrops are so seldom seen in direct contact with the intruded schist that only a rough idea can be gained as to the real shape of the body, but as has been suggested, it, too, is probably roughly meridional.

Thus we see that, like the great granite batholiths of New England,[1] the axis of intrusion of the Enoggera granites differs from the strike of the older country rock,—which in both cases is almost certainly the result of folding in Permo-Carboniferous times—and seems to sympathise with the trend of the adjacent coast line. Further north, in Central Queensland, where the coast line takes the same direction as the prevailing strike of the older rocks, the granite batholiths too have this direction.[2] This suggests that in Queensland—or at least in Southern Queensland—the axes of intrusion belong—as in the case of New South Wales and Victoria[3]—to those newer trend lines, which were initiated soon after the Permo-Carboniferous folding, and which ultimately determined the position of the present coast line.

*Petrology.**—The most marked feature of the granites of the area is their variability. This is shown mineralogically, in the nature of the constituent minerals and their relative proportions, and texturally in the grainsize and fabric of the rocks. In this peculiarity the granites resemble very closely the first of the "Later Granite Types" of

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1. T. W. E. David, Pres. Address to Royal Soc. of N.S.W, 1911, p. 36

2. T. W. E. David, Pres. Address to Royal Soc. of N.S.W. 1911, p. 36.

3. T. W. E. David, Pres. Address to Royal Soc. of N.S.W. 1911, p. 36.

* The Petrology of the igneous rocks of the area will be treated in greater detail in Part II of this paper.

New England, as described by E. C. Andrews,[1] and the "Stanthorpe" granite of Saint-Smith.[2] However, in the case under consideration, the various phases can all be assigned to one of two main types.

Of these types, the one which forms the major portion of the outcrop of the Enoggera Area is a rock of a fairly uniform flesh-colour, which is only relieved by a minority of ferro-magnesian minerals —these constituents, however, being very variable. Usually the rock is holocrystalline and porphyritic, with medium-sized phenocrysts of quartz, pink orthoclase, white plagioclase and black mica set in a fine-grained aplitic, flesh-coloured groundmass. Hornblende is sometimes present, but is always subordinate to the biotite. Occasionally the porphyritic character disappears, and in its place appears a medium-grained holocrystalline rock, which in all other respects resembles the normal type. In this rock the orthoclase is slightly in excess of the plagioclase, while in the commoner porphyritic phase the plagioclase phenocrysts are considerably in excess of the orthoclase. This apparent diversity is however compensated for in the groundmass of the latter type, which is rich in orthoclase. The accessory minerals usually present are apatite in considerable amount, magnetite, and zircon. Pyrites is usually absent. From this short description the rock is evidently comparable in structure and mineralogical character with specimens of a granite from Bolivia which is described by Mr. G. W. Card,[3] and is a representative of the great "Acid" series of New England granites, and also with the "typical 'Acid'" granite described by him.[4]

The second type of granitic rock met with in the Enoggera Area, is usually considerably less acidic than that just described, it has a much greater proportion of ferro-magnesian minerals (often in two generations), has

1. New England Geology. Records of Geol. Survey of N.S.W. Vol VIII. Part 2, pp. 116-117.

2. Geology and Mineral Resources of the Stanthorpe, Ballandean and Wallangarra District. Qland. Geol. Survey Pub. No. 243, p. 39.

3. Geol. Survey of N.S.W. Records, Vol. VIII, p. 219.

4. Mineral Resources of N.S.W., No. 14, p. 23.

hornblende usually in excess of biotite, is lacking in pink orthoclase, and contains a marked quantity of pyrites. Like the former type, it varies somewhat both texturally, and in the proportions of its constituent minerals. For convenience this phase of the granites may be called the granodiorite type. This variety usually occurs as segregations in the former (using the term in its broadest sense), these segregations varying in size from patches a few square inches in area to huge masses covering many square yards. A common size measures about ten feet in diameter. These segregations do not favour any particular shape, rounded, angular, and very irregular patches, all being common. Larger outcrops of this granodiorite type also occur, one area in the north-western portion of the mass measuring some acres in extent.

In connection with this natural division of the granites into these two fairly distinct groups, it is interesting to quote Saint-Smith on the "Stanthorpe" granite. "Speaking generally," he writes, "the 'Stanthorpe' granite is characterised by a markedly pink colour, due to the abundance of pink orthoclase felspar, which is seen through the rock. This colouration does not, however, persist over the whole area examined, for at Wilson's Downfall the rock has a preponderance of long, white felspars having a marked orientation. So pronounced is the difference between these two varied types of the same rock-mass. . . ."[1]

The Green Hill Area is composed of rocks of the first or adamellite type. They are for the most part very acid, of a pink colour, and consist of phenocrysts of quartz, pink orthoclase, white plagioclase, biotite, and a very little hornblende, set in a fine-grained pink aplitic groundmass.

The Kedron Brook Area differs from the one just described in that it contains rocks which bear a general resemblance to the granodiorite type of the Enoggera Area. They contain plagioclase in excess of orthoclase, the pink variety of the latter mineral being entirely absent. They vary in colour from light to dark grey, but are all fine-grained porphyritic rocks. Both pyrites and pyrrhotite occur as accessory minerals.

1. Op. cit. p. 40.

Intrusions in the Granite.—The majority of the dykes found penetrating the granitic rocks can be divided into two distinct classes, viz., dark porphyritic rocks, and light coloured aplites. Several examples of the former type can be seen in the cuttings along the Waterworks Road. They vary in width from a few inches to about fifteen feet. A fairly typical example of this class occurs in the granite quarry off the Waterworks Road. This is about nine inches wide, is dense, heavy, grey in colour, and made up of phenocrysts of a light brown (altered) plagioclase and small patches of secondary quartz set in a very fine-grained felsitic groundmass. Scattered throughout the rock are segregations of pyrites up to 5 m.m. in diameter. The other dykes of this type differ chiefly in the proportion of the phenocrysts to the groundmass, this ratio being very variable. These intrusions are similar in their general characteristics to those considerably larger dykes outside the granite to be described later as the "Porphyries."

The aplitic dykes are considerably more numerous than the porphyritic. They generally occur somewhat near the contact of the granite with the schist, where they are frequently associated with pegmatites. These latter vary from rather coarse-grained rocks—with crystals of orthoclase, about two inches long—to micropegmatites, whose typical structures can only be observed with the microscope, and are often found near, and probably connected with, large masses of quartz. The aplites themselves are, as a rule, very fine-grained. They vary considerably in colour—different examples being white, light brown, pink and red—and are generally almost entirely free from ferro-magnesian minerals. A rather different type of rock, but one which probably belongs to the same phase, is also met with. This occurs well within the granite, in large irregular masses. It is a little coarser grained than the typical aplites, and is generally red in colour. It frequently contains small blebs of quartz as phenocrysts and abundant black tourmaline arranged in stellate groups of small acicular crystals. In this and other points this rock seems to resemble rather closely the aplitic dykes intrusive into the Acid Granite of New England, as described by Leo. A. Cotton.[1] Such an intrusive mass is to be seen on the summit of Mt. Enoggera, which is the highest point in the area. This particular occurrence appears to grade into a biscuit-coloured fine grained rock, containing a noticeable amount of biotite. This phase is interesting since in it the writer has discovered flakes of molybdenite arranged along the joint planes. Other rocks which should be mentioned here are the typical greisen, which occurs near the Enoggera Reservoir, and in Portion 856, Parish of Enoggera

Considered both as a whole and in detail, this aplitic phase corresponds closely to the group of intrusives which followed almost immediately the appearance of the " Acid " and " Stanthorpe " granites of New England and Stanthorpe respectively.[2]

Contact Phenomena.—A study of the contact phenomena associated with the intrusion of the granites brings to light a number of interesting facts. The changes brought about by such intrusion vary in an apparently arbitrary manner from place to place, and are often quite local in character. As the main mass of granite is approached from the east, the schists, which normally strike in a north-westerly direction, are seen to gradually change in strike, until, when near the intrusive mass, they lie roughly parallel to the adjacent edge of the granite. A similar phenomenon is observed when the Enoggera granite is approached from the west, but in this case the dip itself is reversed, the schists to the west and south-west of the granite dipping to the west and south-west respectively. Numerous dips have been observed, and in nearly every case the schist is seen to lie parallel to the edge of the granite, and to dip away from it. For the smaller Green Hill and Kedron Brook areas this generalisation does not seem to hold, for in each of these cases the strike of the schist seems to have been only locally affected by the intrusion of the magma. Indeed, in the case of the former area, quite a different type of structural change is brought about. This involved the

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1. The Tin Deposits of New England, N.S.W. I. Proc. Linn. Soc. of N.S.W., 1909, p. 745.

2. Compare the works of Andrews, Carne, Cotton, and Saint-Smith already cited.

brecciation and grinding-up of the schist, and examples can be seen at a number of points outside the periphery of this ntrusion. The breccia is made up of angular fragments o schist of various sizes, but seldom exceeding one inch in length, set in a finely-powdered ground mass. This rock, as the granite is approached, gradually shades off into a hornfels showing traces of the agglomeritic structure, which in turn is succeeded by a more normal hornfels.

The mineralogical and textural changes induced in the schists not only vary in the different areas considered, but vary at different contacts of the same intrusive mass. In general, as the granite is approached, the quartz veins, which form a noticeable feature even in the normal schist, become more frequent, until in close proximity to the granite, the whole rock seems to have been silicified and hardened. A marked textural change is to be seen near the Enoggera Reservoir where the heat resulting from the intrusion has converted the normal micaceous schist—already somewhat siliceous—into a hard black hornfels. On the north-north-west edge of the main granite area, and twenty-five yards outside the actual contact, on the Cedar Creek Road, there is a band of rock about two feet in thickness, showing the typical schistose and contorted structure of the Brisbane schists, but made up almost entirely of tourmaline and felspar arranged in definite bands. The tourmaline—which is the black variety schorl—is present as numerous minute acicular crystals all arranged with their long axes parallel to the planes of schistosity, and seems to have taken the place of the micaceous part of the schist; while the felspar seems to occupy the spaces previously occupied by the small veins of quartz. The whole schist has been so beautifully replaced that the new rock under the closest scrutiny shows every characteristic of the normal schistose structure. Nearer the granite, and almost right on the contact itself, is a larger body of schorl rock composed entirely of tourmaline in the same slender crystals, but in which the original schistosity is only faintly recognisable. This rock contains cavities which are partly filled with well-shaped quartz crystals with an occasional crystal of pyrites. Small patches of tourmaline are also found in the schist over fifty yards from the contact.

A noticeable textural change in addition to that from schist to hornfels already described, and one that is well developed round the Green Hill Area, is that from the typically schistose to the typically gneissose. This is well shown in the creek bed in the south-east corner of portion 310, parish Indooroopilly. Here, when about one hundred yards from the contact with the Green Hill granite, the schist takes on a gneissose character. The ferro-magnesian minerals are gathered together in long, black, well-defined bands varying from less than one millimetre to over two centimetres in width. These bands appear under the microscope as masses of small fresh crystals of biotite, the rest of the rock being occupied by lenticular streaks of white quartz, which, when examined by the same means, is seen to have undergone recrystallisation.

Chemical changes resulting from absorption of the invaded schists by the granites, or allied phenomena, seem to be almost entirely wanting. With but one exception, the contact between the schist and the igneous rock is very sharp and clearly defined. There seems to be no evidence to show that assimilation of the invaded formation by the intruding magma has taken place. The one possible exception is seen in the creek bed in portion 229, parish of Indooroopilly, where between the granite—which is considerably less acid than normally at this point—and the hornfels—by which the schist is here represented—there is a distinct glassy band of a yellow colour and measuring half an inch in thickness. On examination with the microscope this band proves to be made up of irregular crystals of quartz one-half to three millimetres in length arranged at right angles to the line of contact, with—filling the spaces between them—aggregates of a sericitic mica. The granite in the immediate neighbourhood of this band is considerably darker than the normal pink type. This is due to the facts that the aplitic groundmass has almost disappeared and the proportion of primary biotite has considerably increased. The chlorite resulting from the decomposition of this mineral also tends to make the rock abnormally dark.

A matter which is closely connected with the phenomena of contact metamorphism is the presence of fragments of the country rock in the invading magma. Such inclusions though very rare have been found on the edge of the large Enoggera mass. They are much more numerous in the Green Hill Area, a good development occurring in the creek bed in the south-east part of portion 310, parish of Indooroopilly. Here the granite near the actual contact contains numerous inclusions of schist, or rather of a gneissose rock similar to the altered schist in the neighbourhood of the contact. The largest of these fragments measures only about one foot in length. The edges of these inclusions show a slightly darker band from 1.5 to 2 millimetres in thickness, otherwise they are entirely unaltered, preserving a very definite outline strongly contrasted against the enclosing granite, and internally in no way different from the adjacent country rock. The inclusions seem limited to a narrow zone at the edge of the granite, none having been found in the more central portions of the mass. In this connection, it is interesting to note that Daly's Zone of Apophyses[1]—that belt ' more remote from the intrusive body " than the Zone of Inclusions and consisting of " country rock intersected by more or less numerous apophyses from the main igneous mass " is quite wanting, the contact of granite and schist even in the neighbourhood of the inclusions being quite regular.

In considering the various changes outlined above, there is one fact of observation which is highly interesting. It is that the phenomena of metamorphism resulting from the intrusion of the large mass seem to be more widely spread but less intense in character than those of the smaller Green Hill mass. The chief change caused by the larger intrusion was the alteration in the strike of the intruded rocks and their general hardening. The more pronounced meta-

1. The Mechanics of Igneous Intrusion (Second paper) Amer. Jrnl. of Sci., August, 1905.

morphism resulting in the formation of gneissose textures, in brecciation and the tearing off—by whatever means—of fragments of the wall rock, occurs around the smaller mass, which however does not seem to have influenced the strike of the schists to any very noticeable extent.

Mode of Intrusion—Of the three principal theories at present put forward to account for the intrusion of granitic magmas, the Marginal Assimilation theory, which is supported by some French geologists, suggests chemical energy as the chief factor in the intrusion; the Overhead Stoping Hypothesis of R. A. Daly[1] considers heat energy to be the all-powerful agent, while the Laccolitic Theory, advanced by Harker,[2] Brögger[3] and many others, relies chiefly on mechanical energy.

If the above hypotheses be applied to the present instance, it will be seen that the evidence in general supports the Laccolitic method of intrusion for at least the large Enoggera mass, as witness the following facts.

The schists near the contact strike parallel to and dip away from the granite. Here, obviously, great mechanical energy must have been called into play, either in the preparation by folding movements of a cavity or plane of weakness in the schists into which the magma found its way (forming the "phacolite" of Harker[4]) or—and this seems more probable, since the long axis of the intrusion is not sympathetic with the strike of the schists—in the actual lifting up of the schist cover by the invading magma itself to form the typical laccolite.

The contacts of schist and granite are always very sharply defined. Traces of assimilation are quite lacking and hence the Assimilation Hypothesis seems out of the question.

There is an almost complete absence of inclusions, such few as are found showing no trace of absorption by the magma. Further there is, too, an absence of what Daly terms the Zone of Apophyses. These facts militate against

1. Mechanics of Igneous Intrusion. Am. Jour. Sc., April, 1903.
2. Natural History of Igneous Rocks, p. 82. et seq.
3. Eruptivegesteine des Kristianiagebietes, II, pp. 116-153.
4. Op. cit. p. 77.

the Overhead Stoping Hypothesis, since this postulates a fracturing of the invaded rock followed by the injection of long sinuous apophyses of low viscosity into the fractures, as the essential features of the growth of the intrusion.

The ground-plan is that of a typical laccolite, as are the proportionate lengths of the major and minor axes, that is 3 : 2.[1] While it is impossible from the limited vertical section exposed to observation to classify this igneous body strictly according to its shape—as Daly would have it—these facts taken into conjunction with the probable method of intrusion seem to point to the *shape* of this occurrence as that of a true laccolite. Similar laccolites of Plutonic rock have been described from a number of places,[3] while Brögger explains much larger areas of granite as laccolites.

In the considerably smaller Green Hill Area, the phenom ena seem to resemble more closely those which one would expect as the result of "overhead stoping." The dips of the schists seem to be almost independent of the granite mass. Inclusions are fairly common and answer very well to the description of those found in Daly's type localities,[2] but here again the Zone of Apophyses is wanting. Assimilation is present in this area but on such an exceedingly small scale as to show its practical insignificance to the problem in hand. Yet even in this area mechanical energy has played an important part as witness the schist breccia with its finely-ground base which is so characteristic a feature of this intrusion.

Age of the Granites—Unfortunately, work done up to the present can throw very little direct light on the exact age of the Enoggera granites. They undoubtedly intrude the Brisbane schists, as the various contact phenomena plainly show. Further, the included fragments in the granite are inclusions of schists, not of unaltered sediments, so that the movements producing the schistosity occurred before the intrusion of the granite. Again, the axis of intrusion cuts across the axis of folding, the two

1. G. K. Gilbert, Geology of the Henry Mountains.
2. Mechanics of Igneous Intrusion, p. 272.
3. Alfred Harker Op. cit., pp. 65, 67 and 82.

directions making an angle of thirty degrees, so that the latest folding of the schists also antedated the appearance of the granites.

Unfortunately, the age of the Brisbane schists themselves is still in the region of doubt, but there seems little reason to doubt that they are early Palæozoic sediments, and that the folding referred to took place in late Palæozoic—probably Permo-Carboniferous—times.

Although the granites lie in such close proximity to the Ipswich beds, neither they, nor any of the allied, but somewhat later, intrusives intrude these strata. Since the Brisbane representatives are the basal members of the Ipswich series, and since this is the lowest division of the Trias-Jura, the granites are probably pre Trias-Jura. These facts, though slight, point to the probability that the granites are late Permo-Carboniferous in age.

If we now resort to less direct methods and consider the evidence gained by a correlation of these granites with those of other areas, a practically indentical result is arrived at. From a study of the works of Andrews, Carne, and Cotton on the New England granites, the writer has come to the conclusion that in spite of superficial differences the Enoggera granites resemble very closely, and are probably related to in point of time, the granites which Andrews considers under his "Later Granite Types" or "Acid" granites which are indentical with the Stanthorpe granites. The chief grounds for this conclusion are, the general mineralogical similarity,[1] the marked variability of the rocks of both areas—Andrew's description[2] might be applied word for word to the Enoggera granite—the absolutely sharp lines of demarcation between the granites and the invaded rocks,[3] the association of each of the granites with somewhat later finer-grained aplitic types, lacking in ferromagnesian constituents and containing black tourmaline and molybdenite[4] and the further association of the granites with rhyolitic intrusions, quartz porphyries, and porphyries.[5]

1. Card Mineral Resources of N.S.W. Records, Vol. VIII., p. 23.
2. Op. cit. p. 113.
3. Andrews, Op. cit. p. 232.
4. Andrews, Op. cit. p. 232.
5. Andrews, Op. cit. pp. 117, 128.

These later "Acid" granites of New England have been considered by different observers to be Permo-Carboniferous,[1, 2] "Early Mesozoic,"[3, 4] and Mesozoic[5] in age. A consideration of these opinions and especially the more recent ones seems to point to late Permo-Carboniferous as being the most probable age of intrusion.

Assuming then that the Enoggera granites and the "acid" granites are related as regards time of intrusion, this result gives weight to the decision. already formed on purely local evidence, that the granites are late Permo-Carboniferous, which may then be supposed to approximate the truth.

vi. The Rhyolitic Intrusives.

This is the name given to an extensive series of intrusives which occurs throughout the area, the great majority of them however, lying to the south of the main granite outcrop. The rocks which come under this head vary considerably, but are as a rule light in colour, the commonest shades being white, light brown and grey. They include intrusive rhyolites, felsites and fine-grained granophyric rocks. They are frequently porphyritic—the phenocrysts generally being orthoclase—but in no case is this structure pronounced. Well marked fluxion structure is very common, especially in the more acid varieties. A feature which is characteristic of the group is its mode of weathering. Almost without exception the rocks weather into very angular fragments with sharp edges. The planes along which the rocks break intersect each other at all angles, the cracks generally being filled with limonite. In this respect the group is very strongly differentiated from the younger prophyries to be described later. A common mode of alteration in these intrusives is caused by the continuous passage of siliceous waters through them. The rocks thus attacked gradually become more and more

1. Federal Hand-book, B.A.A.S.
2. Andrews in the Hand-book of N.S.W., issued for B.A.A.S., p
3. Carne, Op. cit. (on maps).
4. Andrews, Op. cit. p. 113.
5. Carne, Op. cit.

siliceous, until at last they resemble very closely some quartzites. A good example of such an altered rock is to be seen in the quarry at Corinda.

As regards mode of occurrence these rocks are found both as dykes, sills and laccolites. Examples of the first type are very common, the great majority of the smaller intrusions being of this nature. Sills, though not so plentiful have been observed at a number of points throughout the area, the large intrusion in portion 684, parish Indooroopilly probably being of this nature.

A good example of the laccolitic type of intrusion is to be seen on the northern edge of the Mount Cootha Reserve. This large mass is now considerably dissected by young streams, but enough remains to show that it is a laccolite. The level of its base—470 ft. above sea level—is wonderfully constant. A small patch of schist still caps the top of the intrusion which is 590 ft. above sea level, giving a thickness of 120 feet for the intrusion. As far as can be determined the laccolite measures about 550 yards in length, the ratio of height to length being approximately 1 : 14. Another splendid example of this type of intrusion occurs at Indooroopilly. Here on the left bank of the Brisbane River, just below the Albert Bridge, is to be seen an oblique section across the end of a laccolite. The schists can be observed dipping away from the intrusion on both sides, while the jointing of the intrusion itself forms a pronounced curve with its convexity upwards since it seems to follow the outline of the intrusion itself. This particular intrusion can be followed for nearly a mile in a north-westerly direction, but the outcrop is merely a small portion of the top which has been exposed by the erosion of the overlying schist.

At first sight, the rhyolitic intrusions seem to lack uniformity of direction, but a study of the map, together with numerous observations in the field, show that there are two or three directions which are particularly favoured. These are west-north-west, north-west, and north-north-west. Those falling under the first and second directions seem to run more or less in the general direction of the strike of those schists, and are well illustrated by the large intrusion at Indooroopilly just discussed. The last direction is shown by a series of disconnected dykes, which, breaking across the strike of the schists extend from the cross roads at Indooroopilly school to the carriage drive in Mt. Cootha Reserve, the line of intrusion in this case being almost parallel to the axis of intrusion of the granites.

An interesting feature in connection with these rhyolites is the fact that some of them have been found to be slightly auriferous. Mr. Rands[1] refers to an intrusion—probably that in the road cutting near Indooroopilly school—in which "very minute specks of gold were visible." An assay of an average sample, however, "gave but a mere trace of the precious metal."

vii. The Porphyries.

This is a field name given to a series of rocks, which differ in many respects from the rhyolitic dykes. They form a distinctive type, and seem to be the result of a rather later series of intrusions than that which produced the more acid rocks. The rock is readily recognised in the field since it always weathers into black, rounded boulders, somewhat rough and pitted on the outside. It is thus easily distinguished from the sharp angular fragments resulting from the weathering of the other more acid type of intrusion. The typical rock is porphyritic with numerous phenocrysts of idiomorphic felspar—brown from alteration—showing zoning in the hand specimen, and a few smaller phenocrysts of quartz set in a brown or grey felsitic groundmass.

The rock easily undergoes decomposition, making it extremely difficult to collect fresh specimens. Under the microscope, the quartz phenocrysts are seen to have rounded outlines, to be deeply corroded and to be surrounded by marked reaction rims. The felspar is very altered being replaced by an aggregate of muscovite and similar secondary minerals. In spite of this alteration the idiomorphic outlines of the original crystals are still definitely preserved. Both the felspar and quartz phenocrysts are very similar

1. Op. cit. p. 1.

to those observed in a quartz-porphry which outcrops in the bed of Ithaca creek, and which in most other respects resembles the rhyolitc rocks. It thus seems to form a connecting link between these two very different types of rock.

A series of intrusions which are very similar to the porphyries have already been described as intruding the granite itself. The porphyries seem then to be younger than the granites, and as they also break through an important chain of rhyolitic dykes on the southern boundary of Mt. Cootha Reserve, they are younger too than this group of intrusions.

There are two principal outcrops of the porphyry. One is roughly parallel to Taylor Range, and outcrops near the top of the ridge which it occasionally crosses, thus probably forming the backbone which has preserved this part of the range as a residual. The general direction taken by this intrusion is thus north-west—south-east. The only other really extensive intrusion of this rock occurs as a series of outcrops about one mile to the west of the Green Hill granite. Here the individual outcrops and the intrusion as a whole seem to strike almost due north, again sympathising with the long axis of the granites.

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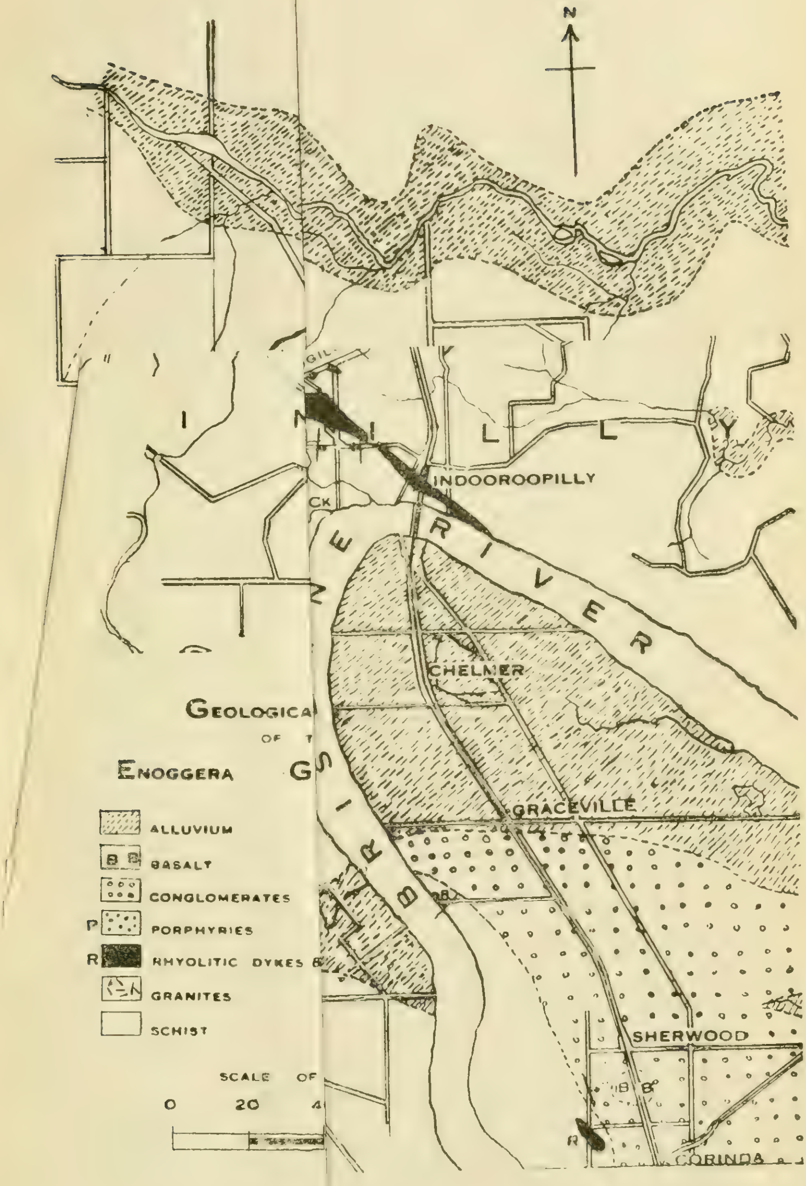
I would like here to express my gratitude to Mr. Richards and Mr. Walkom of the Department of Geology in the University of Queensland, for the help and advice which they were ever ready to offer me in connection with the preparation of this paper, and their kindly encouragement throughout the whole of the work.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FISH CREEK
WATERWORKS ROAD
ENOGGERA RESERVOIR
ENOGGERA CK.
ITHACA CREEK
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AUCHENFLOWER
ITHACA CREEK
MT COOTHA PARK
MT CONSTITUTION
TOOWONG
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TARINGA
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MOGGILL ROAD
WITTON CK.
INDOOROOPILLY
BRISBANE RIVER
BROOKFIELD ROAD
CHELMER
GRACEVILLE
SHERWOOD
CORINDA
GEOLOGICAL MAP
OF THE
ENOGGERA GRANITE AREA
ALLUVIUM
RECENT
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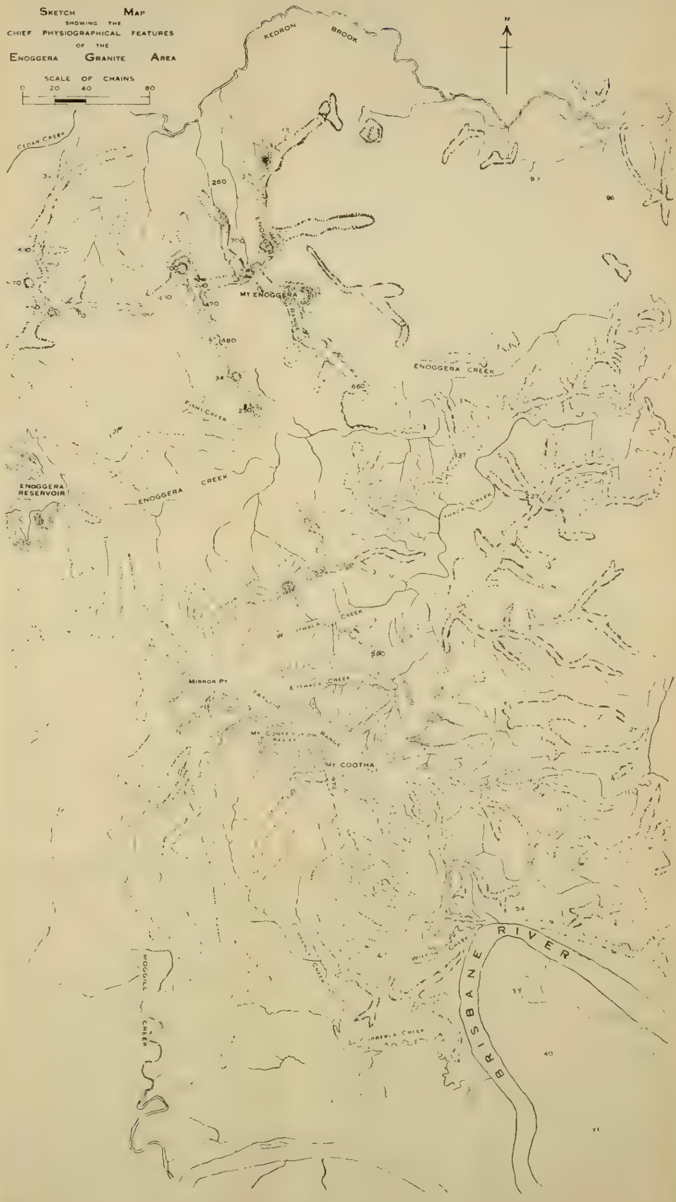
Sketch Map
showing the
Chief Physiographical Features
of the
Enoggera Granite Area
Scale of Chains
0 20 40 80
N
Kedron Brook
Cedar Creek
Mt Enoggera
Enoggera Creek
Enoggera Reservoir
Fish Creek
Ithaca Creek
Mirror Pt
Mt Cootha
Moggill Creek
Brisbane River

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