PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR

1885.

TASMANIA:
PRINTED AT "THE MERCURY" OFFICE HOBART.

1886.

Institut Royal de France

Acad.ie des sciences (Botanique)

DE LA BILLARDIÈRE,

(Jacques Julien)

Né à Alençon, (Orne) le 28 Octobre 1755, élu en 1800.

Photo-lithographed at the Crown Lands Department Hobart

THE responsibility of the statements and opinions given in the following papers and discussions, rests with the individual authors; the Society as a body merely places them on record.

Contents.

ERRATA,

JUNGERMANNIA RETICULATA.

Herr Stephani, a noted specialist in Germany, has, at the request of Baron von Müeller, examined this plant, and he refers it to Polyotus Magellanicus, Jung. Magellanicus of Hook. Mux. Exot. Mr. Boswell, of Oxford, and Mr. Pearson, of Manchester, also refers it to that species. It differs from J. reticulata, Hook. in that the stipules on the main stem are entire, except a slight notch at the apex of a roundish form. Richd. A. Bastow.

Vol. 1884.—Page 260, line 16, &c., for "*Swaart,*" read *Swart*; line 20, for "*Duchesmeur,*" read *Duclesmeur.*

Page 262, line 33, Delete "republished at the same place in 1824-26."

Page 262, Delete foot-note "§ i. p. 50."

Page 263, insert § i. p. 50.

ROYAL SOCIETY.

APRIL, 1885.

A monthly meeting of the Society—the first of the session of 1885—was held at the Royal Society's rooms, on Tuesday, April 14. There was a large attendance of Fellows. Mr. James Barnard, vice-president, occupied the chair.

The following gentlemen were elected Fellows:—The Premier (Hon. Adye Douglas, M.L.C.), Mr. Justice Giblin; Messrs. E. Edmondson, Joseph Davies (Beaconsfield), H. J. Burnett, J. C. Hadley, G. H. Edwards, J. F. MacMullen, Arthur Butler, H. T. Maning, and the Rev. T. M. O'Callaghan.

The Hon. Secretary (Dr. Agnew), said that amongst the novelties laid on the table that eveinng was a catalogue of the library, prepared by the Curator, and which had long been a great desideratum, and it had been compiled now with such completeness that it would be a very valuable possession for some time to come. It was so arranged that any books received in the future could have their names inserted in the proper place. Mr. Morton deserved the greatest credit for the assiduity and ability which he had shown in the compilation of this very useful book, and thanks were not only due to him, but also to the Government for kindly allowing it to be printed at the Government printing office, and so saving the society a great deal of expense. The officers of the department, Messrs. Strutt and Grahame, had shown such an amount of attention, care, skill, and interest in the mechanical part of the work that he could hardly find words to thank them. An enormous amount of trouble had been occasioned by the printing of the work, but it was now in all probability placed in the hands of the Fellows in as perfect a form as possible. He moved,—"That the cordial thanks of the society be given to Mr. Morton for his compilation of the work, and also to Messrs. Strutt and Grahame for the part they had taken in its issue." (Applause.)

Mr. C. P. Sprent seconded the motion, which was carried unanimously with acclamation.

The Hon. Secretary (Dr. Agnew) brought forward the usual returns, viz.:—

1. Number of visitors to the Museum:—January—On Sundays 640, on week days 1,892, total 2,532; do. February—On Sundays 742, on week days 1,324, total, 2,066; do. March—On Sundays 567, on week days 1,336, total, 1,896.

2. Number of visitors to Royal Society's Gardens:—January, 6,500; February, 6,000; March, 5,570

Plants and Seeds received at and sent from the Royal Society's Gardens during the month of January, 1885:—

From Baron Ferd. von Müeller, 48 packets seeds.

From Messrs. Heyne Co., Adelaide, 4 packets seeds.

From Mr. C. F. Creswell, collection of imported bulbs, about 300 varieties.

From Miss Brumby, Old Beach, eight packets seeds.

From Messrs. Heyne Co., Adelaide, three packets boronia seeds.

From Baron Ferd Von Müeller, 14 packets seeds.

From Miss Woodin, seeds Japan Coniferæ and lily bulbs.

To Messrs. Law, Somner, Melbourne, two bags sphagnum moss.

To Mr. Wm. Bull, London, case containing ferns.
To Dr. R. Schomburgh, Adelaide, sphagnum moss.
From Messrs. A. Van Geert, Belgium, five bags abico seeds.
From Mr. Wm. Bull, London, 32 packets seeds and bulbs.
From Miss Woodin, 25 packets seeds from Japan, principally choice Coniferæs.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's gardens during March 1885 :—

8th. Seckle pear commencing to ripen.
10th. Tips of hornbeam commencing to turn brown.
12th. Coe's golden drop plum ripe.
14th. Tips of elm turning yellow.
17th. Horse chestnut leaves turning brown.
18th. Ash leaves commencing to fall.
25th. Oak leaves commencing to fall. Acorns ripe.
10th. Veronica augustifolia in flower.
14th. Royal apricot commence to ripen.
16th. Grevillea robusta in full flower.
19th. Jargonelle pear ripe.
24th. Black mulberries commence ripen.
1st. Windsor pear commence to ripen.
3rd. Bon chretien commence to ripen.
14th. Blackberries commence to ripen.
25th. Ash commencing to shed seed.
28th. Sycamore commencing to shed seed.

METEOROLOGICAL RETURNS.

From the Government observer, Capt. Shortt, R.N., table of observations for January, February, and March. From Mr. F. Abbott, superintendent of the Royal Society's Gardens, register of rainfall for January, February, and March.

Additions to the Library during the months January, February, March :—

Acta Horti Petropolitani Tomus VIII., IX, Fasciculus I.-II., from the society.

Administration's report of the Meteorological Reporter to the Government of Madras for the years 1883-1884, from the Meteorological Department, India.

Agricultural Gazette, December, 1884 ; January, February, 1885.

American Agriculturist.

Annals de la Societe, Malacologique de Belgique, Tome XIV., XV., XVI., from the society.

Annals and Magazines of Natural History, January and February, 1885.

Annual Report of the Surgeon-General U.S. Army, 1884.

Annual Report of the Curator of the Museum of Comparative Zoology at Harvard College, 1883-4, from L. Agassiz.

Annual Report of the Chief Signal Officer to the Secretary of War. Part 1 and 2. Washington, from the War department.

Archives du Musee Teyler, serie II., Troisiéme partie, Deuxieme partie, from the society.

Astronomical and meteorological observations, year 1878-79, Washington, from the U.S. Naval Observatory.

Athenæum, The, December, 1884.

Bericht des Verines für Naturkunde, XXIX., XXX., from the society.

Boletin de la Academie National, Tome VI., from the society.

Bulletin of International Meteorology, January to August, 1883, Washington, from the War department.

Bulletin of the Essex Institute, January, February, March, 1882, from the society.

Bulletin of the Buffalo Society of Nat. Sciences, vol. IV., No. 2, Buffalo, from the society.

Catalogue of zoological works, comprising icthyology, etc. Catalogue of ornithology, mammalia, etc. Catalogue of entomology, from J. Wheldon and Co.

Catalogue of papers and works relating to the mammalian orders, marsupialia, and monotremata, from J. J. Fletcher, Esq., M.A.B. Sc.

Catalogue of superior second-hand books, J. Sotheran & Co.

Catalogue of the Australian Hydroid zoophytes, by W. Bale, Esq., from the trustees Sydney museum.

Catalogue of the choicest portion of the Lyston Park Library, from B. Quaritch, Esq.

Chronologie geologique, la., from E. Dupont, Esq.

Charts of relative storm frequency for a portion of the Northern Hemisphere. Charts and tables showing geographical distribution of rainfall in the U.S., from the War Department, Washington.

Colonies and India, The, January 16, 1885. Comparative vocabularies of the Indian tribes of British Columbia, with map, from A. R. C. Selwyn, Esq.

Compte-rendu de excursion, etc., D. Ræymaekers.

Daily bulletin of meteorological observations, from the Meteorological Observatory, Washington.

Descriptive sketch of the physical geographical geology of the Dominion of Canada, from A. R. C. Selwyn, Esq.

Essex Institute, historical collection, vol. XIX., from the society.

Gardener's Chronicle, December, 1884, January, February, 1885. Geology of Wisconsin, Vol. IV., I., 1873-79. From H. H. Bennett, Esq.

Geological Magazine, January, February, 1885. Goldfields of Victoria, the reports of the Mining Registrars, 1884. From the Department of Mines.

Government Statist's Report on the Vital Statistics of Melbourne and Suburbs, 1884. From the Government Statist.

Hourly Readings, 1881, No. 51, Part 3. From the Meteorological Office, London.

International simultaneous meteorological observations and charts, from the War Department, Washington.

Indian meteorological memoirs, vol. II., III., 1884, from the Meteorological Office, Calcutta.

Instructions for making meteorological observations, prepared for use in China, from the Government Astronomer.

Journal of the Statistical Society of London, part 1 to 4., vol. XLVI.; part 1, vol. XLVII.; part 1, vol. XLVIII., 1883-4.

Journal of the Linnean Society of London, Nos. 126 to 133, vol. XX, 1883-4; Nos. 97 to 102, vol. XXIII., 1883-4.

Journal of the Royal Historical and Archæological Association of Ireland, Vol. VI., 4th series 1883. Nos. 53 to 56.

Journal of the Royal Asiatic Society of Great Britain and Ireland, Vol. XVI., parts 1, 2, 3, 1884, new series

Journal of the Society of Arts, Vol. XXXI., Nov. 1882 to Nov., 1883.

Journal of the Microscopical Society, Vol. IV., part 6, December, 1884, February, 1885.

Journal and Proceedings of the Hamilton Association 1882-3, Vol. 1, part 1.

Journal of Science, January, February, March.

List of the Fellows of the Linnean Society of London, October, 1883.

List of the Fellows of the Zoological Society of London, 1883.

List of the Fellows of the Geological Society of London.

List of the vertebrated animals in the Zoological Society of London, 8th edition, 1883.

Marine Annelids of the order Serpulia: some observations on their anatomy, with the characteristics of the Australian species. By W. A. Haswell, Esq., B. Sc. From the author.

Memoirs of the Royal Astronomical Society of London. Vol. 47, 1882-83.

Memoirs of the Boston Society of Natural History. Vol. III., No. VI., 1883. Vol. III., No. VII., 1883.

Memoirs of the Geological Survey of India. Palæontologia Indica series X., vol. II., pt. 5.

Meteorological and physical observations in the East Coast of British America.

Meteorological observations made at the Adelaide Observ. and other places in South Australia, 1882.

Medical and Surgical History of the War of the Rebellion. Pt. III. Surgical vol.

Meteorological observations, Wellington, New Zealand, December, January, February, from the Government astronomer.

Melanges Geologique et Malacologiques, from D. Ræymaeker, Esq.

Midland Medical Miscellany, The; vol. 4, No. 38, from the society.

Monthly notices of the Royal Astronomical Society, vol. XLV., No. 1, November, 1884, No. 2, December, 1884, from the society.

Monthly weather review (general) weather service of the United States, January to October, 1883, from the War Department, Washington.

Monthly weather report of the Meteor. office, London, for September, 1884, from the Meteor. office.

Monthly weather report, June, July, August, October, 1884, London, from the Meteor. Department.

Monthly record meteorology, Victoria, November and December, 1884, from R. L. Ellery, Esq.

Motions of fluids and solids on the earth's surface, No. VIII., from the War Department, Washington.

Nature, vol. 31, December, 1884; vol. 31, January, 1885.

Pamphlets (15), from the Societie Americaine de France.

Popular Essays on the Movements of the Atmosphere, No. XII., Washington, from the War Department.

Proceedings of the Zoological Society of London, part I. to IV., 1883; part I., 1885.

Proceedings of the Royal Geographical Society of London, vol. V., VI., 1883-4.

Proceedings of the Linnean Society of London, November, 1882, to June, 1883.

Proceedings of the Royal Colonial Institution of Great Britain, vol. X., part I.-II.

Proceedings of the Davenport Academy of Natural Sciences, vol. III., No. 1, vol. 3, parts 2-3.

Proceedings of the Canadian Institute (Toronto), vol. I, No. 34.

Proceedings of the American Association for the Advancement of Science, Salem, from the society.

Proceedings of the American Academy of Arts and Sciences, new series, vol. IX., June, 1881, to June, 1882; vol. X., whole series, XVIII., May, 1882, to May, 1883.

Proceedings of the Academy of Natural Sciences of Philadelphia, pts. 1, 2, 3. January to December, 1883.

Proceedings of the Boston Society of Natural History, vol. XXI., pt. 4, January to April, 1882; vol. XXII., May to November, 1882.

Proceedings of the American Philosophical Society, vol. XX., June to December, 1882; vol. X., January to April, 1883, May to October, 1884.

Proceedings of the Linnean Society of New South Wales, vol. IX., pt. 4.

Proceedings of the Yorkshire Geological and Polytechnic Society, new series, vol. VIII., pt. 3. From the societies.

Preis-Verzeichniss, Chemischer, etc., from Dr. Krantz.

Quarterly journal of the Geological Society, London, vol. 39, parts 2, 3, 4, 1883, vol. 40, parts 1 and 2, 1884, from the society.

Quarterly weather report for 1878. Appendices and plates, London, from the Meteor. Office.

Quelques observations from D. Rœymaekers, Esq.

Records of the geological survey of India, vol. 18, part 1, 1885, from the Geological Survey Office.

Report of the British Association for the advancement of science, from the society.

Report on the results of dredging, "Report in the Blake Echini," vol. XXIV., part 1, by A. Agassiz, Esq., from A. Agassiz, Esq.

Report of the Technological, Industrial, and Sanitary Museum, Sydney, for 1884, from the society.

Royal Colonial Institute, report and proc. Vol. 14, 1882-83, from the society.

Rules of the Linnean Society of New South Wales, and list of the members. February, 1885, from the society.

Rheinisches Mineralien-comptoir (4 pamphlets), from Dr. Krantz.

Signal Service Tables of Rainfall and Temperature compared with the crop production, No. 10, from War Department, Washington.

Smithsonian Report for 1881, from the society.

Studies on the Elasmobranch Skeleton. By W. A. Haswell, Esq., B. Sc., from the author.

Statistical Register of the colony of Victoria for 1883, and index, from the Government Statist.

Tickle's Colonial Export, Prices Current, and Trade Review.

Transactions of the Institution of Engineers and Shipbuilders in Scotland, vol. 26, 1882-83, from the society.

Transactions and proceedings of the Royal Society of South Australia, vol. VIII. for 1883-4, from the trustees.

Verein für Naturkunde gu Kassel, from the society.

Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westfalens, by Dr. C. J. Andra. Zweite Hälfte, 1882. Erste Hälfte, 1883. Zweite Hälfte, 1883, from the society.

Victorian Year Book for 1883-4, by Mr. H. H. Hayter, from the author.

Victorian Naturalist, January, February, March, 1885, from the society.

Vital and Meteorological Statistics of Hobart and Launceston, from the Government Statist.

Washington Astronomical and Meteorological Observations, Vols. XXV., XXVI., 1878-9, from the Meteorological Dept.

Wood Pavement Board Report—Minutes of Proceedings and Appendix, Sydney, New South Wales, 1884, from Professor A. Liversidge.

PRESENTATIONS TO THE MUSEUM.

Mammals.

Golden-bellied beaver rat, Hydromys chrysogaster, Master A. Swan.

Golden-bellied beaver rat, Hydromys chrysogaster, Mr. Propsting.

Kangaroo rat, Hypsiprymnus apicalis, Mr. R. Alomes.

Hairy echidna, Echidna setosa, Mr. Flexmore.

Skull of native tiger, Thylacinus cynocephalus, Mr. Wilson.

Birds.

Nankeen crane, Nycticorax caledonicus, Mrs. John Lord.
Skua Gull, Lestris cattaractes, Colonel W. V. Legge, R.A.
White-fronted falcon, Falco lunulatus, Mr. C. C. Nairn.
New Holland Goshawk, Astur novæ-hollandiæ, Mr. H. Stannard.
Australian Goshawk, Astur approximans, Mr. E. C. Wright.
Australian Goshawk, Astur approximans, Mr. C. Meredith.
Collection of New Zealand bird skins, Mr. A. F. B. Hull.
Red-capped Dottrel, Hiaticula ruficapilla, Mr. C. Blyth.
Little Penguin, Spheniscus minor, Mr. Propsting.

Reptiles.

Diamond snake of Tasmania, or copper head of Victoria, Hoplocephalus superbus, Mr. E. D. Swan.
The Tiger snake, Hoplocephalus curtus, Mr. Geo. Hinsby.
Diamond snake, Hoplocephalus superbus, Mr. J. R. McClymont.

Fishes.

The Thresher or Fox Shark, Alopecias Vulpes, Mr. John Swan.
Three Elephant Fish, Callorhynchus antarticus.
Stone-lifter or Catfish, Kathetostoma læve.
Porcupine Fish, Chilomycterus jaculiferus.
Sea Horse, Hippocampus abdominalis, Mr. F. Self.
A collection of the Freshwater Herring or Cucumber Fish, Prototroctes maræna, Mr. John Swan.

Shells.

Haliotis nævosa, Mr. H. Haywood.
An Octopus, Mr. F. Self.

Insects.

A moth, Mr. J. Northcote.
Two moths, Cossus sp., Mr. E. Palmer.
A moth, Cossus sp., Mr. C. H. Lovett.
Orthopterus insect, Mr. Maning.
A moth, Rev. Mr. Wilson.
A collection of insects, Mr. J. McCance.

Old Newspapers, etc.

A collection of English papers, Mr. Justin McC. Browne.
The *Samoan Reporter*, 1847, Rev. H. Freeland.
Promissory note, value 3d., Hobart Town, 1825.
Programme of the 12th anniversary regatta, Hobart, November 30, 1849, Mr. W. H. Buckland.
One guinea (paper) on the Falkirk Union Bank, October, 1812, Mrs. Geo. Hinsby.

PAPERS.

The Hon. Secretary, Dr. Agnew, stated he had received a letter from Baron Von Müeller, accompanied with a most elaborate paper entitled "The Zoology of Australia," written by that distinguished scientist of Sydney, New South Wales, the Hon. W. Macleay, F.L.S. The paper, the Baron stated, was written at his request for a great forthcoming work in Germany, but as it contained some very valuable information, the Baron thought it was highly important that it should appear in its original English before leaving for Germany. As the paper embraced 51 pages of foolscap, only a part of it was read.

Col. Legge, in answer to an appeal from the hon. sec., said the review was a very interesting one. The most salient point about the region was that the great family order of the Woodpecker was totally absent from it, and it was the only region in the world similarly situated. He also referred to the great number of Petrels in the region. The subject, in his opinion, had been very exhaustively treated in the paper which had been read.

Mr. E. D. Swan said the absence of the Woodpecker was, according to Gould, owing to the Australian trees shedding their bark, so that the beaks of the birds would not be required to bore into the trees to get insects for food.

Col. Legge said it would be very interesting to acclimatise them here and see the result.

A paper by Mr. A. B. Biggs, Launceston, entitled "The Lunar Eclipse of 30-31st March, 1885." The paper was not long, but of great interest to those who pay particular interest in astronomical studies.

A paper, by R. M. Johnston, F.L.S., on the character and relationship of the upper palæozoic and mesozoic formations of Tasmania, and the associated diabasic rocks, illustrated by specimens collected by him in various parts of the colony, and an account of a collection of ferns made by Mr. J. R. McClymont at the Cascades.

Prior to reading his paper on the character and relationship of the Upper Pal. and Mesozoic formations of Tasmania, with the diabasic rocks, Mr. Johnston announced that he had discovered at Porter Hill, near Hobart, an important series of beds, showing a gradual transition upwards, without stratigraphical break of any kind, from the common limestone restricted to marine organisms, to fine sandy shales where the marine organisms have altogether disappeared, with the exception of a minute ostracod. These upper beds are replete with plant remains, chiefly of ferns, allied to the genera — Gangamopteris, Cyclopteris, and possibly Pecopteris. The fossiliferous marine limestones and mudstones, replete with the common forms belonging to the genera Stenopora, Protoretepora, Fenestella, Spirifera, Strophalosia, Terebratula, etc., are followed by thin passaged beds of alternating dark brown sandstones and friable shales, where most of the common lower forms disappear, with the exception of Spirifer Tasmaniensis and P. Darwinii. In these shales a species of Cythere swarms in the greatest number, together with species belonging to the genera Modiolopsis, Tellinomya, and Theca. In these latter beds also the plant remains referred to begin to make their appearance, and in the uppermost shales the plant remains, and an occasional Cythere, with the articulated spines, probably of a species of Ichthyodorulites alone are to be found. Mr. Johnston is of opinion that these upper beds with plant remains are the equivalents of the Tasmanite stage of the upper marine beds of the Mersey.

Mr. Johnston also announced that Mr. McClymont had kindly forwarded to him for the society's collection the following interesting ferns from the Cascades, Tasman's Peninsula, viz.:—Lomaria patersoni, L. lanceolata, L. procera, L. discolor, Polypodium billardieri, Aspidium capense, Grammitis australis, Hymenophyllum rarum, H. crispatum.

Mr. R. A Bastow read a paper entitled "Jungermannia reticulata." This interesting paper was accompanied with some beautifully-mounted specimens shown by the microscope.

The Superintendent and Inspector of Fisheries, Mr. Saville-Kent, F.L.S., F.Z.P., exhibited and made remarks upon the ova and living fry of the Cucumber Mullet, Herring, or Grayling (Prototroctes maræna). The eggs taken and artificially impregnated from fish caught in the Mersey, at Labrobe, were rapidly hatching out in his aquarium. A period of precisely three weeks had elapsed from the collection of the eggs and the appearance of the first fish, the "eyed" condition of the ova having been entered upon on the expiration of the first fortnight. The artificial impregnation or collection of the eggs of this fish not having been previously accomplished it was a point of interest to ascertain whether they were deposited by the parent among the gravel in the river bed, as is the case with the Salmon Trout, and European Grayling (Thymallus), or whether, as obtains with another allied form, the

European Cucumber Smelt (Osmerus), they are deposited upon and adhere to solid substances, such as submerged rocks or timber, as has been suspected by some authorities. The experiment made had resulted in determining that the eggs were non-adherent, and sunk to the bottom of the water immediately on exclusion. A remarkable feature of these eggs was their excessively small size, they not exceeding individually a millimetre in diameter, so that over 600 might be contained in a single even layer having the dimensions of one square inch. As compared with the eggs of the salmon and trout it had been observed that the developing embryo occupied a much larger portion of the cavity of the egg, the yolk sac being almost completely absorbed in the liberation of the young fish. There is in consequence no semi-inactive or "alevin" stage with this species as found in the trout and salmon, the fry on emergence being remarkably slender and buoyant, and swimming actively towards the surface of the water. A more exhaustive technical paper upon the development of this species was promised by Mr. Saville-Kent at a later date. The success he had obtained in the culture of the several hundred fry then in his possession made him altogether sanguine concerning future operations that would be undertaken of rearing them on an extensive scale for the re-stocking of our Southern rivers.

Mr. Sprent laid on the table some copies of a geological map of Tasmania, prepared at the Crown Lands department The work was initiated at the request of the Hon. N. J. Brown, Minister of Lands and Works, and was intended to accompany the "Crown Lands Guide" issued by the department. It has frequently been represented to the Government that Mr. Gould's maps and reports should be republished for general information, but as to do so would entail a great amount of unnecessary labour, it was decided to embody Mr. Gould's work in a general map, and to incorporate therein all the most reliable information obtainable from other sources. Mr. Sprent, finding that Mr. R. M. Johnston was independently engaged upon the preparation of a descriptive account of the geology of Tasmania, agreed to join forces with that gentleman. Several gentlemen, on being consulted, agreed to give information, but a great difficulty was experienced in reconciling statements, it was determined to prepare a map from the materials at hand, and then distribute it amongst those who were likely to take an interest in adding to and correcting it. The map now issued does not claim to be a reliable record of ascertained geological facts; it is put forward rather as a guide, and as an incentive to further work in the same direction; there being no complete geological survey of Tamania, it is impossible to attain to more than approximate accuracy. The authors therefore offer this map as their contribution towards a future and more elaborate work. It will be found to give a clear and fairly accurate delineation of the leading geological features of the colony as far as it is possible to delineate them upon a map of small scale.

Mr. Johnston is now engaged upon the letterpress portion of the work, but as it is necessarily a work of his spare hours it will not be ready for some months yet.

In the meantime Mr. Johnston and Mr. Sprent will be grateful to any gentlemen who will furnish them with information that may be made available for another edition of the map.

Mr. E. D. Swan exhibited an albatross' egg Diomeda exulans. This egg was collected during the cruise of the Erebus and Terror at Campbell Island, lat. 52deg. 33min. S., long. 169deg. 9min. E., in the year 1840; weight, 17¼oz.

The Curator drew attention to a beautiful mounted specimen of a copper-headed snake of Victoria. This specimen had been captured by

Mr. E. D. Swan at Phillip Island, and he had it mounted and presented to the Museum. Attention was also drawn to a very pretty variety of an albino morepork, Podargus cuvieri, caught at Brighton.

On the table were exhibited three specimens of the brown trout, Salmo fario, caught at the Great Lake, their weight being 15, 14, and 13lb. respectively.

A specimen of quartz from Mount Morgan, Queensland, was shown.

SPECIAL MEETING.

At a special meeting, which was held on the same evening, an alteration of a formal character was made in rules 24 and 27, to enable meetings of the Council to be held without the presence of the hon. secretary, which has hitherto been held essential, and altering the date of the first meeting for the session.

MAY, 1885.

The monthly meeting of the Royal Society of Tasmania was held on Tuesday evening, 12th May, Mr. James Barnard, V.P., in the chair, and several ladies were present. A very large number of Fellows were present. The following gentlemen, who had been previously nominated by the Council, were balloted for, and declared duly elected as Honorary Members of the society, viz. :—The Hon. William Macleay, F.L.S., M.L.C., etc., Edward Pierson Ramsay, F.R.S.E., F.L.S., etc., etc., Curator Australian Museum, Sydney. In proposing the former gentleman the hon. secretary (Dr. Agnew) referred to him as one of the first naturalists in the colonies, to whom they were indebted for very many favours. To the trustees of the Australian Museum and Mr. Ramsay, he said, they were under special compliment for valuable additions to their Museum. Mr. Ramsay had it in his power to be serviceable to them, and he had always exercised it in their favour. It was to the Trustees and him they were indebted for the valuable collection of New Guinea and other birds which were displayed on their table that evening.

A HANDSOME DONATION.

The CHAIRMAN said he had, on the part of the council, to make the gratifying announcement to the Fellows of the society that since their last meeting they had received from the executors of the late Dr. Joseph Milligan a legacy of £350, which was to be devot d to furthering the various objects of the society. (Applause.) Although it was nearly 30 years since Dr. Milligan quitted Tasmania for Europe, he had nevertheless taken a vivid interest in the affairs of the society, and this had culminated in his final act of bequeathing such a handsome legacy to the institution he loved so well. (Applause.) Those who had the privilege of enjoying the intimate acquaintance of Dr. Milligan while he was secretary of this society would remember the zeal with which he threw himself into the advocacy of the building of the museum. Through his instrumentality a large subscription was obtained, and the Government having given the site, which was originally part of the old Government House grounds, the present handsome building was the result. His zeal in the cause of science was well known. The first portion of the published transactions of the society were almost exclusively occupied with his report on the coalfields of Tasmania, which might even now be referred to with advantage by any one desiring to inform himself of the extent of the coal deposits in Tas-

mania. On all occasions Dr. Milligan had shown himself a lover of science, and in promoting the objects of this society especially. He (the chairman) would only point the moral by saying that such a life and example were worthy of all imitation. (Applause.)

The hon. secretary (Dr. Agnew) brought forward the usual returns, viz.:—

1. Number of visitors to the museum April—On Sundays, 960; on week days, 1,160; total, 2,120.

2. Number of visitors to Royal Society's Gardens. April—5,500.

Seeds received at the Royal Society's Gardens during the month of April, 1885:—

From the Botanic Gardens, Madras, 16 packages seed.

From the Botanic Gardens, Saharanpur, N.W. India, seeds (Abies dumosa).

4. Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during April, 1885:—

8th. Chinese Chrysanthemums commence to flower.

10th. Elm leaves commence to fall.

12th. Coe's fine late red plum commence to ripen.

15th. Pyrus Ancuparia leaves commence to fall.

24th. Black Mulberry leaves commence to fall.

28th. Seeds of Hornbeam ripe.

Meteorological Returns.

From the Government Observatory, Captain Shortt, R.N., table of observations for April, from Mr. F. Abbott.

Superintendent Royal Society's Gardens, register of rainfall for April.

Additions to the library during the month of April.

Adelaide University Calendar for the year 1885. From the University.

Agricultural Gazette, March 9, 16, 23.

American Agriculturist, March, 1885.

Annals and magazines of Natural History, March 1885.

Bombay magnetical and meteorological observations for 1883.

Bulletin du Musee Royal D'Histoire, Naturelle de Belgique, Tome iii., 1884, No. 1.

Bulletin de la Societe Royale de.

Botanique de Belgique, Tome Vingt. From the Society.

Descriptive notes on Papuan Plants. From Baron F. von Müeller, K.C.M.G.

Epinal glossary, Latin and old English of the eighth century, photo.-lithographed from the original M.S., by W. Griggs, and edited with transliteration, introduction and notes by Henry Sweet, M.A. From the Chief Secretary of Tasmania.

Fac-similes of the declaration of independence, and the treaty of Waitangi, New Zealand. From the Rev. Geo. Clarke.

Forest culture and eucalyptus trees, by Edward Cooper.

Fragmenta Phytographiæ Australiæ, pt. 2. From Baron F. von Müeller, K.C.M G.

Gardeners' Chronicle, Feb. 28, March 7, 14, 21, 28.

Geological Magazine, March.

Index Perfectus ad Caroli Linnæi. Species Plantarum, Nempe Earum From Baron F. von Müeller, K.C.M.G.

Journal of Science, March.

Memoirs of the Geological Survey of India, vol. xxi., pts. 1, 2. (Palæontological Indica). Series xiii., vol. 1, pt. 4. Salt Range Fossils, by W. Wagen, pt. D., 1. Productus Limestone Fossils, iv. Brachiopoda, with plates, lviii., lxxxi. From the Geological Survey Department of India.

Medical Press and Circular, March 18, 1885.

Monthly notices of the Royal Astronomical Society, vol. xlv., No. 4., February, 1885.

Monthly Weather Report of the Meteorological Office, London for November, 1884.

Nature, vol. 31, February.

Organic Constituents of Plants and Vegetable Substances and their Chemical Analysis, by Dr. G. C. Wittstein, translated by F. von Müeller, F.R.S. From Baron von Müeller, K.C.M.G.

Proceedings of the Geographical Society of Australasia, New South Wales and Victorian branches, with maps and illustrations, 1st session, 1883-4, vol. 1. From the Society.

Prodromus of the Zoology of Victoria, decade x., by Professor McCoy. From the Government Printer, Victoria.

Preussische Statistik, lxxix. From the Statistisches, Berlin.

Quarterly Weather Report, pt. 1, 1877. From the Society, London.

Tasmanian Statutes, vol. 4. From the Government.

Victorian Naturalist, March and April. From the Society.

Vital and Meteorological Statistics for April. From R. M. Johnston, Government Statistician.

Wattle Bark Report of the Board of Enquiry.

PRESENTATIONS TO THE MUSEUM.

Mammals :

Two Black Opossums, Phalangista fuliginosa, Mr. J. McCluskey.
A Black Rat, Antechinus swainsoni, Dr. Coverdale.
Tiger Cat, Dasyurus maculatus, Mr. C. S. Agnew.

Birds :

New Holland Goshawk, Astur novæ-hollandiæ, Mr. Headlam.
Swamp Parakeet, Pezoporus formosus, Mr. Tabart.
Lewin's Rail, Rallus Lewenii, Dr. L. Holden.
Australian Gannet, Sula Australis, Mr. P. Seager.
Eagle Hawk, Aquila audax, Mr. ——
Native Companion, Grus Australasianus, Mr. Facy.

Fishes :

Two Salmon, Salmo salar (male and female), from the River Erne, Ireland, from the Salmon Commissioners, Tasmania.
Tasmanian Jack or Pike, Lanicoperca mordax, Mr. R. M. Johnston

Insects.

A Few Insects, Mr. J. McClynont.
A Collection of Beetles. Mr. Moore.

Shells.

Pecten fumatus, Mr. J. McCane.
A Valve (Limopsis tenisoni), Mr. T. R. Atkinson.

Old Documents.

One Spanish Dollar, dated Hobart Town, July 10, 1823 (paper).
A Two Spanish Dollar, dated Hobart Town, March 25, 1823 (paper).
Paper Money, value 2s. 6d., Dr. E. J. Crouch.

Papers.

The continuation of the Hon. W. Macleay's paper, "Zoology of Australia."

A paper by Mr. R. M. Johnston, F.L.S., entitled "Notes regarding the Silurian Fossils of the Gordon Limestones, with generic descriptions and a specific list of the organisms already named and classified."

Mr. Johnston's paper contains a brief history of the silurian fossils

obtained from the Gordon limestones of Tasmania. Although 28 species have been named and classified by Mr. Salter, over 17 years ago, no descriptions of the species have yet been placed upon record, and hence the collection of fossils now in the society's Museum, originally obtained by the late Dr. Milligan, and supplemented by Mr. Chas. Gould in the year 1862, cannot be identified specifically. Mr. Johnston has arranged with R. Etheridge, jun., F.G.S., of the South Kensington Museum, London, to have Mr. Salter's collection fully described, and to facilitate reference in the meantime, among other particulars, the former has given a full description of the various genera, with a complete list of the species already named.

Mr. R. A. Bastow read a paper "On the identification of Tasmanian mosses, etc" The paper was intended to illustrate a hand-book on the Tasmanian mosses, a compiled list of all the genera he (Mr. Bastow) had prepared from Hooker's Flora Tasmaniæ and other authorities of our mosses. The book was beautifully illustrated, and would be valuable to those who took an interest in the mosses to determine the genera they belonged to.

Mr. R. M. Johnston bore testimony to the value of Mr. Bastow's work, saying that it would be of great assistance to anyone commencing a study of the mosses. No part of the world was so favourable to such a study as Hobart, in the vicinity of Mount Wellington.

Mr. C. H. Grant said the thanks of the society were due to Mr. Bastow for his paper on this most interesting branch of the study of botany. No one could enter a mountain glade in Tasmania without seeing how particularly rich they were in mosses. England had been considered rich in them, but here they were in far greater luxuriance and beauty, and a hand-glass was quite sufficient to enable them to be fully inspected, without the aid of a microscope. If only a few people would apply themselves to the study here, new species would, he was sure, be very soon discovered. (Applause.)

A paper "On some new species of Tasmanian marine shells," by W. F. Petterd, C.M.Z.S., was read by the hon. secretary, Dr. Agnew.

Exhibits.

The Paradise birds, presented by the trustees of the Australian Museum, were a theme of admiration for their rich and exquisite colouring, and reflected great credit on Mr. J. A. Thorpe, the head taxidermist of the Sydney Museum, who had mounted them, and no doubt will prove a highly interesting addition to the museum.

Mr. Bastow exhibited, by the aid of the microscope, some beautifully mounted specimens of Tasmanian mosses, which proved of great attraction to the members present.

Lieut. C. E. Beddome stated that no doubt the Fellows were aware of the large shipment of salmon ova which had arrived during the last few days, and which had been deposited at the Ponds, and he was happy to inform them that about 50,000 eggs were alive and looking well. Accompanying the ova, was sent out two fine specimens of salmon, a male and female, which had been admirably preserved and mounted by Mr. Morton, the curator. The two fish were exhibited during the evening, the male weighed 30lbs., the female, 23lbs.

Votes of thanks to donors to the Museum, to authors of the papers read, and the chairman, brought a very pleasant evening to a close.

JUNE.

The monthly evening meeting of the Royal Society of Tasmania was held on Tuesday evening, June 9th, Mr. James Barnard, Vice-President, in the chair. A large number of Fellows were present, as well as several ladies. The following gentlemen, who had been previously nominated by the Council, were ballotted for and declared duly elected Fellows of the Society, viz., Messrs. Alexander Macdonald Ritchie and T. B. Moore.

DR. MILLIGAN'S BEQUESTS.

The CHAIRMAN said that at their last meeting he had the gratification of announcing the receipt of certain pecuniary bequests by the late Dr. Milligan to the Society. He was not then aware that in addition to those bequests Dr. Milligan had also made certain gifts of land, comprising three allotments of one acre each at Bicheno, and one town allotment of three acres at George Town. No doubt these would be of considerable value to the Society. In connection with this he would also say that the Council had thought that the best way to make acknowledgment of these liberal bequests would be to have a likeness of the deceased gentleman suspended in the Museum. They were indebted to Mr. Sprent for the enlarged photograph which they possessed, and which was on the table for the inspection of members. It was a very excellent likeness, as all those who knew Dr. Milligan would recollect.

The photograph, which had been enlarged in the Crown Lands Department, was handed round for the inspection of members.

The Hon. Secretary (Dr. Agnew) brought forward the usual returns, viz.:—

1. Number of visitors to the museum during the month of May:—Week days, 1,372; Sundays, 1,000; total, 2,372.

2. Number of visitors to Royal Society's Gardens during the month of May, 5,600.

3. Plants and seeds received at and sent from the Royal Society's Gardens during the month of May, 1885:—

From the Acclimatisation Society, Queensland, case containing 25 plants.

From Mr. G. Brunning, St. Kilda, Victoria, case containing 45 plants.

From Baron Ferd. Von Mueller, Victoria, 135 packets seeds.

From Dr. R. Schomburgk, Adelaide, 25 packets South Australian seeds.

To Messrs. Law and Somner, Melbourne, 2 bags sphagnum moss.

To Mr. John Smith, Riddel's Creek, Victoria, 2 bags sphagnum moss

4. Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during May, 1885:—

14th. Dutch medlars, commencing to ripen.
16th. Diosma alba, commencing to flower.
18th. Photini serrulata, commencing to flower.
20th. Ailanthus glandulosus, leaves all shed.
25th. Laurustinus, commencing to flower.
31st. Jasminum nudiflorun, in full flower.

Meteorological Returns.

From the Government Observer, Captain Shortt, R.N., table of observations for May.

Additions to the library during the month of May:—

Agricultural Gazette, March 30, April 6, 13.
American Agriculturist, April.
Annals and Magazine of Natural History, April.
Athenæum, The, January, February, March.

Catalogue of the Passeriformes, or Perching Birds, in the collection of

the British Museum, "Fringilliformes," Pt. 1, containing the Families Dicæidæ, Hirundinidæ, Ampelidæ, Mniotiltidæ, and Motacillicdæ. Vol. X. By R. Bowlder Sharpe. From the Trustees of British Museum.

Den Norske Nordhavs Expedition, 1876-78. XII. Zoologi, "Pennatulida," by D. C. Danielssen and J. Koren. XIII. Zoologi "Spongidæ," by Dr. G. A. Hansen. Christiana, 1884-85. From Prof. H. Mohn,

Entomologisk Tidskrift, April, 1884

Gardeners' Chronicle.

Geological Magazine, April.

Journal of Science, April.

Journal of the Royal Microscopical Society. Vol. 5. Pt. 2. April.

Monthly Notices of the Royal Astronomical Society. Vol. 45. No. 5. March.

Nature. Vol. 31. March.

New Zealand Journal of Science. No. 8 and 9. March and May.

Proceedings of the Academy of Natural Sciences of Philadelphia. Pt. III. Nov., Dec., 1884.

Primer of Tariff Reform, A. By D. A. Wells. From the Committee of the Cobden Club, London.

PRESENTATIONS TO THE MUSEUM.

Mammals.

Two Tasmanian Tigers, Thylacynus cynocephalus, male and female, Messrs. French Bros.

One do. Tiger, do. do., male, Mr. F. Mace.

A Platypus, Ornythorhynchus paradoxus, Mr. W. E. Shoobridge.

Flying Squirrell, Belideus sp., Mr. T. Oakley.

Birds.

Little Penguin, Eudyptula minor, Mr. F. Selfe.

Grey-tailed Thickhead, Pachycephala glaucura, Mr. G. Hinsby.

Tasmanian Honeyeater, Meliphaga Australasiana, Capt. E. T. Wallack.

Fishes.

Native Freshwater Perch, Microperca Tasmaniæ, Mr. J. Swan.

Parrot Fish, Labrichthys sp., Mr. R. M. Johnston.

Coins, etc.

1 Swedish krona, a 25 ore, a 10 ore, a 4 skilling (1842), a 5 cent., a dime, 2 Egyptian pennies. Specimen from the Bitter Lakes. Part of the keel of the Vega, Capt. Nordenskiold, Sub-Inspector O. Hedberg.

Papers.

"Notes on the discovery of new species of leaf impressions from the Tertiary sandstones at Mount Bischoff, belonging to the genera Eucalyptus, Laurus Quercus, Zamia, etc." By Mr. R. M. Johnston, F.L.S.

In Mr. Johnston's paper he describes a number of new species of very interesting leaf impressions obtained by Mr. Kayser in sinking through Tertiary sandstone beds, which underlie the recent basalt at Mount Bischoff as it does at Breadalbane, One-Tree Point, Geilstone, and other places in Tasmania. Mr. Kayser is highly commended for his services to science in this matter, as he has by his painstaking energy added considerably to our knowledge of the Tertiary Flora of Tasmania. In the collection made by Mr. Kayser, Mr. Johnston recognises at least 10 new species belonging to the genera Eucalyptus, Quercus, Laurus, Ulmus, Zamia, and possibly the genera Lomatia, Ceratopetalum, and Ficus, are also represented. This, according to the writer of the paper, is most interesting, as it substantiates the opinions advanced by Baron von Ettingshausen and Baron Sir Ferd. von Müeller, that the whole

existing vegetation of the world can in its development be traced to an universal flora in bygone geologic ages, and, therefore, in perfect accord with the evolution hypothesis. It is strange to observe that the prevailing forms of vegetation in Tasmania during the Tertiary period should be more closely allied to the existing flora of Europe than to the existing flora of Tasmania.

Mr. Johnston states that the species of Eucalyptus from Mount Bischoff named by him E. Kayseri, is the first indication of our most characteristic vegetation (the gum tree) which he has yet observed in a fossil state in Tasmania. Quercus, so abundantly represented in a fossil state at Mount Bischoff, is now restricted entirely to the Northern Hemisphere.

A Paper, entitled "The Tasmanian Earth tremors 1883-4-5," by Mr. A. B. Biggs, which was replied to by Captain Shortt, and Messrs. R. M. Johnston and W. H. Knight.

The following note on the determination of the coal plants of Tasmania, by Mr. T. Stephens, was read:—Some five years ago I submitted to the notice of the Royal Society specimens of Glossopteris, Gangamopteris, Noeggerathiopsis, with other forms not yet fully identified, from the Mersey coal measures, and shortly afterwards a fine collection from the same beds was presented by Mr. Hainsworth, of Latrobe. At the time of the Calcutta Exhibition I sent a box of specimens from the same locality, together with a few from the Jerusalem basin, to Dr. Ottokar Feistmantel, Palœontologist of the Geological Survey of India, who is thoroughly conversant with the flora of all the Australian coalfields, and better able than any other living authority to settle questions concerning the relative age and affinities of the coal measures of Tasmania. In the correspondence which has followed, Dr. Feistmantel expressed his readiness to determine for us the species of our coal plants, and thus facilitate comparisons and conclusions which at present are necessarily made very much in the dark. In a letter received by the last mail he says:—"I don't want to publish anything about the subject before I have got again your opinion about the position of the Mersey beds in reference to the marine fossils. I intend, then, to publish figures and descriptions of the fossils you have sent: for this purpose I would be much obliged to you for any other fossils from the coal measures of Tasmania which you might be able to communicate to me, so that my memoir on the plant fossils of Tasmania might be more complete. When I wrote my first notices on the Australian fossil flora I had no sufficient information about the occurrence of Glossopteris in Tasmania." It is a long time since I have had any leisure to dovote to the collection of geological specimens, and those which I possess from the southern and eastern coal measures are mostly in a fragmentary condition, having been obtained hurriedly from roadside cuttings, or the *debris* of coal workings, while traversing the country on horseback. I am, however, able to supply Dr. Feistmantel with a good collection from the Mersey basin, and shall be glad to do any thing in my power to send him one representing the other coal formations in Tasmania. If any of the Fellows of the Royal Society are willing to help in this direction, and will either send specimens to the Museum, or furnish the names of local collectors from whom they can be procured, they will materially aid in the accomplishment of an important work, which cannot be performed except by the transmission of a good representative collection to a competent authority.

EXHIBITS.

Mr. James Andrew produced a specimen of rock from the Kimberley district in South Africa in which the diamonds are found.

Mr. F. Belstead, of Launceston, sent a specimen of fossil wood obtained in the Ringarooma district.

SUGGESTIONS.

Mr. C. E. BEDDOME suggested that an alteration should be made in their third rule, and that the Governor of the colony should be made the honorary president or vice-patron, and that they should elect a president annually from the Council.

The CHAIRMAN was of opinion that it was not competent to the Fellows to adopt the change proposed, as it would contravene one of the fundamental principles of the Society, which had received the royal approval when the Queen became its patron, and confirmed the annual grant. The rules can be altered at any time, but certainly not the fundamental principles and constitution, and he therefore ruled that the proposed motion could not be entertained.

Mr. BEDDOME also suggested that certificates should be issued to honorary and corresponding members of the Society.

The CHAIRMAN said the Council would take that into consideration if Mr. Beddome would bring it under their notice.

The HON. SECRETARY, referring to the late election, as Honorary Members of the Society, of the Hon. W. Macleay, M.L.C., F.L.S., of Sydney, and E. Pierson Ramsay, Esq., F.R.S.,E., F.L.S., the curator of the Sydney Museum, said he had sent them complimentary letters referring to the fact, and that it had since been noted in the newspapers.

VOTE OF THANKS.

On the motion of Colonel LEGGE, seconded by Mr. C. E. BEDDOME, a vote of thanks was passed to the donors of exhibits and the authors of papers.

EXHIBITION OF MOSSES.

Mr. R. A. BASTOW, with the aid of the microscope, exhibited a very interesting collection of specimens of Tasmanian mosses, which were greatly admired.

A vote of thanks to the chairman concluded the meeting.

JULY.

The monthly evening meeting of the Royal Society of Tasmania was held on Tuesday evening, Mr. James Barnard, Vice-president, occupying the chair. There were fifty-six Fellows in attendance, amongst those present being the Bishop of Tasmania (Dr. Sandford), the Acting-Chief Justice (Hon. W. R. Giblin), and several ladies.

Dr. A. Bingham Crowther and Mr. R. R. Rex were re-elected Fellows of the Society.

Owing to the indisposition of the Hon. Secretary, for whose absence the Chairman apologised, the Curator of the Museum brought forward the usual returns, viz.:—

1. Number of visitors to the Museum during the month of June:—Week days, 1,155 ; Sundays, 570 ; total, 1,725.

2. Number of visitors to Royal Society's Gardens during the month of June, 4,550.

Plants and seeds received at and sent from the Royal Society's Gardens during the month of June, 1885 :—

From the Agri. Horti. Societies' Gardens, Madras. Seeds of Podocurpus affinis.

To Mr. G. Brunning, Melbourne. Box cuttings.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during June, 1885 :—

12th. Maelaura aurantiæa, leaves falling.
15th. Iris alata, commencing to flower.
18th. Calycanthus prœox, in full flower.
20th. Crocus vernus, commencing to flower.
22nd. Common privet, leaves falling.
30th. Black mulberry, leaves all shed.

METEOROLOGICAL RETURNS.

From the Government Observer, Captain Shortt, R.N., table of observations for June.

Additions to the library during the month of June :—

Agricultural Gazette, April 20, 27, May 4, 11.

American Agriculturist, May and June.

American Museum of Natural History. Annual report of the trustees for the year 1884-5.—From the Trustees.

Annals and Magazines of Natural History, May.

Auckland Institute and Museum. Report for 1884-5.—From the Trustees.

Athenæum, The, April.

Bulletin du Musee Royal D'Histoire Naturelle de Belgique, Tome III., IV., No. 3, 4, 1885.—From the Trustees.

Catalogue of the Fossil Mammalia in the British Museum, pt. 1, containing the orders Primates, Chiroptera, Insectivora, Carnivora, and Rodentia. By Richard Lydekker, B.A.K.

Catalogue of the Lizards in the British Museum, 2nd Edt., vol. 1, Geckonidæ, Eublepharidæ, Uroplatidæ, Pygopodidæ, Agamidæ.—From the Trustees British Museum.

Elephant Pipes in the Museum of the Academy of Natural Science, Davenport, Iowa, 1885, by Chas. Putman.—From the Trustees.

Gardener's Chronicle, April 25, May 2, 9, 16.

Geological Magazine, May.

Guide to the collection of Fossil Fishes in the Department of Geology and Palœontology, British Museum (Natural History), 1885.

Guide to the Galleries of Mammalia, Mammalian, Osteological, Cetacean, in the Department of Zoology in the British Museum, 1885.—From the Trustees.

Journal of Science, May.

Meteorological Observations, November, 1884.—From the Meteor. Office, India.

Midland Medical Miscellany, Vol. 4, No. 41.—From the Editor, Leicester, England.

Monthly Weather Report of the Meteorological Office, London, for December, 1884.—From the Meteor. Office, London.

Monthly Notices of the Royal Astronomical Society, Vol. 45, No. 6, April, 1885.—From the Society.

Nature, Vol. 31, April.

Principles of Forecasting by means of Weather Charts, by the Hon. R. Abercromby.—From the Meteorological Office, London.

Proceedings of the Canadian Institute, Toronto, 3rd Ser., Vol. III., Fas. No. 1, March 1885.—From the Society.

Proceedings of the Linnean Society of New South Wales, Vol. X., Pt. 1, June 1885.—From the Society.

Records of the Geological Survey of India, Vol. XVIII., Pt. 2.—From the Geological Survey Office.

Report of the Acting-Secretary for Mines and Water Supply, Annual, Victoria, 1884.—From the Mines Department.

Report of the Meteorological Council to the Royal Society for the year ending 31st March, 1884.—From the Meteorological Office, London.

Results of Astronomical Observations made at the Melbourne Observatory in the years 1876, 1877, 1878, 1879, 1880.—From the Government Astronomer.

Results of Rain and River Observations made in New South Wales during 1884.—From the Government Astronomer.

Scientific Transactions of the Royal Dublin Society, Vol. III., Series II., IV. Catalogue of Vertebrate Fossils, from the Siwaliks of India, in the Science and Art Museum, Dublin, by R. Lydekker, B.A. Plate and Woodcuts.

Scientific Transactions of the Royal Dublin Society, Vol. V., on the origin of Fresh Water Faunes, a Study in Evolution, by W. J. Sollas, M.A.

Scientific Transactions of the Royal Dublin Society, Vol. VI.—Memoirs on Coleoptera, of the Hawaiian Islands, by the Rev. T. Blackburn, B.A., and Dr. D. Sharpe. Plates IV. and V.

Scientific Proceedings of the Royal Dublin Society, Vol. IV., N.S., July 1884, Pt. V.; Vol. IV., N.S., January 1885, Pt. VI.—From the Royal Dublin Society.

Transactions of the Royal Historical Society.—New Series, Vol. II, Pt. IV.; 1885.—From the Society.

Transactions and Proceedings of the New Zealand Institute.—Vol. XVII., 1884.—From the Trustees.

PRESENTATIONS TO THE MUSEUM.

Mammals:

Two Grey Opossums, Phalangista vulpina; Three Black Opossums, Phalangista fuliginosus; Two Ring-tailed Opossums, Phalangista viverrina, Mr. W. Lester.

Two Tasmanian Tigers, Thylacinus cynocephalus; One Tasmanian Devil, Sarcophilus ursinus, Mr. W. Turvey.

Duck-billed Platypus, Ornithorhynchus anatinus, Mr. John Swan.

Two Ring-tailed Opossums, Phalangista viverrina, Mr. T. M. Atkinson.

Ring-tailed Opossum, Phalangista viverrina; Golden-bellied Beaver Rat, Hydromys chrysogaster, Mr. A. Brent.

Birds:

Two Musk Ducks, Biziura lobata, Mr. R. Read.

Blue Crane, Ardea novæ hollandiæ, Mr. L. Massey.

Mandarin Drake and Duck, Aix galericulata; Javanese Pheasant, Phasianus sp., Mr. E. D. Swan.

Ten species of American Birds' Eggs, Mr. Geo. Hinsby.

Fishes:

Tail of an Indian Stinging Ray, Mr. W. H. Buckland.

Crustacea:

A Hermit Crab, Pagrus sp., Mrs. John McCance.

Relics, Etc.:

A Paper, *The Saunders News Letter*, Friday, May 16, 1777, Dublin, Mr. J. F. Echlin.

Two Swedish Coins, Mr. L. O. Laroson.

WATER AND TYPHOID.

Mr. W. F. Ward, A.R.S.M., Government Analyst, read the following paper on the Impurities of Water in Relation to Typhoid Fever:—

At the request of the sanitary officer of the Launceston Corporation I have, at different times, examined 11 samples of water collected by him during his enquiries into outbreaks of typhoid fever; to the results obtained I shall refer later on, only stating now that they show painful neglect of the simplest necessary health precautions; some of the

figures are given in the table before you, also analyses of Hobart and other waters for comparison. In dealing with my subject, the considerable outside interest, and I am sorry to have to add ignorance, which attach to it must be my excuse for repeating and emphasising many points with which you are already familiar, but the knowledge of which is not so widespread as it should be. I propose to begin with the impurities found in different classes of water, to define the conditions which a really good natural water should fulfil, and to point out some means which may be employed for the improvement of a bad or suspicious water, in cases where no other supply above suspicion is by any means obtainable.

Foreign Matters found in Waters.

Chemically speaking, no water found in nature is pure; the impurities are very various—gaseous, liquid, and solid, organic, and inorganic—some beneficial, some harmless, some deadly in their effects when introduced into the human body; but the word "impurity" for our present purpose may be taken to mean something objectionable either in itself, in its origin, or its excessive quantity. The gaseous constituents of natural waters are mainly oxygen, nitrogen, and carbonic acid, all present in the air, and beneficial or harmless; small quantities of carburetted hydrogen in marsh waters, and sulphuretted hydrogen with its unmistakable smell like rotten eggs in some mineral waters. The usual mineral or inorganic constituents are lime, magnesia, potash, soda, and ammonia, with sometimes iron, manganese, or alumina, combined with chlorine, sulphuric, carbonic, and nitric acids, in some cases also nitrous, silicic, and phosphoric acids; forming chlorides, sulphates, carbonates, nitrates, nitrites, silicates, and phosphates.

Not one of these substances is, in itself, injurious, if in small quantity; but the amounts of ammonia, nitrous and nitric acids, and chlorine are used with other results of analysis in forming an opinion as to the purity or otherwise of the water under examination, while anything more than the most minute trace of phosphoric acid is considered a certain indication of sewage contamination.

The more or less poisonous metals, arsenic, lead, copper, and zinc are sometimes found, derived either from minerals in the rocks, or from pipes and tanks. The use of zinc-coated or galvanised tanks has been discontinued in the French navy on account of the action of water in dissolving zinc. The remaining constituents found in water are various kinds of organic matter, that is, matter of animal or vegetable origin, both dissolved and in suspension; the suspended matter is in part dead and decaying, the remainder consisting of innumerable minute living organisms of many kinds, sometimes including water-fleas and worms, and the ova of parasitic worms of men and animals, and almost always some forms of fungi, algæ, etc., or infusoria, the immense variety of the last named class being shown in Mr. Saville-Kent's wonderful manual lying before you. Amongst the fungi are classed the schizomycetes, minute, mostly colourless cells or threads, globular, in short rods, or straight or spiral filaments embracing the various species of bacterium, bacillus, spirillum, micrococcus, vibrio, etc., they include the smallest organised bodies known, and as a class may be said to measure from 1-150th to 1-15,000th of an inch, they multiply in two ways, either by the splitting up of one into two or more individuals, or by the coalescence of two organisms into one, followed by the production of spores which develop in to the parent form. Most of these species must be considered harmless, if we take into consideration their world-wide distribution, both in air and water, and the fact that they, as well as the other impurities mentioned, with the exception of the parasitic ova, associated as they too frequently are with excrementitious matters, are daily swallowed by millions of people without apparent

ill effect; indeed Pasteur has suggested that they may render material aid in the vital process of digestion. Some of them act the part of scavengers, causing the putrefaction or decay of dead organic matter; others, however, are accepted as the undoubted causes of such diseases as anthrax or splenic fever in cattle, cholera in fowls, and a form of typhoid in pigs: less generally, but yet by some of the highest authorities, consumption, cholera, and typhoid fever in man are considered to have been proved at least within a measurable distance of certainty to be due in each case to the presence and multiplication in various parts of the human body of a specific bacillus; some of these specific germs, or perhaps their spores, finding a resting place in a suitable subject, and reproducing as an accompaniment of its own enormous multiplication each its special disease, and apparently no other.

The bacillus tuberculosis is pretty firmly established; the battle still rages over the "comma bacillus" of Dr. Koch, attributed by some to segments of the spirillum, while comparatively recently Dr. Gaffky has found in various organs of the human body after death from typhoid a special form of bacillus which was absent in only one case out of 28 examined.

It is also claimed that diphtheria, ague, leprosy, relapsing fever, pneumonia, small- pox, scarlet fever, etc., in fact all diseases hitherto classed as zymotic, as well as several others, are caused by the presence in the body of specific forms of these schizomycetes, derived either from air or from water, the latter being undoubtedly the chief agent in disseminating typhoid fever.

The presence in water of minute organisms, in most cases, as I before said, harmless, but occasionally deadly, may be shown by growing them in various culture or cultivation fluids in which appropriate chemical substances are dissolved, they multiply enormously in a few days, rendering the clear fluid milky, and some of them can then readily be examined microscopically. The serum of blood, the aqueous humour from the eye of an ox, slices of half boiled potato and beetroot, and other substances, have also been used, but the best method by which their presence may be rendered apparent to the naked eye is by mixing the water with melted gelatine jelly in a tube, adding a very small quantity of phosphate of soda, allowing the jelly to set, and stand protected from air germs by cotton wool for some days. Each point of life multiplies and forms round it, either a sphere of liquid, or a gas bubble, and in this way different waters may be compared, at least so far as quantity or intensity of life is concerned, and so far as our present limited knowledge goes we may assume "the fewer the better" a general rule. Strong sewer water does not show globules, but the whole mass becomes turbid, and liquifies from above downwards.

The mode of action of the disease germs has been variously supposed to be either a struggle for existence with the vital cells of the animal body, death following if the function of the parts invaded be destroyed; the formation of poisonous matter in the fermentation produced by them; or mechanical obstruction of the capillaries by millions of them blocking the circulation.

Definition of Good Water.

Water for human consumption ought to fulfil all, or at least as many as possible, of the following conditions:—It should be almost, if not entirely, free from—(*a*) Floating matter, whether finely divided earth or organic matter, either animal or vegetable living or dead and decaying. (*b*) Dissolved animal or vegetable matter, or more than a moderate quantity of dissolved mineral matter. (*c*) More or less injurious or poisonous metals in appreciable quantity, such as lead, copper, zinc, arsenic, or iron. It should have no corroding or dissolving effect on

the first-named metal; and it should not contain more than two parts of iron or zinc, or one part of lead or copper, in a million parts of water. It should be free from the slightest suspicion or possibility of contamination with sewage or drainage or foul gases of any kind, from houses, cesspools, church yards, slaughter yards, tanneries, farm yards, manured fields, etc. No sediment should form on standing, and only a moderate amount on boiling. It should be moderately cool and well aerated, containing seven or eight cubic inches of dissolved gases per gallon, two cubic inches at least being oxygen. Such water will be entirely free from taste, smell, and colour; soft, clear, bright, and transparent, and entirely wholesome and palatable.

Classes of Water.

Rain-water in falling takes from the air traces of nitric acid, ammonia, mineral and organic matter, including the germs of animals and plants; and if collected from the roof of a house, will sweep into the tank much additional impurity, as the droppings of birds, dust, decayed leaves, zinc from gutters, etc. Some of these germs are the producers of fermentation, putrefaction, and sometimes, doubtless, of disease.

Springs may contain excess of mineral or vegetable matter, or poisonous metals. Lakes and ponds or water-holes will contain various impurities, according to position and the source from which they are fed, but usually yield water inferior to good river water. Rivers may receive drainage from manured land, pastures, houses, farm yards, etc., and thus contain the germs of various diseases of men and animals, and of intestinal worms and other parasites; or sheep may have been washed in them. Wells frequently receive leakage from cesspools, farm yards, etc., and may be much polluted, although the water remains perfectly clear, bright, and tasteless. Marsh water usually contains much vegetable matter, and has a "peaty" taste.

Purification.

Tanks and barrels used for storing, and filled from any of these sources, are liable, if not frequently emptied and cleaned out, to become foul from the accumulation of sediment, and the possible presence of drowned rats, mice, and insects, and the absorption of foul gases from neighbouring cesspools, pigstyes, stables, etc.; water in this condition also dissolving greater quantities of harmful metals, as lead, copper, and zinc (from galvanised iron) with which it may come in contact. In addition to frequent cleansing of store tanks and barrels, it is always advisable to use a filter, which, if efficient, will retain suspended matter and the larger organisms, including the ova of fluke, tape, and other intestinal worms, and some of the dissolved albuminous matter will be oxidised; but many of the minuter forms of life, including the dangerous ones, will pass through an ordinary filter. I mention this not to discredit filters, but to prevent too implicit reliance being placed upon them.

Boiling for some time, either without, or, better, with the addition of a very small quantity of permanganate of potash, is necessary if the quality be doubtful; but it is much safer to obtain, if possible, a supply quite free from suspicion, as it is not certain that all dangerous germs will be destroyed even by boiling, the spores of some forms bearing a still higher temperature.

Filtering, especially through a dripstone, will re-aerate the water after boiling, and so remove its insipid flavour. The dripstone should of course be out of reach of noxious gases from ill-kept yards, etc. Filters should be cleansed every two months by pouring through a quart of pure water containing 30 grains of permanganate of potash, and 10 drops of strong sulphuric acid (oil of vitroil), then two to four gallons of pure water containing a quarter to half an ounce of pure hydrochloric acid (spirits of salt), and followed by a like quantity of pure water only; the filter is

then again fit for use. If the filter contain charcoal which can be taken out, this may be first boiled in water containing a little permanganate of potash, and then baked in an oven. Unless cleansing be regularly carried out, the organic matter accumulated on the filter may render the water of worse quality than it was originally.

Very hard water containing large quantities of lime and magnesia salts may be rendered more fit for drinking by boiling, with the addition of a very small quantity of carbonate of soda, it is softened, its medicinal effect destroyed, and some of the organic matter also carried down by the precipitate formed. Lime water will have a similar effect in cold water, if the hardness be due to carbonates, while recent experiments show beneficial results in organically impure waters from the addition, to each gallon, of two grains of dissolved alum. It is advisable, however, not to rest content with purified water if by any possible means an originally pure supply can be obtained.

RESULTS OF ANALYSES.

Source of Supply.	Grains per Gallon.		Parts per Million.	
	Total Solids.	Chlorine.	Free Ammonia.	Albuminoid Ammonia.
CRESSY.				
1. Creek supplying Cressy	6·02	0·42	0·10	0·19
2. Ditto	5·60	0·52	0·12	0·18
3. Marsh draining into Creek	6·72	0·59	0·29	0·37
4. Tank of house (fever case) .. (Filled from creek.)	10·50*	0·77	0·61	2·20
5. Barrel (next door to No. 4) (Filled from creek.)	7·70	0·35	3·20	3·14
6 Tank in neighbourhood .. (Filled from creek.)	4·06	0·77	0·69	0·27
7. Lake River	7·00	1·68	0·21	0·13
EVANDALE.				
1. South Esk River ..	6·5	1·08	0·01	0·13
2. Nile Creek (Gutteridge's)	14·5	0·46	0·10	0·13
3. Ditto (common supply)	5·5	0·46	0·07	0·09
4. Well, near graveyard..	33·0	10·80	0·08	0·26
For comparison :—				
A. Dr. Hassall's proposed Standard for greatest allowable impurity ..	14·17	—	0·05	0·10
B. London Water Supply (Thames)	18·5	1·2	0·01	0·06
C. Thames, London Bridge	—	—	1·02	0·59
D. Effluent from sewage...	—	9·9	16·20	0·90
E. Hobart supply, taken the day after heavy rain had succeeded drought	7·28	0·70	0·02	0·11
F. Cascade Brewery Reservoir	3·92	0·56	0·01	0·09
G. Ditto, Diamond Drill	65·03	23·82	Trace	Trace
H. Well, near Green Ponds	86·80	29·00	—	—
I. Well, near Emu Bay ..	6·02	1·02	0·40	0·23
K. Rain Water (tank near drain)	3·92	0·21	0·12	0·16
L. Cascades Reservoir ...	—	—	0·01	0·11
M. Tap in Laboratory ...	—	—	0·005	0·07

*Sediment, in addition to dissolved solids, 51·8 mineral matter, 11·2 organic matter.

Nitrogen as Nitric and Nitrous Acids :—Evandale. —1., 0·25 ; 2., 0·11 ; 3., 0·10 ; 4., 21·41. A., 0·90 ; B., 3·50 ; H., Traces.

EXPLANATORY NOTES TO TABLE OF ANALYSES.

Nitrogen is present in considerable quantity throughout the bodies of animals, and in smaller quantity in plants, chiefly in the fruits and seeds ; consequently the estimation of nitrogen, found in the three forms of free ammonia, nitrogenous, or albuminous organic matter, and nitrous and nitric acids, forms the most important part of the analysis of drinking water.

Free ammonia, present in larger proportion than 0·08 part per million of water, is usually due to the decomposition of urea, showing that admixture with urine has occurred. The average amount of free ammonia in river waters is 0·01 part per million, but this is subject to some variation. Albuminoid ammonia is formed in the process of analysis employed, and represents approximately ten times as much living or dead nitrogenous organic matter. A water yielding more than 0·15 part of albuminoid ammonia is considered to be unfit for drinking purposes. Imperfectly filtered water yielding 0·10 - 0·29 part per million is stated to frequently produce diarrhœa. Nitrous and nitric acids are formed by the oxidation of nitrogenous matter, and have been described as the "Skeleton of Sewage," and as representing "previous sewage contamination ;" but the term "old organic matter" seems more appropriate, the nitrogen not being of necessity originally derived from sewage, but possibly from other contaminating matter. The admixture of sewage, etc., may, however, have been quite recent. A good water will contain no nitrous acid. In ordinary cases the total solids consist chiefly of dissolved mineral matter, which in small proportion is unobjectionable ; but in some spring and well waters are found excessive quantities of lime, magnesia, and soda salts (chlorides and sulphates), which render them wholly unfit for every-day use. Water containing more than eight grains per gallon of lime and magnesia salts is stated to be injurious to many persons, but in limestone districts a much greater proportion is always present.

The proportion of chlorine in natural waters varies greatly, but as it is always found in some quantity in urine and sewage, the knowledge of the amount, considered with the other results of analysis, may be of some assistanc in forming an opinion as to purity.

NOTES ON SAMPLES EXAMINED.

Cressy.

Samples 1 and 2, taken from creek supplying Cressy. Colour brownish, from finely divided matter in suspension ; living organisms present.

Sample 3, taken from marsh draining into creek about 100 yards above spot where Nos. 1 and 2 were taken. Milky, from the presence of much suspended matter, the quantity being sufficient to render the water opaque when seen in a layer of about 9in. in depth. A farm-yard and privy drained into the creek near the point where the marsh joins the creek.

Sample 4, taken from tank of house where typhoid fever had occurred. Water orignally taken from creek. Colour, brownish yellow, sediment amounting to 63 grains per gallon, about 52 grains being mineral, and the rest organic filth, swarming with life, including worms.

Sample 5, from tank or barrel next door to house where sample 4 was taken. Water originally from creek. Colour brownish yellow, slight turbidity, offensive smell, contained portions of insects, much organic matter, sporules, etc.

Sample 6, from tank or barrel in neighbourhood, filled from creek. Colour faintly yellow, slight sediment, and living organisms, including worms.

In the case of Nos. 4 and 5, and to a less marked extent in No. 6,

water, originally impure, appears to have been from time to time added to store tanks or barrels which were never cleaned out—a filthy mixture, dangerous at all times, and especially so with disease in the vicinity, being the result.

Sample 7. It is to be regretted that the water from the Lake River should have been influentially defended in the Press in a letter from which the two following extracts are taken :—"A friend of mine from Queensland . . . laughs at the idea of it being unfit to drink after seeing the stagnant water of that colony;" the river being just previously described as ". . . flowing through a large grazing as well as a marshy country which carries a large quantity of stock, the excrement of which is washed into the streams."

Evandale.

Samples 2 and 3, taken from Nile Creek. The results obtained show a perceptibly greater amount of impurity in No. 2 than in No. 1. The creek was fuller than usual when the samples were taken, and this probably rendered the results more favourable.

Sample 4, from well near graveyard, has probably received both sewage and the drainage from the graveyard. Its immediate closing was strongly recommended.

Very great care is necessary in making deductions from the results obtained, and no single standard for comparison has been or can be adopted, the general characters of the water of the particular districts when obtainable being the best guide.

A. This "standard" was proposed some years ago as showing the greatest allowable amounts of various impurities in drinking water, and it is of course desirable that they should fall as much below this as possible.

B. C. That portion of the London water supply which is taken from the Thames is usually considered to be more impure than is desirable, and various proposals have been made to replace it at enormous expense by water brought from places hundreds of miles distant. The river at London Bridge is proverbially impure.

D. Effluent sewage after removal of all solid matters by filtration.

E. This sample of Hobart water was coloured brown with vegetable matter, and was taken from an ordinary house-tap the day after a long-continued drought had been succeeded by heavy rain. The loss of residue on ignition amounted to 4·2 grains per gallon, which may in this case be considered to fairly represent the total organic matter, chiefly of vegetable origin, present in the water.

F. This water contained only a small quantity of vegetable matter in suspension, and the analysis was made on the unfiltered water. The total mineral matter amounted to 2·9 grains per gallon.

G. Total solids and chlorine in considerable quantity; two-thirds of the former consisting of chloride of sodium (common salt) and chloride of potassium, the remainder chiefly of lime and magnesia salts; very small amounts of ammonia and nitric acid, not accurately determined.

H. Chloride of magnesium and other salts of lime and magnesia present in sufficient quantity to produce medicinal effects.

I. The water of this well had evidently been polluted by surface drainage.

K. Contained various living organisms and their ova; mineral matter 2·8 grains per gallon.

Comparative experiments made in cultivating the minute forms of life in the Hobart and Evandale waters showed them to be most numerous in the first-named and the South Esk waters, and least so in the well water. No conclusions can, however, be drawn from these or similar

results at present, in the absence of knowledge as to what are dangerous or harmless forms.

CONNECTION BETWEEN IMPURE WATER SUPPLY AND SPREAD OF DISEASE.

Typhoid fever is spread by the contamination of water or air by a specific poison derived from the discharges of infected persons, and there is little doubt that this poison consists of living germs, although they have not yet been absolutely identified. The disease may be due to—

1. Percolation of liquids containing these germs, sometimes to a considerable distance, through the soil into wells and springs or underground tanks, or discharge of sewage into rivers.
2. Exhalations from ill-trapped closets, perhaps connected with house cisterns, defective sewers and privies, etc., containing germs derived from patients; water or milk stored in the immediate vicinity may in this way be rendered dangerous. When exhalations issue into the air they are stated to be immeasurably more likely to communicate disease than is the atmosphere which immediately surrounds fever patients.
3. Contamination of milk, and also possibly of spirits, by admixture with germ-polluted water; the disease is said to have been spread in one case at least by the use of bad water for washing the milk-cans. The popular belief in the absolute protective action of spirits, even in immoderate proportion, is a dangerous delusion.

The following cases of the spread of typhoid fever by water are instructive, and can scarcely be too frequently quoted:—

1. Three hundred and fifty-two persons suffered from typhoid fever, the cause being conclusively proved to be the accidental addition to the water of a small amount of excrement from a sick man who worked for a time in the deep wells supplying otherwise pure water to a large district. Such minute admixture would defy detection by chemical or any other means known at present.
2. A case of typhoid fever occurred in a cottage on the banks of a Swiss mountain stream, which below the cottage flowed for some distance underground; the water, etc., taking two to three hours to reach a village some distance lower down, the course and rate of flow being ascertained by throwing in opposite the cottage about a ton of salt. A still larger quantity of flour was afterwards thrown in and well mixed with the water; none of it reached the village, showing that tolerably efficient filtration, which entirely stopped the flour, allowed the germs of typhoid to pass in sufficient quantity to communicate the disease to 17 per cent. of the population.
3. The town of Croydon was supplied with water obtained from deep wells sunk inside the town; these were lined with iron cylinders for a certain distance from the surface to shut out the subsoil water which was known to communicate more or less with the sewers; water from the wells was frequently analysed, but no results pointing to defilement could be obtained until the level was lowered by pumping, and samples of the water trickling through the sides of the wells collected and examined, the movement of the subsoil water being also traced by chemical means. Undoubted sewage contamination was discovered, a sufficient reason for the fact that one person in 42 living in the Croydon water district suffered from typhoid fever, as compared with one in 809 in the district immediately outside, although in many cases the same sewers were used in common by the two districts. The well yielded 0·04 part, and three samples of the leakage 0·14, 0·26, 0·22 parts of albuminoid ammonia per million.

The cases in which this disease has been spread by wells found to be in communication with cesspools are very numerous.

Unfortunately, neither the microscopist, the physiologist, nor the chemist can give a definite answer as to the freedom from disease germs of any water, or, save outside rather wide limits, pronounce an opinion as to its probable unwholesomeness, the difficulty in the latter case being much greater if no history of the supply and its surroundings, and no knowledge of the general character of the waters of the surrounding district, be available.

The safest plan is to consider no water to be fit for human consumption into which sewage has entered, or can at any time enter; and the best test of safety to carefully trace the supply to its source and ascertain that no objectionable impurity gains access to it in its course.

Water mixed with sewage may be, and has been, usde for a long time with apparent impunity; but the greater the pollution the greater is the liability to receive sooner or later the germs of typhoid and other diseases, the nitrogenous matter furnishing material for their multiplication, and possibly also, by lowering the general health, preparing the way for their attack.

The slightest admixture of these germs with the purest water having been conclusively shown to be most dangerous, it is manifestly of the highest importance that the supply of towns should be preserved from risk of contamination by the prohibition as far as possible of all settlement on the gathering grounds, while that precaution, as in this colony, remains a comparatively easy matter. This matter has received much attention in Victoria with very beneficial results.

An originally pure supply may be fouled in the mains by leakage through defective joints when the water is turned off, or the pressure is insufficient to reach the higher ground. The partial vacuum produced in the empty pipes by continued drawing in the lower parts of the distric, would greatly facilitate the entrance of surface water.

The necessity for the utmost care in thoroughly disinfecting all discharges, etc., from a typhoid patient cannot be too frequently insisted on, and full directions as to the best means to be employed are given in the "Rules" issued by the Government; this precaution should be continued for two or three months, as it is stated that a patient is capable of communicating the disease during that period of convalescence. The burial of excreta recommended should be carried out as far as possible from wells.

Other germ diseases, notably cholera, may be spread through the medium of water; and, even in the absence of specific germs, an undue proportion of organic filth is injurious to health, and consequently predisposing to disease.

The typhoid germ finds in excreta a most suitable seed bed for its propagation, and in the words of Parkes:—

"The occurrence of typhoid fever points unequivocally to defective removal of excreta, and it is a disease altogether and easily preventible;" in other words, it is like diphtheria, a "filth" disease.

Tyndall says, on the general question of germ diseases:—

"The physician and the sanitarian have no longer to fight against phantoms, requiring only the fortuitous concourse of atoms to bring them into existence. Their enemy is revealed, and their business is to thwart him, to intercept him, and to slay him; it is not noxious gases, but organised germs, which, sown in the body, and multiplying there indefinitely at the body's expense, produce the most terrible diseases by which humanity has been scourged. Contagia are living things. Men and women have died by the million that bacteria and bacilli might live. These virulent organisms, these ferments of disease hang about the walls, the furniture, and the clothing of the sick

room. How is this room to be disinfected? They are diffused in the air of our drains (hence the mystic power of sewer gas). How is that air sufficiently noxious on its own account to be prevented from entering our houses? We know how typhoid fever is generaliy spread. How are our water and milk to be protected from that contagion? Our hospitals, it is said, infect their neighhourhoods. Is not this preventible?"

While Pasteur says :—

"Man has it in his power to cause parasitic diseases to disappear off the surface of the globe, if, as we firmly believe, the doctrine of spontaneous generation is a chimera."

Having now done with general considerations, let us consider our own case.

The original purity of a water from such a superb gathering ground as Mount Wellington may be to some extent counteracted if the channel by which it is distributed be not carefully constructed, and a watch kept both as to settlement on this gathering ground and along these channels. I propose to indicate shortly a few points which can only be regarded as blemishes on what should be an almost perfect supply; small, perhaps, some may say fanciful, but in my opinion not desirable, either from a sentimental or a sanitary point of view.

On one side, the Fern Tree Inn and a cottage are not far removed from the covered troughing, which just below them runs through a shallow cutting in a vegetable garden, and on the upper bank of this cutting manure is heaped, possibly all the year round, while on the reservoir dam stands a house, the ground sloping down from it to the edge of the reservoir. On the other side water is brought for some distance in an open channel parallel with and below the Huon-road, from which it probably receives rain washings; from the small reservoir it flows unconfined down the hill-side, spreading over much ground covered with vegetation, until it reaches an open channel, unprotected for hundreds of yards from the drainage from steeply sloping paddocks on either side, some ploughed, others much used for pasture, all heavily manured, directly or indirecly, passing then through the busy brewery yard to an uncovered reservoir by the side of and below a much frequented road.

The effects of this treatment are shown in analyses marked L. and M. in the table, M. being a mixture of the waters from both sides; the increase of impurity, looking at the quantity only, is extremely small, but it indicates the possibility of risky contamination in the future. (Applause).

Mr. R. A. Bastow stated in reply, that they were all deeply indebted to Mr. Ward's able paper, and would like to call the attention of the Fellows to the maps and diagram on the wall, as they bear on the subjects of typhus and typhoid fever. The City of Manchester is divided into a number of registration sub-districts, and these are again divided into sanitary districts, the maps of two of their sanitary districts are there hung, and it will be at once perceived that they contain very differently arranged properties; they are two districts, and each represents one-ninety-ninth part of the city of Manchester. In 1881 there was not a single case of typhus or typhoid fever in the sanitary district tinted with green and blue, its streets are wide and straight, every house has its own earth or ash-closet and yard, and the drainage of both yards and streets is not to be excelled in any city in the world. The other map, tinted red and brown, contains old houses, with numerous courts and alleys, along these the health inspectors are continually perambulating, but notwithstanding their watchfulness, typhus and typhoid fever often there prevail to a great extent. In the year 1881 in this small district there were 20 cases of typhus and typhoid fever, resulting in five deaths; the population being only 3,955, against 10,305 in the neigh-

bouring healthier district just alluded to. From this we conclude that, given old brick drains, ineffective stench traps, close courts, dirty rooms, and a filth-loving population, we have a pabulum favourable in a high degree to the development of typhoid and typhus fever. That an outbreak of such fever can be effectively stamped out, we need only point to the pen and ink diagrams to prove. It is drawn to the scale of 100 deaths per inch vertical, the column of greatest height respecting the deaths from typhus and typhoid fever in 1868 for the whole city, viz., 638; these gradually diminish for the subsequent years until we reach 1881, in that year only 75 deaths occurred from typhus and typhoid fever in Manchester. Glancing at the diagram, if it be asked, What made so great a change in the mortality from fever? The reply is—The removal of 16 acres of cesspool, 4ft. deep, the thorough cleansing of many miles of ill-swept streets, courts, passages, and yards, partially covered with decomposing animal and vegetable matter; the closing of burial grounds in the city; the condemnation of private slaughter houses; and the removal of emanations from drains. Nevertheless, cases of typhus and typhoid fever still occur in that well-regulated city, and will continue so to do as long as a certain grade of the population will congregate in the dark corners, and by choice be filthier than brutes. The drinking water of Manchester has been pronounced very good by eminent analytical chemists, but it is patent to all who visit the locality referred to, that the population is of the lowest stratum, and their habits are of the filthiest. The dirty, drinking, gossiping women inhabiting such a district as that shown on the brown coloured map, can, with the assistance of the milkman, sow the infection broadcast. May not the germs of typhus and typhoid fever be the bacilli or bacteria left high and dry from the sewers, or raised from that thin native noisome element by evaporation, and before they have time to be otherwise affected by the atmosphere, find a congenial hotbed for propagation in the systems of ill-fed, ill-clothed, ill-housed, and ill-washed humanity? According to their environment, do these germs develop sometimes into animal, and at other times into vegetable forms. (Hear, hear.)

Mr. R. M. Johnston said he had himself on a former occasion drawn attention to some of the supposed causes which led to the rise and fall of the death rate in Tasmania, and now Mr. Ward had brought forward another one, namely, the pollution of the waters. The care that should be exercised in regard to the state of the water they drank could not be overestimated, and should not be neglected in any respect. He had been very sorry to see that in some of the thinly populated districts there was great neglect on this point, especially in the neighbourhood of the tributaries of the great local rivers. In the bends of the river he had seen animal skins lying, and various matters connected with tanneries. In the South Esk he had seen animal matter largely carried into the river, which might, at some future time, cause very great injury to the community. Notwithstanding the value of Mr. Ward's paper, he did not think the discovery of the nature of the typhoid germ had been fully explained. There was an unknown cause, an inexplicable wave movement, which obtained much greater power at one time than it did at another, the deviation being accompanied by no apparent cause. These difficulties did not show that the conclusions come to already were of no value, but how difficult a matter it was to settle if there were something else hidden behind those conclusions. Why, for instance, should the death rate have gone up so suddenly in 1878, the year referred to by Mr. Ward; and why, again, last year with a probable increasing impurity in the water did the rate fall to a lower level? This wave action was felt while the local influences were the same. With regard to Mr. Ward's experiment, they required to know whether the germs he had developed was the typhoid germ, or whether it was harmless. He

was inclined to think they were so, and that in this room bacteria germs were floating about in large quantities (—laughter)—and would develop themselves in the proper medium if it were present, so they must inquire if the germs found in the water came from the air or from the water itself originally. It was very significant that Mr. Ward had shown that the liquidity of the substance commenced from the top. It was possible, therefore, that the germs were imported from the air. So they should look and see that the germs did not fly hither and thither through the town in the air to the injury of weak persons. Mr. Johnston drew special attention to the immunity from disease, which was the rule in Tasmania, and showed by diagrams that the death rate, in its entirety, and as regarded zymotic diseases alone, was less here than in either of the other colonies.

Dr. A. B. Crowther said though he had not come to the meeting with any intention of speaking he thought it only right that as a medical man he should give the assistance to the society which lay persons could not do. Mr. Ward had already pointed out some of the evils which existed in the colony, and what Manchester, for instance, had done in order to remove abuses, and the example ought to be followed in Tasmania. When he was resident in Campbell Town some years since, an outbreak of typhoid was distinctly traceable to the way in which the waters of the Elizabeth were dammed up, and now they were made to flow freely there was no such danger. In Launceston typhoid was no doubt owing to the presence of the burial grounds within the town boundaries, draining towards the centre of it, and to the presence of cesspools, some of which had not been emptied for years. He had done his best while he resided there by lecturing and in other ways to get these things remedied, and had pointed out how much better Hobart was than Launceston in having the cemeteries outside the city. There could be no question that when they got a proper system of dry earth closets the cesspools would be done away with altogether. Year by year they found typhoid arising in the same place over and over again, showing that there were the *foci* from which the disease spread. He thought that typhoid and typhus should be placed in the general wards of the hospitals, as was the rule in the old country, and as there was no danger of subjects adjoining becoming affected. In relation to the question of the filtration of water, he would say that water ought to be filtered over gravel beds and sand. This would help to do away with many childish diseases, such as worms. They knew very little about the relation of worms to the human body as yet, but something might be done in the way he had indicated. It was very important that the public should be instructed in the use of disinfectants. Sulphate of iron was very cheap and effective in assisting to destroy the germs.

Dr. Perkins said he had not prepared any remarks for the meeting, as he was unaware of the nature of the paper to be delivered. A great deal of it was not new, but it was true, and none the less interesting. One was almost inclined to say with Lyon Playfair, that he was inclined to eat and drink everything, and ask no questions at all. It was an almost superhuman task to eradicate everything that was bad. But still Dr. Playfair had been converted, and so he hoped they might be in a similar manner. In reference to the destruction of germs, he would point out that it was now known that disinfectants would not destroy some bacilli. The bacilli of cholera, for instance resisted them, and the only way in which some of them could be disinfected was by drying them, and even then, if they were again moistened, they were reanimated. The only way to kill them was to make them perfectly dry, and keep them so. In that way they were taught not to use disinfectants indiscriminately in all cases, or to use much washing and

cleaning, but to expose the clothing, etc., of cholera patients to the sun and air. They could not go on using one fixed line for everything. He would have liked to have seen the question of the origin of typhoid in the colonies gone into at this meeting. Dr. Thompson, of Melbourne, had gone into it very thoroughly. Were the germs brought to the colonies by passengers in ships, or had they been present in the world from the beginning of all creation, ranking with the first origin of all things? Was it that the germs were not noxious—things to be hated—and not merely things for the transmission of disease to man, but having their own proper rank in the scale of creation? Was the fact of the transmission of disease by them a mere accident, or the result of man's own fault? That would of course open up the question of spontaneous generation. Bacteria and bacilli were present everywhere throughout the world, and the greater part of man's immunity from their influence was due to his powers of resistance. In regard to Dr. Crowther's remarks about typhoid patients being allowed to mix with the other patients in a hospital, he would like any medical man to show him what advantage could accrue from doing so, instead of keeping them distinct, as they did here. Even allowing the disease to be neither contagious nor infectious, what advantage would be gained by putting them with the other cases? As they knew, typhoid was disseminated from the excreta, and if that was to be carried about up and down stairs, a great risk would arise from it. They would need better reasons than had been given before they changed the plan which the medical officers here thought it wise to pursue. He was quite sure there were exceptions, and in London and in Edinburgh the typhoid patients were kept apart, and for his part, he hoped they always would be. (Applause.)

Mr. Ward, in answer to Mr. Johnston as to the germs in his liquids coming in from the air instead of being developed from the water, pointed out that the wool at the mouth of the tubes would act as an effectual filter; and further, that he had treated distilled water in a similar fashion, and no germs had been developed. He had not intended by his attention to this subject to imply that there was any particular prevalence of typhoid in our midst, but rather to, if possible, reduce the quantity still lower, and to do his best to arrive at the conditions sketched by Pasteur. Their immunity in the past was not due to any particular care in guarding against evil. All they had to do in regard to food and drink was not to do as Dr. Playfair said, but to see that they got a good supply; to be careful that they got it pure, and then to think of it no more than was necessary to keep it in good order. In regard to the introduction of typhoid into the colonies, that might have occurred on board ships by carelessness in the filling of water casks, either here or on the way home. He saw a case of this description reported only the other day, where every member of a ship's crew was prostrated, owing to the bad quality of the water at the last port of call. (Applause.)

The Curator read a paper by Baron F. Von Mueller, K.C.M.G., entitled, "Notes on Jean Julien Houton Labellardiere, botanist of the search expedition sent out under Admiral D'Entrecasteaux to ascertain the fate of Count La Perouse and his crew." The paper was accompanied by a photo-lithograph of Labellardiere, a copy of which will be inserted in the proceedings of the society for the year.

NOTES AND EXHIBITS.

Mr. C. J. Atkins read some notes on the sea-worm Synapta, illustrated by Polarized Light. He said: The class Echinodermata includes the marine objects known as sea-hedgehogs, sea-urchins, and sea-eggs. The members of the group generally develop a calcareous skeleton (set with

spines) as an outer covering or integument. The body is globose or cylindrical, and a ring of nerve branches issues from the mouth. The genus of this class called Synapta are cylindrical in form, the body being traversed by an alimentary canal, and the mouth is surrounded by a fringe of radiate feelers, which are the ends of the nerve system of the animal, and serve the purpose of drawing in its food. A skeleton of calcareous plates exists below the tough outer skin, and embedded in these plates are curious anchor-like appendages, which protrude through the skin, giving a rough or rasp-like appearance to the worm. The anchors are used both as an assistance to the Synapta in its movements, and for fixing itself in the mud or sand; they are attached to the anchor-plates, and are immovable. The Synapta is common on the coast of the south of France, and on other shores of the Mediterannean, also in those of the Red Sea. Dr. Herapath mentions the species galliennii as being obtained by him at Torquay, England. (Quart J. Microscopy, 1865.) It is generally found in burrows in the sand, and is difficult to collect as a perfect specimen, owing to its dividing into separate pieces when handled. The anchor-like spiculæ and plates appear as very brilliant objects when polarised, and I have placed under the microscopes specimens of them this evening.

Mr. Saville-Kent, in reply, said: I have much pleasure, in illustration of the paper last communicated, in exhibiting to the society living examples of the genus Synapta, dealt with by Mr. Atkins, and also of a yet rarer, but closely allied form belonging to the genus Chirodota. These specimens were obtained by me a few days since when dredging between Kangaroo Point and Ralph's Bay. This locality I may refer to as being remarkably rich in representatives of the same animal class, the Echinodermata, no less than thirteen distinct species, including members of all five of the leading sections or orders of this interesting group having been secured. These embraced three members of the sea-cucumber order, or Holothuridea; three varieties of ordinary starfishes, or Asteridea; two sorts of brittle stars, or Ophiuridea; four species of sea urchins, or Echinidea; and several examples of feather stars, or Comatula, representing the Crinoidea, or fifth order of the class. A very remarkable feature is associated with the genus Chirodota, to which I would more particularly draw attention. This organism is an elongate worm-like animal, of a violet hue, possessing an oral tuft of retractile tentacles, as in Synapta, and, like that type, the substance of the integument is strengthened by the development within it of innumerable calcareous plates. These plates are of a very peculiar form, taking the shape of beautifully symmetrical six-spoked wheels, and having interspersed among them, at more or less distant intervals, hook-like spines, which evidently fulfil the same function as the anchor-like spicules of Synapta. The species obtained in the Derwent estuary differs from the more familiar European species (Chirodota violacea), in the minute structure of the calcareous "wheels," and in their general outline, which more nearly approaches a hexagon than a perfect circle. Writing of the European species in his book, "The Microscope and its Revelations," Dr. Carpenter has characterised Chirodota as differing from Synapta in the entire absence of anchoring spicules. This diagnosis must, however, evidently be modified with relation to the Tasmanian variety. My recent study of living examples of these two genera has shown that their method of feeding is precisely identical with what obtains in the large and more familiar representatives of the same group, known as the Sea-cucumbers or Trepangs. The manner in which these last-named animals took their food long remained a mystery, and was solved by me in connection with specimens cultivated at the Manchester Aquarium in the year 1875. A correspondence upon this subject will be found in the pages of *Nature* for the year 1884.

It was then observed that the plumose tentacles that surround the mouth are systematically swept like mops or brushes over the surface of all objects with which they came in contact, and all minute organic particles that can be detached are carried off and thrust bodily with the tentacle down the creature's throat. The tentacle is then withdrawn and extended to repeat the mopping process, all the other tentacles following suit in almost rhythmical order. This feeding process here described may be witnessed in the relatively small species of Chirodota now exhibited. Under a higher power of the microscope I also exhibit the remarkable wheel-shaped plates and hooklets that underlie the surface of the integument. Among the practical results derived from my recent examination of the Holothurians I have to record one fact which I regret to say somewhat detracts from the admiration hitherto conceded to their aspect and structure. A friend (Mr. Mackay) having suggested to me that a large assortment of the minute shells known as foraminifera might be obtained from their intestines, I dissected and examined several specimens, with the view of ascertaining what varieties they obtained for food on this coast. Foraminifera were found in abundance, comprising chiefly the genera Miliola, Rotalia, Textularia, and an arenaceous form allied to Reophax. There was also a large variety of diatoms, and the main bulk of the food material of these holothuria may therefore be said to consist of the simplest animals and plants, or protozoa and protophytes. There was a small residuum of food matter, however, that had to be relegated to a much higher organic group. This consisted of the shells of exceedingly minute bivalve molluscs, which I identified as the embryonic stages of some representative of the cockle tribe. This fact being determined, the suspicion naturally arises that in the sea cucumbers a new enemy of the oyster in the earliest stage of its development has been discovered. The habit of the animal to feed on all minute forms of organic life, including embryonic molluscs, being established, it may be logically predicated that the large sea cucumbers, more especially with their relatively powerful mop-like tentacles, would make a clean sweep of any newly-attached oyster spat that might be adhering to the stones, shells, or other objects over which they creep. How far these deductions are borne out by fact I shall hope to report to you at length on some future occasion. Mr. Saville-Kent intimated that the construction of the marine hatchery and aquarium at his residence being now completed, he would be very pleased at all times to welcome members of the society who would like to inspect it. It would be some time yet before the tanks were sufficiently seasoned to allow of the maintenance of a large stock of marine animals, but they would already, perhaps, find a few things to interest them. (Applause.)

THE MICROSCOPE.

A most interesting feature of the evening's proceedings was the microscopic exhibition which took place at its close, illustrative, to some extent, of the papers read. There were seven microscopes on the table, five of them binoculars, viz., three of Ross', one of Baker's, and one of Smith's. Mr. Atkins' very fine Ross instrument was used for the display of the various features of the Synapta suriniensis referred to in his paper, their peculiar formation and anchor-like appendages creating much wonderment. As seen in the field of the microscope, these latter have the perfect form of a ship's anchor, and the objects seen under the influence of polarized light display the most brilliant iridescent tints. Synapta and bacteria were similarly exhibited by Mr. Saville-Kent, F.L.S. Some very beautiful mounted specimens of mosses were shown by Mr. R. A. Bastow, among them Andræa petrophila, Sphagnum obtusifolium, Phascum apiculatum, and Fissedens bryoides. Mr. Bastow's paper was postponed until a future evening.

A CELEBRATED PICTURE.

On the table was exhibited an oil painting of an English salmon by S. Rolfe, the celebrated fish artist, who is familiarly known as the Landseer among fishes. In addition to his contributions to the Royal Academy, he painted many of the casts of salmon and other fish made by the late Mr. Frank Buckland, and exhibited in the South Kensington Museum. Our own museum is also the fortunate possessor of two of these artistically executed casts.

VOTE OF THANKS.

Mr. Justin Browne, in rising to propose a vote of thanks to the authors of papers, and the donors of gifts to the Museum, said that it must be gratifying to the members of the society to note the tone of the papers, and their scientific tendency during the last two years. Previously we used to count our scientific members by ones and twos; now we seemed to be getting more science men amongst us. (Applause.) It might not be known to everyone present that the last speaker, Mr. Saville-Kent, had spent a great part of his life upon a work which had given him a great reputation. The society had this book, which would well repay any time spent in examining it. Another speaker had passed 10 years in Manchester, carrying out sanitary measures, which all civilized people now considered as essential. Such addresses as we had heard to-night would give a tone and a scientific turn to our papers which would add to the society the scientific character which it was presumed to possess under the name of the Royal Society. (Applause.)

Bishop Sandford, in rising to second the motion, said that he could say but very little after the able manner Mr. Browne had proposed the vote; he would, however, merely state that he was of opinion much might be done in keeping in check most of these diseases that were so fatal in many cases. (Cheers.) He was glad to see some members of Parliament present, and trusted that what they had listened to this evening would tend to encourage them to vote for strict sanitary measures. (Applause.)

Dr. H. A. Perkins, in supporting the motion, said that no doubt the Fellows were aware that a Public Health Bill was shortly to be introduced by the Government, but he was sorry to see that the power in some cases to deal with this important matter was to be left in local hands, which, in his opinion, would not tend to work satisfactorily.

The motion was carried by acclamation.

AUGUST, 1885.

The monthly meeting of the Fellows of the Royal Society of Tasmania was held at the Museum building last evening. Mr. James Banard, Vice-President, occupied the chair, and there were also present the Bishop of Tasmania (Dr. Sandford), the President of the Legislative Council (Hon. W. A. B. Gellibrand), and about 40 other gentlemen.

NEW MEMBER.

Mr. Turnbull was re-elected a Fellow of the Society.

Returns.

1. Number of visitors to the Museum during the month of July :—Week days, 2,150; Sundays, 780. Total, 2,930.

2. Number of visitors to Royal Society's Gardens during the month of June, 4,900.

Plants and seeds received at and sent from the Royal Society's Gardens during the month of July, 1885 :—

To Messrs. Shepherd and Co., Sydney. Two bags Sphagnum moss.
To Baron Ferd. Von Mueller. Collection of seeds.
To Messrs. Shepherd and Co., Sydney. Collection seeds.
To Mr. G. Brunning, St. Kilda, Victoria. Collection seeds.
From Mr. S. Purvis, Waratah. Seeds.
From Royal Gardens, Kew, London. Package seeds.
From Mr. G. Brunning. Plant Prunus pissardi.
From Mr. C. Traill, Stewart Island, N.Z. Case containing 38 plants.
From Botanic Gardens, Cape Town. Seeds Pentzia virgata.
From Messrs. Shepherd and Co., Sydney. Case containing 60 plants.
From Botanic Gardens, Bombay. Fifteen packets seeds.
From Mr. C. Purchase, Parramatta, N.S.W. Thirty-six dahlias.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during July, 1885 :—

8th. Eranthes hyemalis, commencing to flower.
18th. Garrya elliptica, commencing to flower.
28th. Almond, commencing to flower.
30th. White mulberry, commencing to break.
31st. Crocus aureus, in full flower.

Meteorological Returns.

From the Government Observer, Captain Short, R.N., table of observations for July.

Additions to the library during the month of July :—

Agricultural Gazette, May 18, 25, June 1, 8, 15, 22.
Annals and Magazines of Natural History, June.
Athenæum, May.
Bulletin de la Societe Imperiale des Naturalistes de Moscow, tome lx. No. 3, Moscow, 1885.—From the Society.
Cuvier's Animal Kingdom. By H. McMurtrie, M.D. Woodcuts; Lond., 1824.
Class Pisces, arranged by Baron Cuvier, with Supplementary Additions by Edward Griffith and Lieut. C. H. Smith. Woodcuts; London, 1834.
Class Insecta, arranged by Baron Cuvier, with Supplementary Additions to each order by Griffith and Pidgeon, and Notices of New Genera and Species by Gray. Vol. 1 and 2; plates; London, 1832.
Classified Index and Synopsis of the Animal Kingdom, arranged by Cuvier, with Supplementary Additions by E. Griffith. London, 1835.—Mr. J. Backhouse Walker.
Field Naturalists' Club of Victoria, fifth annual report, 1884, list of members, etc.—From the Society.
Gardener's Chronicle, May 23, 30, June 6, 13, 27.
Geological Magazine, June. From the Society.
Government Statistician's Report on the Vital and Meteorological Statistics of the registration districts of Hobart and Launceston for July, 1885. From the Government Statistician.
Journal of the Society of Arts, February, March, April, and May, 1885.
Journal of Science, June.
Journal of the Royal Microscopical Society, London, Vol. 5, pt. 3, June 1885. From the Society.
Journal of Science, New Zealand, No. 10, Vol. II., July, 1885.
Meteorological Observations for the month of December, 1884. From the Meteor. Office, India.
Midland Medical Miscellany, Vol. 4, No. 42. From the Editor.

Monthly Notices of the Royal Astronomical Society, Vol. 45, No. 7, May, 1885. From the Society.

Monthly Record Meteorological Observations, Melbourne, during February, 1885. From the Government Astronomer.

Nature, May, 1885.

Official No. 52, Quarterly Weather Report. Part 11, 1877. Official No. 54, Hourly Readings. Part 4, 1882. Official No. 57, Metorological Observations at Stations of the Second Order, 1880. Official No. 65, Monthly Weather Report for January, 1885.—From the Meteorological Office, London.

On some New South Wales Minerals (plates). On the Chemical Composition of Certain Rocks, New South Wales (plates). By A. Liversidge, F.R.S., etc.—From the Author.

Proceedings of the Academy of Natural Sciences of Philadelphia. Part I., January, February, March, 1885.—From the Society.

Proceedings of the Royal Society of Queensland. Vol. I., Part II., III., IV., 1884.

Proceedings of the Linnean Society of New South Wales. Vol. X., Part 2nd, 1885.

Revision of the Genus Lamprima of Laterelle, with descriptions of new species. By W. Macleay, F.L.S.—From the Author.

Reports of the Mining Registrars for the quarter ended 31st March, 1885. The Goldfields of Victoria.—From the Mines Department, Melbourne.

Report of the Superintendent of the U.S. Coast and Geodetic Survey, showing the progress of the work during the fiscal year ending with June, 1883. Part I., Text Part II. Sketches Washington, 1884.—From the U.S. Survey Office.

Statistical Register of Victoria, 1884. Part I. Blue Book.—From the Government Statistician.

Statistics of the Colony of New Zealand for the year 1884. Part I., Blue Book; Part II., Population and Vital Statistics; Part III., Trade and Interchange.—From the Government Statistician.

Synonymy of and Remarks Upon the Specific Names and Authorities of Four Species of Australian Marine Shells, originally described by Dr. John Edward Gray in 1825 and 1827. By John Brazier, C.M.Z.S.—From the Author.

Victorian Naturalist, The, Vol. II., No. 3, July.—From the Society.

PRESENTATIONS TO THE MUSEUM.

Mammals:

Tasmanian Tiger (Thylacinus cynocephalus), Mr. Dunbabin.

Two Tasmanian Tigers (Thylacinus cynocephalus), Mr. R. Douglas Bethune.

An Albino Ring-tailed Opossum (Phalangista viverrina), Mr. H. Morrisby.

An Albino Grey Opossum (Phalangista vulpina), Mr. G. Edwards.

Two Live Wallabys (Halmaturus bennetti), Mr. Triffett.

Two Skulls of Tasmanian Tigers, the Hon. W. Gellibrand, M.L.C.

Birds:

Wedge-tailed Eagle (Aquila audax), Mr. L. Wilson.

Wedge-tailed Eagle (Aquila audax), Mr. ———

A More Pork (Podargus cuvieri).

Two Blue-banded Grass Parrakeets (Euphema chrysostoma), Mr. Wilkins.

Spotted Owl (Athene Maculata), Mr. J. R. McClymont.

A More Pork (Podargus cuvieri), Miss Propsting.

Little Penguin (Eudyptula minor), Miss Featherstone.

Fishes :

A Hapuku (Oligorus gigas), Mrs. Cearns.
A Fish (probably a new genus), Mr. T. Stanfield.

Crustacea :

A Crab (Leptomithrax Spinulosus), Mr. ———

Mollusks :

A Cluster of Oysters, adhering to portion of a bott'e, from Spring Bay, Mr. J. McCluskey.

Minerals :

Sample of Quartz Conglomerate, from the summit of Cabbage Tree Hill, 460ft. above sea level.

Samples of Friable Quartz, Gold-bearing. Three samples, surface caps of lode, 400ft. above sea level, the Tasmanian mine, Beaconsfield, Mr. J. Davies.

Coins :

A collection of Coins and Tokens, the Hon. Wm. Crosby, M.L.C.
A collection of Coins and Tokens, Mr. Easton.

Framed copy of diploma presented to the Commissioners of Tasmanian Fisheries, by the International Fisheries Exhibition Commission, London, 1883, from the Chief Secretary (Hon. Adye Douglas).

ABSENCE OF THE HON. SECRETARY.

The CHAIRMAN announced with regret the inability of the Hon. Secretary (Dr. Agnew) to be in his place, it being still undesirable that he should encounter the night air. The Curator (Mr. Morton) would officiate in his place.

PAPERS.

The following papers were read:—

ICELAND AND THE ICELANDERS,

By the Rev. J. B. W. Woollnough.

1. Iceland is an unfinished corner of the world. Heat force which, after forming the earth's crust left it to cool, and become a home for man, is there still hard at work. Yet Iceland is but just outside the Arctic circle. It is so close that at midsummer on a northern hilltop the sun never sets ; whilst the level of perpetual snow is but 3,000 feet, and the larger glaciers all but reach the sea. In this close embrace of heat and cold lies one of the claims of Iceland to the interest of members of a scientific society. If further apology for this paper be needed, it may be found in the fact that in such a land a race of men has lived for more than one thousand years, never conquered, holding their own, not only against their neighbours, but also against nature at her worst; first discoverers and colonisers moreover of Greenland and of America; possessing a rich literature; and at this day the very best educated people in the world. There is not throughout the island a child of ten who cannot, and who does not, read and enjoy the Sagas of his forefathers.

Of the land first. A few miles from the seaboard, except where the poor pasture struggles up the valleys of the larger rivers, extends inland a desert covering nine-tenths of the whole island, being a tract much larger than all Ireland, and this desert is altogether desolate. In one part 4,000 square miles are covered with one vast white mass of lava mountains, glaciers, and snow-fields. Elsewhere, within it, are isolated black hills standing out of rugged lava fields, barren and waterless, or, it may be, swelling belts of volcanic sand, or again, bare earth ; but where soil is found it is waste, without even the tiny

fern frond or willow shrublet which I have sometimes, to my delight, found in the lava cracks, the one witness to the power of life in this great wilderness of death.

Thus only the seaboard of Iceland is habitable, whilst across the desert interior from south to north are three passes, though two are but rarely, and the third not frequently, used. The interior mountain ranges have never been, and probably never can be, explored.

Of the habitable seaboard, but one-third will grow even the coarsest herbage. Only a short distance from Reykjavik, the capital, I crossed wide tracts of bare lava, in one place level, where, I suppose, streams passing over a plain, had cooled evenly; in another, formed of blocks of all sizes, weathered into position like your stony field of Mount Wellington, though the boulders were not commonly so large.

Abruptly from such plains rise black detached conical hills of comparatively recent tufa, or a long flat topped basaltic ridge. The valleys, the wooded glens and gullies, which, running deep into the mountain recesses, make so much the beauty of mountain scenery elsewhere, are altogether wanting in Iceland. In these plains are set lakes, commonly with low shelving banks, and through them rush down the rivers, fed by the snows of the central desert; thus form and colour, two elements of the beautiful, are wanting, and in their place are barrenness and gloom, and yet there is also a great fascination. It arises partly, perhaps, from the stillness, the absence of life, the largeness of the waste, the sense that we look upon the two great forces, cold and heat, at their work on matter so nakedly, so largely, and with such grim results. Something, too, there is in the stimulating dryness of the air, and again in the feeling of separation by so wide a stretch of southern seas from all but this singular land, and equally singular offset of mankind.

The sense of strong contrast formed my first impression of this weird land. Coming on deck early in the morning I found not only that Iceland was in sight, but that we were hugging the shore somewhat closely. An ice mountain towered up 7,000 feet, not far from the shore, and from its lower spurs a wide glacier stream ran down, apparently straight into the sea. One flank of the mountain fell in rugged black precipice until it softened into the grassy bed of an upland valley, where the sun shone on a low farmstead and a large flock of scattered sheep. Yet close on the other flank, almost side by side with the glacier, and yet wider, was a broad stream of lava, which in past ages had sullenly forced its way from some volcanic mountain, hidden inland.

Hitherto I have painted in black and white, but there is yet a third colour marking Icelandic scenery—the yellowish green of the scanty vegetation. Much of this is marshy bog. Where forests once stood are now treacherous tussocky hillocks of rank grass rising out of quaking bog, ground almost impassable for the wayfarer on foot, but which the clever little ponies cross in a quick run without a stumble. The pasture lands where they exist, are left undrained, unworked, and unenclosed to the sheep, saving a few acres about the farmhouses carefully manured, and enclosed within low turf walls. These enclosures are called tüns, and here the few head of cattle graze, and the crops of hay are had upon which the prosperity of the Icelanders so largely depends, since it is the only provender they can raise for their beasts. The climate is now so severe that no grain will ripen, and there is but one tree throughout the south, with a few dwarf birch in the north. Here and there on the better land some brushes of willow and birch struggle for life. Sometimes, moreover, the summer in the north will be changed into winter by the drifting in of Greeland ice. Still, the land is not only habitable, but could be made far more

productive than it is. The pastures are excellent, and nowhere else have I enjoyed such rich thick cream, albeit, like the milk and butter, it is the yield, not of the cow, but the sheep. These pastures support 400,000 sheep, with a few cattle and a large number of ponies.

The pony fills a very large place in Icelandic economy since there are no roads, no carriages, and but two bridges. During the summer walking is impossible, and your Icelander jumps on a pony for a journey of one hunded yards. They receive neither grooming, stabling, nor feeding, and go far afield in search of pasture. I have seen them eat seaweed and fish offal. They neither trot canter, nor gallop, but usually amble, or move more quickly with a strange shuffle. They will go with a load of 100lbs. some 40 miles in the day, are great at hopping over lava blocks, discovering the one safe path across a morass, and that at a fair pace, and grand in wading a river against a rush of water. They are only puzzled on good level ground, where they are apt to stumble, and, in fording rivers, they need a firm hand. The rider must of necessity sit down to the saddle. The Icelander rides as often without stirrups as with them, guiding more by a touch of his seal skin covered heel than with the bridle, often giving way to a habit of his people of a constant drumming with his heels on his beast's ribs. The ponies are the carriers of Iceland, and strings of them tied head to tail are often met. They are largely bred, and during the last few years, rival sheep as the chief export of Iceland.

Apart from cattle, sheep, and horses, there are few animals wild or domestic. There are cats; and dogs not unlike the Esquimaux, clever as Scotch colleys in gathering in the ponies; but no pigs, ducks, geese, and until lately not even the domestic fowl. The blue fox is found, with a few imported reindeer. In hard winters a stray bear crosses on a Greenland icefloe, but is very inhospitably treated. Amongst the birds ptarmigan are very numerous, and I saw also plover, snipe, and snowbirds, all very tame, a characteristic they are not likely to keep long now that the British tourist has made his way to them. The eider duck, however, is not likely to suffer from the Englishmans' anxiety to kill something, as it is protected by a heavy fine. This bird lines its nest with down plucked from the breast, after which man robs the nest both of lining and eggs. This is done twice, and the third time the drake supplies the down, and they are then allowed to rear their brood in peace. Eider down, as those know who have a coverlet made of it, is very elastic, and I have met with this Icelandic riddle—"What is higher when the head is taken off?" with the answer—"An eider down pillow."

Together with ponies, and sheep; wool, eider down, dried and tinned fish, some Icelandic spar, and Icelandic moss, form, as far as I am aware, the chief exports of the island.

Geologists may be interested in the following account of Icelandic spar:—"This double refracting calc is found only in one place, filling a fissure of greenstone from two to three feet wide, and twenty to twenty-five long, on the north bank of the Reyder Fiord, about a thousand feet above the sea. A cascade rushing over the rock brings down fragments of the spar, whilst the whole mass is gradually loosened through the action of frost on the moisture between the laminæ, wedging them apart in the direction of the cleavage of the crystals." Specimens more than a few inches in size are rare and valuable.

The Icelandic moss is not, I believe, so much used now as formerly. It is easily distinguishable, and widely distributed.

Fish abound both in the rivers and the sea. The Lax Elv or Salmon River is, I was told by some of my friends who fished there, only too full of salmon and trout, the chief drawback being the mosquitoes,

which have the dubious merit of a singular persistency. They make their way into the boots, under the trousers, and up the nostrils, until, in my friend's case, the guide, with an Icelander's patient endurance, retired to a lava block, covered his face with his hands, and surrendered.

The only vegetables I saw in Iceland were potatoes and turnips, but although they will ripen they are seldom grown. In sheltered place, there are many wild flowers. I have picked or seen buttercups, violets, forget-me nots, wild geraniums, thyme, dogdaisy, catchfly, seapink, with others whose names I did not know.

Hekla, the Geysers, even the sulphur springs of Kriusivik, have been so often described that it would be an impertinence to say much of them here. Hekla is in every way unworthy of her world-wide fame. Built up of sand and clay, the mountain, like so many more in Iceland, rises abruptly from a plain, a long low flat ridge, 5,000ft. in height, marked by three cones. Hekla is but one of eighteen intermittently active volcanic mountains in the island, and has not even to boast of being the most destructive—a distinction belonging to the Skapta Jokul, which in 1783 threw out a mass of lava greater in bulk than Mount Blanc, greater than has ever been known elsewhere in the world. But Hekla is isolated, can be seen from the sea, is easily approached, and has twenty-five times in the course of one thousand years spread desolation ; circumstances to which she doubtless owes her reputation. Once only did I see Hekla as a thing of beauty, and happily it was for the first time, so that the impression remains as the clearest and most prominent. At Oddi the church and priest's house are built on the edge of a plateau some height above the lava fields Wet, tired, hungry, and thirsty, after riding all day and half the night, fording two rivers, and running a madcap race after midnight over the boulders with an Icelandic farmer, who insisted upon trying issues with "the walking priest," as they called me, I dismounted on the platform before the long line of low-gabled buildings that made the priest's home. It was about two in the morning. Turning round, I saw far away on the edge of the desert plains, through a pure, still, yet dimmed light, that most beautiful atmosphere of an arctic summer night, the white mountain mass, standing out from its azure background. There, alone, and then, she looked worthy of the place men have given her.

The last eruption of Hekla was in 1878, and I ascended the mountain in order to see the new crater formed on one of its outlying spurs. We started on ponies from a solitary farm-house set down amidst some grass land, girt about by a vast level barren plain. Crossing a river, deep-sunk between precipitous banks, after riding some hours over sand and pumice, we tethered our ponies on the only bit of green sward between the farm and Hekla. The ascent was wholly over boulders and lava beds, on which lay a few patches of snow in the sheltered hollows. The lava of 1841, which we skirted, was easily distinguishable by its glossy black appearance, and the knobby vitrification of its blocks. The last arrête is reached by a long narrow ridge, with a somewhat steep fall on either side, across which the wind swept viciously. After reaching the summit, and whilst picking my way up the slope of the crater of '78, one leg sunk suddenly to the knee through a yellow, clayish substance, and with it, when I drew it out, came a considerable outburst of smoke, with an evil smell. I suppose it is owing to the presence of heat close to the surface everywhere, that the crater is not a basin, within which the volcanic force has been exercised. It is rather a large portion of the mountain slope, through which the lava had burst in many places, tossing about the surface soil over a considerable area, This eruption had covered the plain in one direction with new lava as far as the eye could reach, and

from it still rose in many places columns of smoke. It did not, I believe, do much damage, but lava streams have at different times and places overflowed some of the richest farmsteads and most fertile pastures in Iceland. The Skapta Jokull lava in 1783, of which I have already spoken, formed two streams, each some forty-five miles long, seven to twelve miles broad, and varying in depth from ten feet to six hundred feet. The greatest depth was reached in the sunken river beds which the lava first filled. In this eruption alone, it is estimated that 1,300 men, 20,000 horses, 7,000 cattle, and 100,000 sheep were destroyed. Some who discussed the cause of the remarkable afterglow last year may not know that the same phenomenon followed the Skapta Jokull eruption ; was speculated upon by Benjamin Franklin, and alluded to by Cowper in the second book of the Task.

Of the Geysirs, I can probably say little that will be new. They spring from a narrow table land, about three hundred yards in length, raised by a few feet above a green marshy plain. This plain is separated by a river from the sandy desert, on the north side of which stretched away the vast snow-covered range of the Lang Jokull. The scene would be utterly desolate but for a farm house nestling under the trap hills which rise behind the Geysers.

The surface of the plateau is formed of reddish white thin layers of silica, deposited by the springs whose overflow of boiling water is running away in numerous tiny channels worn in the white flint floor. Although these springs number nearly one hundred, only three are active, the Great Geyser, the Strokr, and the Little Geyser. The Great Geyser has formed a shallow basin, about sixty feet in diameter, on the top of a coned mound. In the centre of the basin is a hole about ten feet across and eighty-three feet deep, in which the water is always bubbling, whilst frequently it rises a few feet, accompanied by a rumbling noise and a slight movement of the ground. I slept on the mound in the hope of seeing one of the great bursts, but was disappointed. Formerly they came every day or oftener, but now a week or fortnight will pass without one. I was awoke indeed about two a.m. by the swaying of the ground beneath me, and scrambled out of the low tent opening, only to see the water rising a few feet. It was uncanny enough ; the pale clear light over the snowy ranges and desert waste, the still, deathly solitude broken only by the intermittent throbbings of the geyser and the continuous murmur of the overflow trickling down the tiny channels it had formed everywhere in the flint deposits. The water in a great eruption is thrown up about two hundred feet. It is almost tasteless, and, *experto crede*, makes excellent chocolate and tea. An analysis shows that in every eleven parts of sub stance held in solution one-half is silica, about 4·90 soda and its compunds, and the rest alumina. The Strokr is but a poor relation of the Great Geyser, a well hole six feet across perhaps, where some ten feet down the water can just be seen, always seething, groaning, and now and again rising some height up the funnel as if making up its mind for an outburst. It is easy enough to provoke one by throwing in a heap of turf. This we did, and whilst about twenty minutes afterwards I was bending over the water rising at every effort a little higher and again falling, suddenly, with one vigorous protesting groan, up rose a column of dirty boiling water one hundred to one hundred and fifty feet, which I had barely time to escape by hard running. For about ten minutes one outburst succeeded another, each of lessening volume and height, until the Strokr had got rid of the meal we had given it, and contented itself with its accustomed perpetual motion and noisy accompaniment.

The sulphur springs of Kriusivik are another witness to great heat force working close to the surface. These springs are not without

danger to those who visit them alone, as I did. After walking for some hours over such ground as I have endeavoured to describe, my map and compass had brought me within sight of a broad high column of steam rising over some low hills. About me was coarse grass on a reddish clay, and I was about to take a step forward, when, hearing a bubbling noise, I looked down, and where my next footfall should have been was a small circular hole in which the sulphur was boiling, rising from time to time to the surface level. Making for the hillside I soon looked down upon a mud basin about twenty feet across, covered with a steam cloud, and from which came a confused noise of boiling and splashing. When the steam lifted at times I could see the boiling mud rising some six or eight feet into the air. From the lava rock close underlying the white clay and sulphur deposit came small sulphur jets over a considerable area about the central pool. The greatest care is necessary in choosing ground, for in many places a man's weight would break through the thin layer of clay or sulphur crust. An attempt is being made by a Scotch company to work this large surface deposit of sulphur, but the cost of transit has hitherto hindered the success of the adventure.

It will seem strange that even the hardy Norwegian Viking of the ninth century should have sought a home in such a land, but it is certain that in his day the climate was much milder than now. Their Sagas, covering the first four centuries of colonisation, mention both trees and grain crops. At the present day the mean temperature is in the south 47°, in the north 33°, but during the summer, though the latitude of the north is 3° higher, the temperature is about equal. This is said to be owing to a branch of the gulf-stream washing Iceland, with which the rain clouds cross, brought by the prevailing southerly winds. These rain clouds, as they pass over Iceland, meet a falling temperature, and discharge their moisture before they reach the north, so leaving it the larger share of summer sunshine, and enabling its inhabitants to raise the earliest and heaviest hay crops.

I have left myself no time to speak of the remarkable people who for one thousand years have kept up a hard constant struggle with difficulties such as no other race has had to encounter. They have done more. Separated from other men, unhelped by the appliances of modern civilisation, they have in intellectual development kept abreast of, and in some respects surpassed, the most civilised European nations. Their national hymn, set to the same tune as ours, is characteristic of the people, and shows to how great an extent love of country is independent of any beauty or advantage in the country itself. Thus the first verse runs, and with it I conclude this discursive paper :—

Most ancient Iceland,
Best loved fatherland,
Fair mountain queen!
Whilst the sea girdles land;
While men ask maiden's hand;
Sungleams on hillsides stand;
Thou art our Queen.

2. The Split Mosses, Bog Mosses, and Earth Mosses of Tasmania, by Mr. R. A. Bastow. The paper was a continuation of a series of Papers on Tasmanian Mosses that Mr. Bastow is engaged on.
3. Descriptions of some Fossil Leaves from Mount Bischoff, by Mr. R. M. Johnston, F.L.S. The two new fossil leaf impressions described by Mr. Johnston belong to the genera *Taxites* and *Eucalyptus*. The former was discovered by Mr. Thureau at Mount Bischoff associated with clays and in drift deposits underlying the basalt sheet formerly referred to in connection with the Tertiary Leaf Beds at this place. The species has been named *Taxites Thureaui* in honor of its

discoverer. The locality from whence the splendid new specimen of Eucalyptus *(E. Milligani.* Johnston) was obtained is not known, although supposed to be from Tertiary Leaf Beds at Macquarie Harbour, where probably it was discovered by the late Dr. Milligan. It is associated with well known forms in Tasmanian Tertiaries belonging to the genera Fagus, Laurus, Cinnamomum, Magnolia, etc.

EXHIBITS.

Mr. T. Stephens exhibited a specimen of the Coal which had been found at some distance from Longford, on the road leading from that township to Launceston, and near Jordan's Bridge. The existence of coal had been suspected in the neighbourhood for the last 40 years, but it had been left to Mr. Mason, a landed proprietor in the district, to prosecute a search, and he was rewarded by finding a seam which was stated to be 4fft. in thickness. He, Mr. Stephens, thought that these coal measures might be traced from near Hadspen to a place where he had reported favourable indications many years ago on the N. Esk, and eventually to the Fingal Valley. The infiltration of water had loosened its texture, and had given it a flaky character, and it was that appearance, together with some of the surface indications, which led some persons to suppose that it was a lignite, and not a true coal. It was, however, a true coal, and belonged to the same system as all the Southern and Eastern coal measures. There was an admixture of sulphide of iron, but not, apparently, in any objectionable quantity. The calcite present in the specimen was a point of resemblance between this and some of the Jerusalem and Fingal coal. It was not likely to prove prejudicial to the use of the coal for ordinary purposes. It seemed highly probable that the discovery would be a valuable and important one to those persons on whose property it was found. From some preliminary investigations, the proprietor had come to the conclusion that it rose in an easterly direction, and he was now driving from the lowest level that he could find in that direction, so as to strike it on a rise and eventually drain the mine by gravitation.

Mr. R. M. Johnston remarked that the specimen which had been sent to him had rather a ligneous appearance. He had no hesitation, however, in saying that he believed it to be good coal, and from the presence of *Zeugophyllites elongatus, Phyllotheca, Taeniopteris* and *Sphenopteris,* identical with species in the coal measures at New Town and York Plains. There was no doubt in his mind that it belonged to the mesozoic coal measures.

The Curator drew attention to two fine specimens of fish that had been secured, both new to the Museum, during the month. One of these, the "Hapuku" *(Oligorus gigas),* a fish that attains to a large size, in New Zealand many of them reaching to 150 lbs. in weight, is a deep sea fish, the present one being caught off the Hippolyte Rocks. The "Hapuku" has a peculiar interest from its close relationship to the well-known Murray Cod *(Oligorus Macquariensis).* Dr. James Hector, M.D., F.R.S., in his "Notes on the Edible Fishes New Zealand," says in regard to the flavour of this fish: "The head and shoulders cut off this fish is most dainty food, but the flesh of the remainder is rather coarse and stringy; it is, however, well adapted for pickling, and may yet become an article of commerce." The specimen now on view to the Fellows weighed 53 lbs., and had a roe weighing about 5 lbs. The other fish was one that Mr. Morton stated he had been unable to identify with any species of Australian, Tasmanian, or New Zealand fish, in fact, he was in hopes at the next meeting he would not only be able to describe it as a new species, but to make a new genus. This specimen had during the month been washed on the bank at Bridgewater, and had been forwarded to him by Mr. T. Stanfield.

Mr. R. M. JOHNSTON said, in regard to the latter fish, he felt confident Mr. Morton would be perfectly safe in making a new genus, as it was altogether unlike any genus he had observed in Gunther's valuable work on Fishes.

The CURATOR also drew attention to two skulls of Tasmanian Tigers *(Thylacinus cynocephalus)* which had been presented by the Hon. W. Gellibrand, M.L.C., one being very large, the teeth in capital condition.

MICROSCOPE.

Mr. R. A. BASTOW showed some beautiful mounted specimens of Tasmanian Mosses.

VOTE OF THANKS.

Bishop SANDFORD proposed a vote of thanks to the authors of papers read at the meeting, as also to the donors to the Museum and Library.

Mr. C. T. BELSTEAD seconded the motion, which was carried unanimously.

SEPTEMBER, 1885.

The monthly meeting of the Fellows of the Royal Society of Tasmania was held at the Museum-building on Monday evening, September 7th, 1885. Mr. James Barnard, vice-president, occupied the chair, and about 40 gentlemen were present.

In the absence of the hon. secretary (Dr. Agnew) who was professionally engaged at New Norfolk, the secretarial duties were performed by the curator, Mr. Alexander Morton.

The following gentlemen, who had been previously nominated as Fellows, were ballotted for, and duly elected as Fellows of the Society, viz.:—Messrs. Chas. W. Garrard, B.A., Lond., W. Eldridge, W. Duffy, Joseph Tasman Facy.

The Curator brought forward the usual returns, viz.:—

1. Number of visitors to the Museum during the month of August:—Week days, 1,980; Sunday, 850; total, 2,830.

2. Number of visitors to Royal Society's Gardens during the month of August, 6,150.

3. Plants and seeds received at and sent from the Royal Society's Gardens during the month of August, 1885:—

From Messrs. J. Smith and Sons, Victoria—Case plants.
From the Botanical Gardens, Jamaica—Packet seeds.
From Mr. Elliot, Hobart—14 papers seeds.
From — Emmett, Esq.—Seeds Telopea truncata.
From Charles Traill, Esq.—Case plants, N.Z.
To Messrs. Vilmorin Andrieux, Paris—Package seeds.
To A. Van Geert, Belgium—Package seeds.
To Mr. Wm. Bull, London—Package seeds.
To the Royal Gardens, Kew, near London—Package seeds.
To the Botanical Gardens, Calcutta—Package seeds.
To the Botanical Gardens, Saharanpur, India—Seeds.
To the Forest Board, Madras—Package seeds.
To Messrs. J. Smith and Sons, Victoria—Plants and seeds.
To Charles Traill, Esq., Stewart Island, N.Z.—Case plants.
To the Botanical Gardens, Christchurch, N.Z.—Case plants.
To the Botanical Gardens, Melbourne—2 bags sphagnum.
To Mr. S. Purchase, Parramatta—Case plants.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during August, 1885 :—

10th. Weeping willow commencing to break.
12th. Silver wattle commencing to flower.
14th. Common elm commencing to flower.
15th. Common snowdrop in flower.
20th. Sambucus Niger commencing to break.
20th. Common oak commencing to break.
24th. Lombardy poplar commencing to break.
25th. Horse-chestnuts commencing to break.
26th. Gooseberries commencing to break.
30th. Royal apricot commencing to flower.

METEOROLIGICAL RETURNS.

From the Government Observer, Capt. Shortt, R.N.—Table of Observations for August.

ADDITIONS TO THE LIBRARY DURING THE MONTH OF AUGUST.

Agricultural Gazette, July 6, 13, 20.

Annals and Magazines of Natural History, July.

Athenæum, June.

Australian Scientific Magazine, The. Vol. 1, No. 1 ; August, 1885, Victoria—From the Editor.

Birds and Mammals of Australia. By Gracius J. Broinowski.—From the Hon. W. J. Trickett, M.P., N.S.W.

Catalogue of Canadian Plants, Pt. II., "Gamopetalæ." By John Macoun, M.A.—From the Geol. and Nat. Hist. Survey, Canada.

Descriptions of the stations.—From the Meteor. Office, India.

Gardener's Chronicle, June 11, 18, 25.

Geological Magazine, July.

Goldfields of Victoria, Reports of the Mining Registrars for the quarter ended 30th June, 1885.—From the Mines Department, Victoria.

Journal of the Society of Arts, June 5, 12, 19, 26.

Journal of Science, July.

Journal and proceedings of the Royal Society of New South Wales for 1884, Vol. XVIII.—From the Society.

List of the specimens of Cetacea in the Zoological Department of the British Museum, by Henry Fowler, LL.D., London, 1885.—From the Trustees.

Micro.—Chemical Observations on the Blood, in Health and in Typhoid Fever, by Thos. S. Ralph, M.R.C.S., Victoria—From the author.

Monthly Weather Report of the Meteor. Office, London, for February, 1885.—From the Meteorological Department.

Nature, June.

Nineteenth Annual Report on the Colonial Museum and Laboratory, together with a list of donations and deposits during 1883-84, and the Ffteenth Annual Report on the Colonial Botanic Gardens, New Zealand, 1883-4.—From the Director.

"Open and Air Currents," by Thos. D. Smellie, Glasgow, 1885.

Provincial Medical Journal, vol. iv., No. 43, July, 1885, Leicester, Eng.—From the society.

Publication der Norwegischen Commission der Europaishen Gradmessung, "Geodatische Arbeiten," heft IV.—From the society.

Report of Progress, with maps, 1882-4.—From the Geol. and Nat. Hist. Survey, Canada.

Statistical Register of the Colony of Victoria for the year 1884, part II., population.—From the Government Statistician.

Udgivet af den Norske Gradmaalingskommission Vanstandsobservationer, heft III., Christiania, 1885.—From the society.

Victorian Naturalist, vol. II., No. 4, August.—From the society.

PRESENTATION TO THE MUSEUM.

Mammals:

Two Tasmanian Devils (Sarcophilus ursinus), Mr. Albert Flexmore.

Two Tasmanian Porcupines (Echidna setosa.) One Black Opossum (Phalangista fuliginosus.) One Grey Opossum (Phalangista vulpina), Mr. Geo. Edwards.

One Tasmanian Porcupine (Echidna setosa), Mr. A. Brent.

Birds:

One Sacred Kingfisher (Halcyon sanctus), Mr. J. N. Short.

One Diving Petrel (Puffinuria urinatrix), Mr. Bush.

Two Mock Regent Birds (Meliphaga phrygia), The Helmeted Honey Eater (Ptilotis cassidix.) Mr. E. D. Swan.

Fishes:

Two Apogon Guntheri, Miss Gertrude Swan.

The Sweep (Girella sp.), Mr. R. M. Johnston.

The Lamprey (Mordacia mordax), Mr. A. K. Chapman.

Crustacea:

Shrimps (Palæmon sp.), Miss Gertrude Swan.

Papers, etc.

A reprint of *The London Times*, containing the account of the Battle of Waterloo, London, Thursday, June 22, 1815. Mr. Geo. Richardson.

An oil painting, "The Australian Schnapper." The Hon. Wm. Crosby, M.L.C.

PAPERS.

An interesting paper entitled, "Contributory information regarding the tin ore deposits at Mount Bischoff, Tasmania," by Baron Von Groddeck, chief mining councillor of the Hartz mining districts, and director of the Royal Prussian Academy of Mines at Clausthal, Germany, was read by the Curator, in the absence of the translator, Mr. Thureau, who had telegraphed to say that he was unavoidably detained in the country, and so was prevented from attending the meeting of the Society. In a letter from Mr. G. Thureau, F.G.S., to the Royal Society, he stated that the above paper had been published in the journal of the German Geological Society, of 1884. It was a subject he (Mr. Thureau) thought would be of great interest to the Fellows of the Society, so he had, therefore, translated Mr. Groddeck's paper. The Baron states that the Royal Academy of Mines at Clausthal was some time ago placed in possession of a very fine collection of Australian ores, the collection being presented to the Academy by Mr. M. Wajenknecht, a resident of Tasmania. Amongst the samples were found a number of specimens of tin ore, together with the rocks and the minerals said to be associated with same from Mount Bischoff. The Baron says the series particularly interested him on account of a piece of supposed quartz-porphyry, which rock, it was represented, is associated (according to the description of Mr. S. H. Wintle and Mr. Geo. H. F. Ulrich) with those tin ores, and also because of some peculiar, dense, greyish-blue coloured masses of mineral which most frequently are found to enclose those tin ores. The Baron gives a very careful analysis that he made of the specimens he had received.

Mr. C. P. SPRENT said the paper was a most interesting contribution, but it raised so many unexpected new points that it would require very careful study before the Fellows could discuss it. He would have liked to have seen some of the specimens which were

sent to Germany, because since Mr. Wagenknecht visited Bischoff more information had been obtained, not only of Bischoff itself, but of the country further south. The specimens, too, ought to be considered in connection with the Meredith Range and Mount Heemskirk. He believed that some of the explanations of the German professor would throw a great deal of light on matters on which there had been great uncertainty, especially in regard to the green rock, which had always—he did not know why—been called chlorite. The professor said it owed its green colour to tourmaline. In confirmation of this tourmaline occurred at Mount Heemskirk in chlorite veins, which stuck up on the side of the mountain, being harder than the surrounding surfaces. It was curious that at Mount Heemskirk this green rock was found on one side of a vein, while on the other side was quartz rock with tourmaline in it. At Mount Ramsay and the Meredith Range they also found quartz rock full of tourmaline. When the quartz porphyry decomposed it became Kaolin, owing to the large percentage of felspar it contained, a specimen of which he produced. It would be interesting to have the paper referred to Mr. Kayser and other scientific gentlemen, with a request that they should make some remarks upon it. (Applause.)

Mr. T. Stephens took the same view, and thought they should have further information about the specimens sent to Germany. There might have been mistakes which, though no one was to blame for them, might have led to misconception. It would, perhaps, be well to forward specimens of rock to which Mr. Sprent supposed the author to allude to Professor Liversedge, in Sydney, for his inspection.

Mr. R. M. Johnston said the observations were well worthy of attention. The specimens might not be characteristic of the country generally, though found there. The topaz rocks were found in a dyke, or wall in the mountain. He thought the typical rocks as a whole should be sent to Professor Liversedge.

The Chairman said Mr. Sprent's suggestion was a valuable one, and he would, on behalf of the Council, undertake that it should be carried into effect.

2, General Observations regarding the Classification of the Upper Palæozoic and Mesozoic Rocks of Tasmania, together with a full description of all the known Tasmanian Coal Plants, including a considerable number of new species. By R. M. Johnston, F.L.S., etc., etc., illustrated by diagrams and maps which were displayed on the walls, and referred to during the reading of the paper.

Mr. Johnston, in the above paper, deals with many important questions connected with the proper classification, and the true relations of the important series of rocks in Tasmania belonging to upper palæozoic and mesozoic age, which include the upper coal measures of the midland and south-eastern parts of the island as well as the lower coal measures, which are well represented in the vicinity, Latrobe, or the Mersey. Elaborate tables were prepared by the author, showing the distribution of all the known coal plants of Tasmania, also of the fossils of the upper and lower marine beds. Sections were also prepared, showing the relations of the principal rock systems to each other; and the question of the probable age of the greenstone mountains and tiers was very thoroughly discussed, so far as it touched upon the relation with the stratified rocks with which the greenstone masses are so intimately associated. Mr. Johnston gave illustration of greenstone rocks older than the lower marine beds of upper palæozoic age, and others again of a later date than the upper coal measures; he is, however, inclined to the opinion that the massive greenstones of the mountains and tiers have been erupted prior to the deposit, even of the lower members of the carboniferous system. Mr. Johnston, in dealing with the local nomenclature of systems, is of opinion that the finer

subdivision names of Europe will not fit the known divisions of Tasmanian rocks, and accordingly with Professor Hutton and others, would prefer local names for the sub-divisions of rocks later than the English "carboniferous." He also pointed out dangers to true classification which may arise by ignoring the facts of local stratigraphy, when dealing with imperfect fossil remains. He urges that questions of local stratigraphy should not be divorced from local palæontology, and that the association of the stratigraphy and palæontology of one hemisphere, is not always a safe guide in the determination of the actual association, in the other hemisphere of stratigraphy and palæontology.

Mr. C. H. Grant thanked Mr. Johnston, on behalf of the Fellows, for the very valuable paper he had read to the Society. It showed very deep research and careful reading amongst the best authorities, a large number of whom were quoted. He was pleased to see how thoroughly and philosophically Mr. Johnston treated the subject of geology, as in his earlier writings he had a far more positive manner of treating the subject. The paper would be of great value to the records, and he trusted would be only one part of the great work on geology which he understood Mr. Johnston was preparing. (Hear, hear.) It hardly admitted of discussion, but he thought they should express their satisfaction at such a valuable foundation for the study of geology in Tasmania. (Applause.)

Mr. C. P. Sprent referred to the application which had recently been made to the Government to put a sum of money on the estimates to assist deep sinking, and said that though that might be very desirable, the most important thing they could do was to ascertain the value of the coal deposits of the colony, especially on the extensive plain between Ben Lomond and the Western Tiers. He thought a series of bores should be put down across the plain, and that they should also have a first-class man from New South Wales who was used to the coal formations there to make an enquiry into the matter. Only within the last few days they had found coal cropping up at Longford, and very important results might follow from such action. Last year Mr. Cosmo Newbery was over here, and was speaking about the same thing, as well as of the value of their building stone, pointing out that both articles were likely to be found in the same locality, and that anyone finding a quarry of white stone in a practicable position would have a better thing than any tin mine or gold mine that had been found in Tasmania. He thought something ought to be done in the matter. He had tried to get the authorities to move in it, but they had so many important things to look after now they had not been able to give it attention. He thought the Society might use its influence in this direction. (Hear, hear.)

The Curator and Mr. Stephens also referred in complimentary terms to the paper,

The Chairman promised, on behalf of the Council, that the Society's influence should be used in the direction indicated by Mr. Sprent.

Mr. Johnston briefly returned thanks.

3. Description of two apparently new species of genus Ancillaria, by W. F. Petterd, C.M.Z.S., was read by the Curator.

AUSTRALIA OR AUSTRALASIA.

The following paper was read by Colonel A. Crawford :—

There is a matter that, I conceive, certainly comes within the range of subjects of which our association takes cognisance, and to which many circumstances combine, in my humble opinion, to render its immediate and careful attention most desirable. In the hope that my views may win the approval and support of the Royal Society, I will ask you kindly to read this note at its next meeting, trusting

that steps may then be taken to obviate the hazard that to me appears imminent. We are living in the expectation that at a very near date the majority of the Australian colonies—may we not hope all?—will become federated, and assume a higher position before the world in the dignity and strength that unity confers. Under what title, what cognomen, shall we claim our place among the nations of the earth? At the first glance, the query might to many appear trivial, and they would probably feel inclined to waive it as one on which they are in no way called upon to decide, whilst they might also consider it will doubtless be satisfactorily dealt with by the Federal Council at its first session. But I am sure that our Society will agree with me that every individual in these lands is or should be interested in the question of our future style and title, and that it shall be both euphonious and correct, and if I can show that a great risk does exist of our being made to appear under a designation every way inappropriate, I think the Royal Society will not hesitate to call public attention to the fact, and bring the weight of its opinion to bear upon the same. I doubt not it will have been noticed by many that in the numerous despatches and telegrams that of late have been passing between the Imperial Government and the Australian Governments relative to federation, two words constantly appear as designating this portion of the globe "Australia" and "Australasia," and they seem to be used by all parties alike as convertible terms, frequently presenting themselves in the same document as, if so used, for the purpose of avoiding tautology. A little reflection, however, will show that these terms are by no means one and the same. Their signification differs *in toto*. "Australia," whilst musical and pleasing to the ear, places at once before the mind the idea of a large and noble southern land, and therefore may be regarded as adequately representing this great portion of Her Majesty's dominions. "Australasia," on the other hand, whilst it might reasonably be applied to Burmah, Siam, Cochin-China, or even India, has in reality no true geographical significance in connection with our great island continents and its sister isles of Tasmania and New Guinea. Let it be remembered that Australia (I cling to that term) is separated from Asia and its islands by an ocean of soundings so deep as effectually to prohibit chance intercourse, and so nature has, in her own unmistakable language, proclaimed these countries by their peculiar fauna and flora to be a distinct region. Why, then, should we in any way, in name at least, allow ourselves to be looked upon as a species of dependency or excresence of Asia? Poor relations, perhaps. Whilst our real and only debt to that quarter of the world is limited probably to a few stray cocoanuts, drifted by wind and tide to our northern shores. There would be more reason exhibited in calling Africa Austral-Europe" than in denominating these colonies "Australasia," for a reference to the map will at once show that the meridians of longitude within which Australia is comprised are those that mark only the extreme eastern portion of Asia, so that, strictly speaking, Austral does not accurately describe our position in respect to that continent. I will not enlarge further on these points. The little I have said will, I think, suffice to prove that "Australia" is alone the befitting title for this great division of the British realm; and, hoping that the meeting may fully concur in this opinion, I will conclude my note by begging the chairman and members to take immediate action thereon, for if anything is to be done it should be done promptly. A draft of a Federal Council Adoption Bill, prepared by the Premier of Queensland, has been received by the Cabinet, and will no doubt be speedily submitted to Parliament. Whether that bill contains any generic term for our federated provinces I can only conjecture, but

whilst we still have the opportunity let us do what we can to insure for our united states a name to which no just exception shall hereafter be made.

Colonel CRAWFORD added that just as the name Hobart Town was altered to Hobart, so the opportunity of federation should be taken to adopt the more euphonious name of Australia for the group.

Mr. JUSTIN McC. BROWNE called attention of the Fellows to a series of interesting articles in *Notes and Queries*, which appeared a few months since on the subject of the use of the words Australia and Australasia.

Mr. R. M. JOHNSTON said that statisticians used the term Australasia to mean the Continent of Australia, and the Islands of New Zealand and Tasmania.

Mr. E. D. SWAN: And Fiji.

Mr. R. M. JOHNSTON: When such a term was generally used, it would require very great courage to suggest any alteration. It was, however, one which would very fairly come within the scope of the dealings of the Federal Council.

Mr. J. B., WALKER said they were indebted to a Frenchman President De Brosses for the term Australasia, he having conferred it in 1756. He had brought down a book "Histoire des Navigations aux Terres Australes,' Paris, 1756, showing the charts of that day for the inspection of the Fellows. Australia now, as he understood it, was used for the Continent, and Australasia for the larger group. He did not know whether the shorter term being more euphonious would be sufficient reason for altering it.

Colonel CRAWFORD: But we have nothing to do with Asia at all. If you have anything call it South-eastern Asia. It makes me writhe to think of the incongruity. A Frenchman may have introduced the word, but I won't be guided by any Frenchman. (Laughter.) A century ago, too—what did he know about it? (Renewed laughter.) Let us use our own commonsense. We are famous for misnomers in this island.

The CHAIRMAN said no doubt the Colonel's remarks would elicit discussion and call attention to the subject, and so he would attain the object he had in view.

EXHIBITS.

The CHAIRMAN drew attention to a further donation of a collection of mounted birds, received from the Trustees of the Sydney Museum. Among them was particularly noticeable two species of the handsome Racquet-tailed Kingfisher (Tanysyptera galatea, and Dana.)

The CURATOR drew attention to a fish he had received from Mr. D. Whitehouse. It was known as the Frost Fish of New Zealand (Lepidopus caudatus); the specimen was captured near the wharf, swimming about the surface.

Mr. R. M. JOHNSTON drew attention to a fine specimen of a bream (Girella sp.) that he had obtained during the month; he was of opinion that the species, simplex and tricuspidata, would turn out to be identical with each other.

4. The CURATOR drew attention to a specimen of a kingfisher shot at Cambridge; the bird, although not included in "Gould's Handbook" or "Krefft's Fauna of Tasmania," has been occasionally shot and seen in Tasmania; it is known in Australia as the Sacred Kingfisher (*Halcyon sanctus*).

ORNITHOLOGY.

The CURATOR stated that the Council of the Royal Society had received during the month a letter from the President of the Intercolonial Permanent Ornithological Committee, Vienna, which

he would read to the Fellows, in doing so he was of opinion that among the Fellows of the Society were many close observers of the habits, etc., of the birds of Tasmania, and the co-operation of those gentlemen would materially assist the object that the Vienna Society were desirous of carrying out. The letter was as follows :—

Sir,— The first International Ornithological Congress at Vienna has resolved upon creating an International Permanent Ornithological Committee, whose task it is to establish a net of ornithological observation stations, embracing the whole inhabited world. Extremely difficult as this task appears to be, we, however, think to realise a happy solution, encouraged by the exceedingly kind favours bestowed on us by most of the Governments, and relying upon the mighty protection of our High Protector. But such a solution is, however, only possible, if everybody, who has the progress of science at heart, will energetically assist the committee in their assiduous exertions of completing this great work worthy of the working together of all mankind. We therefore confidently think to do no false step by applying to you with the kind request to look for men in your circles, who have the mind and intelligence of undertaking this meritorious task by regularly observing all the birds of their surrounding countries, referring to their occurrence, trains, hatchings, and ways of life, and sending those observations annually (every first quarter of the calendar-year) to the secretary of the committee. Dr. R. Blasius, President I.P.O.C. Vienna.

The Chairman said that Colonel Legge, Mr. Swan, and other ornithologists, would, no doubt, give the writer the benefit of their researches and observations, and bestow attention on the very interesting questions raised by it. The letter would appear in the report of the proceedings, and would receive the attention it deserved from the Fellows.

VOTE OF THANKS.

On the motion of Mr. C. H. Grant, seconded by Mr. J. B. Walker, a vote of thanks was passed to the readers of papers and donors of contributions to the Museum.

OCTOBER, 1885.

The usual monthly meeting of the Royal Society of Tasmania, was held at the Museum on Monday evening, October 12th. Mr. James Barnard, Vice-President, occupied the chair, and about 20 Fellows were present.

The following gentlemen, who had been previously nominated as Fellows, were balloted for and duly elected as Fellows of the Society, viz., Messrs. J. T. Triffet and T. A. Tabart.

RETURNS.

The Hon. Secretary (Hon. Dr. Agnew, M.L.C.), brought forward the usual returns, viz.:—

1. Number of visitors to the Museum during the month of September :—Week days, 1,414 ; Sunday, 850 ; total, 2,264.

Number of visitors to Royal Society's Garden during the month of September, 4,767.

Plants and seeds received at and sent from the Royal Society's Gardens during the month of September, 1885 :—

To the Botanic Gardens, Cape Town, South Africa—Collection seeds.
To the Chamber Agriculture, Washington, United States—Collection seeds.
To Messrs. Smith and Adamson, Melbourne—Seeds.
To Mr. L. Bachmer, Yokohama, Japan—Seeds.
To Miss Owen, Ireland—Collection seeds.
To the Conservator Forests, Punjaub, India—Collection seeds.
To Mrs. Oliver, New Plymouth, New Zealand—Seeds.
To C. Moore, Esq., Botanic Gardens, Sydney—Sphagnum.
To Messrs. Shepherd Co., Sydney—Case plants.
To B. F. Wellington Co., San Francisco—Seeds.
From Mr. J. Latham, Hobart—24 plants.
From Mr. S. Purchase, Parramatta, N.S.W.—Small case plants.
From Messrs. Shepherd Co., Sydney—Small case plants.
From Mrs. Archer, Hobart—Seeds.
From C. Sprent, Esq., Hobart—Seeds.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during September, 1885 :—

6th. Acacia pycnantha commencing to flower.
15th. Moutan pœony commencing to flower.
15th. Horse-chestnuts commencing to flower.
27th. Sycamore commencing to break leaf.
28th. Grape vines commencing to break leaf.
30th. Common ash commencing to break into flower.
30th. Common plane commencing to break into leaf.

METEOROLOGICAL RETURNS.

From the Government Observer, Captain Shortt, R.N.—Table of observations for September.

ADDITIONS TO THE LIBRARY DURING THE MONTH OF SEPTEMBER.

Agricultural Gazette, August 3, 10, 17, 24.
Annals and magazine of Natural History, August.
Athenæum, The July.

Bulletin of the Museum of Comparative Zoology at Harvard College, vol. XI., No. 11 ; Studies from the Newport Marine Laboratory, communicated by Alexander Agassiz, XV.; on the development of Agalma, by J. Walter Fewkes, vol. XII., No. 1 ; Chlamydoselachus anguineus, *Garm.*, a living species of Cladodont shark.—By L. Garmon. —From Alexander Agassiz.

Bulletin de la Societe Royale de Botanique de Belgique, June, 1862, 1885.—From the Society.

Catalogue of the Echinodermata in the Australian Museum, part 1, "Echini;" Desmosticha and Petalosticha.—By E. P. Ramsay, F.R.S.E.—From the author.

Catalogue des Livres de Fonds et en Nombre, Histoire, Archeologie, Ethnographie, et Lingiustique De L'Europe, De L'Asie, De L'Afrique, De L'Amerique et de L'Oceanie.—From the Society.

China and the Roman Orient, researches into their ancient and mediæval relations as represented in old Chinese records.—By F. Hirth, Ph. D.—From the author.

Chart of Java, by S. H. Lerne. From Mr. J. Wemyss Syme.

Gardeners' Chronicle, Aug. 1, 8.
Geological Magazine, Aug.

Indian Meteorological Memoirs, being occasional discussions and compilations of meteorological data, relating to India and the neighbouring countries under the direction of H. Blandford, F.R.S., vol. IV., Part 4--6. Account of the S.W. Monsoon Storms generated in the Bay of Bengal during the years 1877 to 1881.—From the Meteor. Office, India.

Journal of Science, August.

Journal of the Society of Arts, July 3, 10, 17, 24, 31.

Map showing the site of Melbourne and the position of the Huts and Buildings previous to the foundation of the Township, by Sir Richard Bourke, in 1837.—From the Government.

Maps to accompany Report of Progress, 1882-3-4.—From the Society.

Mémoires de la Société Royale des Sciences de Liège. Le tome xi., Mai, 1885.—From the Society.

Mineral Statistics of Victoria for the Year 1884, with Report of the Secretary of Mines.—From the Mines Department.

Monthly Record Meteorological Observations, April 1885, Melbourne. —From the Meteorological Department.

Monthly Notices of the Royal Astronomical Society. June.

Provincial Medical Journal, vol. IV., No. 44.—From the Editor.

Proceedings of the Royal Society of London, vols. 27—38, Nos. 232 to 237.—From the Society.

Proceedings of the Canadian Institute, Toronto, July, 1885, 3rd series, vol. 3.

Records of the Geological Survey of India, vol. 18, part III., 1885.—From the Geological Department.

Registers of Original Observations in 1885, reduced and corrected, January 18, India.—From the Department.

Statistics of the Colony of New Zealand for the year 1884, part IV., Finance, Accumulation, and Production.—From the Government.

Systematic Census of Australian Plants, with Chronologic, Literary, and Geographic Annotations.—By Baron Von Müeller. Second Annual Supplement for 1884.—From the Author.

Transactions of the Asiatic Society of Japan, vol. XII., part 4, vol. XIII., part 1, July, 1885.—From the Society.

Victorian Naturalist, Vol. XI, No. 5, September, 1885. From the Field Naturalist Club of Victoria.

Vital and Meteorological Statistics of the Registration districts of Hobart and Launceston for August, 1885. From the Government Statistician.

PRESENTATIONS TO THE MUSEUM.

Mammals.

Tasmanian Porcupine (Echidna setosa), Mr. Archer.

Birds.

New Holland Goshawk (Astur novæ hollandiæ), Mr. Street.
Wedge-tailed Eagle (Aquila audax), Mr. J. N. Whitehead.
Lewins Rail (Rallus lewini), Mr. A. Flexmore.

Fishes.

A Parrot Fish (Labrichthy mortoni), Mr. W. L. Boyes.
Blenny (Cristiceps sp.), Mr. Self.
A Young Ray, Herr Schott.
Native bread, Mylitta Australis. Mr. P. S. Seager.

Rocks, Etc.

1. Yellow Copper Ore and Pyrites, from the Tasmanian Mine. 2. Quartz, New Native Youth Gold Mining Co., Lefroy, 800 feet level, 470 feet below sea level. 3. Outcrop of Quartz-conglomerate, Ophir Township, Beaconsfield. 4. Outcrop, "Gossan," Tasmanian Mine, Beaconsfield. 5. Sandstone, from the Lefroy Mine, Beaconsfield, 400 feet level, and 260 feet below sea level. From Mr. Joseph Davies, Beaconsfield.

Old Documents, Etc.

Memorial Tablet of Lord Nelson, from engraved plate, demy. Miss Burgess.

Passport, granted to J. Wemyss Syme to Canton, 1885. From Mr. J. Wemyss Syme.

Ethnology.

Two Malay creeses or daggers, used for executions, one Malay Peninsula creese, one Malay knife for cutting timber, one Malay knife for ordinary purposes, one quiver containing poisoned arrows, one Malay native dress, "sula," or native ladies' dress, one Malay head-dress, "Tappa," or native cloth used by the jungle tribes, Malay Peninsula. Volcanic dust from the late eruption, Straits of Sunda.—From Mr. J. Wemyss Syme.

"Sampitan," or blowpipe, used by the natives of the Malay Peninsula for hunting, etc. Two swords worn by Malay gentlemen.—From Mr. Brian Gaynor, of Kwaldkhangsar, State of Perak (through Mr. J. Wemyss Syme.)

In reference to the poisoned arrows,

Dr. Agnew said there was a considerable amount of discussion as to whether they maintained their poisonous qualities, and the Curator had told him that day that he had tried an experiment on a cat with a South Sea Island arrow by introducing the tip of one of the so-called poisoned arrows under the skin, and the cat received no damage or injury from it. Some years ago the death of Commodore Goodenough was supposed to be caused by one of these poisoned arrows, but, on the whole, it was afterwards believed he died from tetanus, brought on by the season and by the nature of the wounds. A punctured wound was more apt to produce tetanus, and probably that was the cause of his death.

Dr. Perkins said the poison used by the natives of South Africa to tip their arrows with was a fluid obtained from the bark of a tree. It acted very speedily, and some of it which had been recently analysed in Great Britain contained an alkaloid called Strephanthine which had a paralysing effect on the heart. Arrows tipped with such a fluid would kill almost instantaneously if the poison was fresh.

Mr. E. D. Swan said the arrow by which Commodore Goodenough was killed was a very formidable weapon. These would have no such effect.

Mr. C. T. Belstead: Was it an arrow or a spear?

Mr. E. D. Swan: An arrow I believe, but the wound was a terrific one.

On examining the native ladies' dress, several members questioned if it were made on the Malay Peninsula, and

Mr. E. D. Swan said that Wallace, in his "Malay Archipelago," said that such materials as these were sold cheaper there than in England.

Mr. J. Mc C. Browne related how, when at Guam, in 1850, he had seen the native women wearing such fabrics on Corpus Christi Day. Probably they were supplied from Manilla, who in turn got them from English and Scotch houses in Liverpool and Glasgow.

Mr. Charpentier said one specimen was evidently block-printed. Some of the South Africans sent their native cloths to England to be printed.

Dr. Agnew described the dresses of the native women in Ceylon as being similarly varied in hue to these specimens.

PAPERS.

An interesting paper was read, entitled, "Shells of the Group Polycystina, illustrated by the microscope," by Mr. C. J. Atkins.—The living animalculæ of this family of microscopic shells belong to a type that ranks lowest in the scale of creation. They are Protozoa, the

first or earliest form of animal life that is known to us. The floating scum of the tepid tropical ocean ceases under the microscope to be one gelatinous mass, and resolves itself into minute, but distinct globules of this rudimentary life. Though the Protozoa are unendowed with the organs that according to our ideas usually accompany animal life, we find that Providence redeems them from insignificance by the splendours of colouring that they possess, and by the variety and complex beauty of the shell framework that supports them. The Polycystinæ are classified by Dr. Carpenter (who is followed by Dr. Wallich) as Rhizopodal (*i.e.*, root-footed Protozoa). The shells are thus associated with those of the many-chambered Foraminiferæ, and mingling with that larger family they are often found, both as fossils, and in more recent deposits. The shells of the Polycystinæ, however, are composed of pure silex, and to this they owe their brilliant and ivory-like appearance under the microscope; in this particular differing from those of the Foraminifera, which are built up of limestone (*i.e.*, carbonate of lime). The shells are further distinguished by their perforations, and by their being pronged into spines and other projections, which are frequently arranged in symmetrical devices of striking design, as in the species Haliomma Humboldtii and Podocyrtis Schomburgkii. A slide placed under the microscope this evening shows these two species from Barbadoes with black- ground illumination. Another slide shows the Haliomma separately, and mixed groupings of several other species are also on the table. Dr. Carpenter, who is always a safe guide, says of these objects:—"Few microscopic objects are more beautiful than an assemblage of the most remarkable forms of the Barbadian polycystina, especially when seen brightly illuminated upon a black ground, since their solid forms become much more apparent than they are when these objects are examined by light transmitted through them. . . . . No class of objects is more suitable than these to the binocular microscope, the stereoscopic projection of which causes them to be presented to the mind's eye in complete relief, so as to bring out with the most marvellous and beautiful effect all their delicate sculpture, reminding the observer—to compare small things with great—of the finest specimens of the hollow ivory balls carved by the Chinese."—(Dr. Carpenter: The Microscope, cap. x.) In conclusion, I cannot do better than ask you, on the recommendation of this high authority, to spend a few moments in examining the Polycystina before the close of the meeting.

Mr. R. A. Bastow read a paper on the mosses of Tasmania in continuation of former papers, illustrated by his own drawings and photographs, and by the microscope.

The following letter from Mr. A. B. Biggs, of Launceston, was read by the Honorary Secretary:—

"In my paper on our earth tremors (read 9th June last) I referred to indications of change in the general direction of the shocks, from time to time. In connection with this branch of the subject, it is interesting to note that the direction of the shock felt in Victoria on 8th inst. (as per telegram) was supposed to be from the south-west. This, so far as it may be relied on, accords approximately with the indications as per time reports, of our shock of 11th ult., which would appear to have passed through the island, beginning at Hobart (as the first noticed) and leaving at the N.E. Coast. This is almost in the reverse direction of the generality of our tremors. I have recently had the pleasure of two or three interviews with Professor Malno Milne, of Japan, who, I think, holds premier position in seismology. There was one sentence at the end of my paper of June 9, which I now regret was sacrificed for brevity's sake in

printing. I there stated that, on examination, I was unable to discover any connection between our tremors and lunar positions. This deduction accords with that of Professor Milne, both as conveyed to me verbally by himself and as intimated in his latest pamphlet."

Dr. AGNEW asked if any Fellow present had felt a shock of earthquake on Friday last in the forenoon.

Captain SHORTT, who was referred to, said he had not felt it.

Dr. AGNEW said some people in his house had felt a slight shock, but he had seen nothing about it in the newspapers.

Mr. BERNARD SHAW said one of the gentlemen in his office had felt a shock on Friday morning, and had gone in and asked him if he had not felt it also.

THE LONGFORD COAL DEPOSITS.

Mr. BRAIN, who is in charge of the coal mines at Longford, gave some information respecting them at the request of the Hon. Secretary. He said it was hardly fair to judge the mine yet, though, as far as he had been able to prove it up to the present time, it looked very well. The seam varied from 3ft. to 4ft. 6in. in width. It had a fine sandstone top and bottom, and the inclination or dip was from N.E. to S.W., and was very slight indeed. It would, he thought, be an excellent household coal, but not fit for steam purposes.

Dr. PERKINS said perhaps Mr. Brain would be able to send them some fossils.

Mr. BRAIN said he had some very fine leaf impressions which he would be glad to send. He had already forwarded some to Mr. Johnston, but would be glad to make a collection for the society.

The CHAIRMAN: They will be very acceptable.

VOTE OF THANKS.

On the motion of Dr. AGNEW, seconded by Mr. BELSTEAD, a vote of thanks was accorded by acclamation to donors of contributions and readers of papers.

After inspection of the microscopes the meeting terminated.

NOVEMBER, 1885.

The monthly meeting of the Royal Society of Tasmania, the last of the session of 1885, was held on Monday evening, Nov. 16, at the Museum, James Barnard, Esq., V.P., in the chair. The Bishop of Tasmania, several ladies, and a large number of Fellows were present.

RETURNS.

The HON. SECRETARY (Hon. J. W. Agnew, M.D.) brought forward the usual returns, viz.:—

Number of visitors to the Museum during the month of October:—Week days, 1,557; Sundays, 550. Total, 2,107.

Number of visitors to Royal Society's Gardens during the month of October, 6,500.

Plants and seeds received at and sent from the Royal Society's Gardens during the month of October, 1885:—

From Mr. Wm. Bull, new plant merchant, London. Case containing 103 new chrysanthemums.

From the Botanic Gardens, Christchurch, New Zealand. Case plants, various.

From Baron Ferd. Von Mueller. Bulbs of a new crinum, and package seeds.

From the Horticultural Society, Madras. Seeds Phœnix paludosa.
To Mr. C. F. Creswell. Plants, chrysanthemums, and dahlias.

Time of leafing, flowering, and fruiting of a few standard plants in the Royal Society's Gardens during October, 1885 :—

4th. Carpinus octulus commencing to break leaf.
8th. Ailanthus glandulosus commencing to break.
14th. Tilea europœa commencing to break leaf.
14th. Morus niger commencing to break.
18th. Ulmus campestris seeds commencing to fall.
25th. Melia azederach commencing to break.

Meteorological Returns.

From the Government Observer, Captain Shortt, R.N., table of observations for October.

Additions to the Library during the month of October :—

Abhandlungen der Mathematish. Physikalischen Classe der Koniglich Bayerischen Akademie der Wissenschaften. Munchen, 1883—From the Society.

Almanach der Koeniglich Bayerischen, 1884.

Annual Report of the Board of Regents of the Smithsonian Institution, showing the Operations, Expenditures, and Condition of the Institution for the Year 1882.—From the Institution.

Annual Report of the Chief Signal Officer U.S. Army to the Secretary of War, for the fiscal Year ending June 30th, 1882, Parts I. and II.—From the Department.

Do. do. for 1883.

Annual Report of the Department of Mines, New South Wales, for the year 1884.—From the Mines Department.

Anales de la Oficina Meteorologica Argentine. Tome IV. By B. A. Gould.—From the Department.

Annals and Magazine of Natural History, London, September, 1885.

Archives du Musée Teyler, Série II. Quatrieme Partie.—From the Society.

Athenæum, The. August.

Australian Scientific Magazine, Vol. 1, No. 3; October, 1885, Melbourne.—From the Editor.

Bericht des vereines für naturkunde Zu Cassel über das Vereingsaha rom. 18, April, 1883 bis dahim, 1884. From the Society.

Bibliotheca hassiaca, by Dr. Karl Ackermann. From the Society.

Bestimmung der erdmagnetischen Inklination von Kassel, Von Dr. Karl Ackermann.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass. No. 2. The Felsites and their associated rocks north of Boston, by J. S. Diller. No. 3. On an occurrence of gold in Maine. No. 4. A microscopical study of the iron ore or Peridotite of Iron Mine Hill, Cumberland, Rhode Island, by M. E. Wadsworth. No. 5. Observations upon the physical geography and geology of Mount Ktaadn, and the adjacent district, by C. E. Hamlin. No. 6. Report on the recent additions of fossil plants to the Museum collection, by Léo Lesquereux. No. 7. The great dike at Hough's Neck, Quincy, Mass., by J. Elliott Wolff. No. 8. On some specimens of Permain fossil plants from Colorado, by Léo Lesquereux. Vol. 11, pt. 1. The Azoic system and its proposed sub-divisions by J. D. Whitney and M. E. Wadsworth. From Alexander Agassiz.

Bulletin of the Buffalo Society of Natural Sciences, Vol. IV., No. 4.—From the Society.

Bulletin of International Meterology for 1882-3, Washington.—From the Department.

Catalogue de las Zonas, Zone Catalogue, mean positions for 1875, of the stars observed in the zones at the Argentine National Observatory. By B. A. Gould. Pts. 1 and 2.—From the Society.

Catalogue of the Library of the Statistical Society, with preface and regulations, 1884.—From the Society.

Den Norske Nordhavs, expedition 1876-8, XIV. Zoology, Crustacea. Plates. By Geo. O. Sars.

Gardeners' Chronicle.

Geological Magazine, September.

International Meteorological Observations, Washington, 1882.—From the Department.

Journal of Society of Arts, August 7, 14, 21, 28.

Journal of Society of Arts, Vol. XXXII., 1883-4 (bound).

Journal of the Society of Arts, Index to Vols. XXI. to XXX., 1872 to 1882.

Journal of Science, September.

Journal of the Statistical Society, London, Vol. XLVII., pts. 2, 3, 4, 1884; Vol. XLVIII., pt. 1, March, 1885.—From the Society.

Journal of the Linnean Society of London Botany, Nos. 134 to 137; Zoology, Nos. 103 to 108.—From the Society.

Journal of the Royal Historical and Archæological Association of Ireland, Vol. VI., 4th Series, January, April, and July, Nos. 57, 58, 59.; Vol. VII., 4th Series, January, 1885, No. 61.—From the Society.

Journal of the Royal Asiatic Society of Great Britain and Ireland, Vol. XVI., pt. 3, New Series, 1884; Vol. XVI., pt. 4, New Series, 1884; Vol. XVII., pts. 1 and 2, 1885, New Series.—From the Society.

Leeds Philosophical and Literary Society, the annual report for 1884-5. From the Society.

List of the Linnean Society of London, 1884-5. From the Society.

List of the Zoological Society of London, November 1, 1884. From the Society.

Memoirs of the Geological Survey of India Palæontologica Indica, being figures and descriptions of the organic remains procured during the progress of the Geological Survey of India. Ser. X. Indian Tertiary and Post Tertiary, Vertebrata, Vol. III. pt. 3. Rodents and new Ruminants from the Siwaliks and Synopsis of Mammalia, by R. Lydekker, B.A., etc., Vol. III., pt. 4. Siwalik Birds, by R. Lydekker, Vol. III., pt. 5. Mastodon teeth from Perim Island. Nos. 16, 17, by R. Lydekker, B.A., Vol. I., pt. 4. The Labrinthodont from the Bijori Group, by R. Lydekkerr. Tertiary and upper cretaceous fossils of Western Sind. Ser. XIV., Vols. I., III. The fossil Echinoidea Fas. IV., the fossil Echinoidea from the Nari series. The Oligocene formation of Western Sind, by P. Martin Duncan, M.B., W. Percy Sladen, F.L.S., etc. Series xiii. Saltrange Fossils, by W. A. A. Wagen, Ph. D., 1 Productus—Limestone fossils, iv. fas. 5 Brachiopoda lxxxii.—lxxxvi., Vol. xxi., part 3. Hughes' Southern coalfields of the Rewah Gondwana Basin. Vol. xxi., part 4. Mallet: The volcanoes of Barren Island and Narcondam, in the Bay of Bengal. From the Geological Survey Department of India.

Memoirs of the Literary and Philosophical Society of Manchester, vol. IX., a centenary of Science in Manchester, by R. Angus Smith, F.R.S., vol. VII., third series, 1882-3.—From the Society.

Memoirs of the Royal Astronomical Society, London, vol. 48, pt. 1, 1884.—From the Society.

Memoirs of the National Academy of Science, vol II., 1883, Washington.—From the Society.

Memoirs of the Museum of Comparative Zoology, at Harvard College, Cambridge, Mass., vol. VIII., No. 3; The Reptiles and Batrachians of North America, by Samuel Gorman, vol. X., No. 3.;

Results of an Examination of Syrian Molluscan Fossils, chiefly from the range of Mount Lebanon, by Charles E. Hamlin, vol. XI., pt. 1, Lithological Studies, a Description and Classification of the Rocks of the Cordilleras, by M. E. Wadsworth ; vol., XII., The Water Birds of North America ; vol. I. and II., by S. F. Baird, T. M. Brewer, A. R. Ridgway.—From Alexander Agassiz.

Memoirs of the Boston Society of Natural History, vol. III., No. 7, on the development Olecanthus Niveus and its parasite Teleas, by H. Ayer. No. 9. Two new and diverse types of carboniferous myriapods, the species of Mylacris, a carboniferous genus of cockroaches. By S. H. Scudder. No. x. Notes on the Peeping Frog, Hyla Pickeringii, Leconte. By Mary H. Hinckley.—From the Society.

Meteorological Observation, February and March, 1885. Meteorological Office, India.

Monthly Weather Review, Washington, for 1884. From the department.

Monthly record of Meteorological observations, etc., during June, 1885, by R. L. J. Ellery, F.R S.—From the Department.

Natural History of Victoria, Prodomus of the Zoology of Victoria, decade XI., by Prof. McCoy.—From the Government.

Observations and Researches made at the Hong Kong Observatory in the year 1884, by W. Dobeck.—From the Department.

Proceedings Manchester Literary and Philosophical Society, vols. XX., XXI., XXII., 1880-3.—From the Society.

Proceedings of the Royal Institution of Great Britain, vol. X., pt. 3, No. 77.—From the Society.

Proceedings of the Royal Colonial Institute, vol. XV., 1883-4. - From the Society.

Proceedings of the Boston Society of Natural History, Vol. 22, pt. 2, November, 1882, February, 1883 ; pt. 3, March, 1883, October, 1883.—From the Society.

Proceedings of the Canadian Institute, Toronto ; Vol. II., Fas. No. 1, 2, 3 ; March, July, October, 1884.—From the Society.

Proceedings of the American Academy of Arts and Sciences, New Series, Vol. XI.; whole series, Vol, XIX., pt. 1, from May, 1883, to December. 1883 ; pt. 2, from May, 1883, to May, 1884.—From the Society.

Proceedings of the American Association for the Advancement of Science, Minneapolis meeting, Vol. 32, 1883.—From the Society.

Proceedings of the American Philosophical Society held at Philadelphia for promoting useful knowledge, Vol. XXI., April, 1883, to January 4, 1884, No. 114; No. 115; January 4 to May 16, 1884; No. 111, 1884.—From the Society.

Quarterly Journal of the Geographical Society, Vol. 40, pts. 3 and 4, Nos. 159, 160 ; Vol. 41, pts. 1 and 2, Nos. 161, 162.—From the Society.

Report of the British Association for the Advancement of Science, Montreal, August, 1884.—From the Society.

Report of the Superintendent of the U.S. Naval Observatory for the year ending October 30, 1884.—From the Observatory.

Report on the Meteorology of India in 1882. By H. F. Blandford, F.R.S.—From the Meteor. Department.

Report of the Board of Governors of the Public Library, Museum and Art Gallery of South Australia, with the reports of the Standing Committees for 1884-5.—From the Department.

Register of Papers published in the Transactions and Proceedings of the American Philosophical Society, compiled by H. Phillips, jun.—From the Society.

Resultados del Observatoris Nacional Argentio en Cordoba, Vol. III., IV. By B. A. Gould.—From the Society.

Second Annual Report of Ethnology to the Secretary of the Smithsonian Institution, 1880-1. By J. W. Powell.—From the Institute.

Sitzungsberichte, Heft III., 1883; Heft I., 1884.—From the Society.

Statistics of the Colony of New Zealand for the year 1884, Pt. V., Law, Crime, and Education.—From the Government.

Third Annual Report of the U.S. Geological Survey to the Secretary of the Interior, 1881-2. By J. W. Powell. Plates. Washington, 1883. —From the Department.

Transactions of the Institution of Engineers and Shipbuilders in Scotland, Vol. 27, 1883-4.—From the Society.

Transactions of the National Association for the promotion of Social Science, Birmingham meeting, 1884.—From the Society.

United States Geological Survey, Clarence King, director, Geology of the Comstock lode and the Washoe district, with atlas, by G. F. Becker. Plates V. The Copper-bearing rocks of Lake Superior, by R. D. Irving. Plates. Washington, 1883. Mineral resources of the United States, by Albert Williams, jun. Washington, 1883. Atlas to accompany the Geology of the Comstock Lode and the Washoe district, by G. F. Becker.—From the Department.

Victorian Naturalist, The, Vol. 11, No. 7, November 1885.—From the Society.

Washington Astronomical and Meteorogical Observations made during the year 1880. —From the Department.

PRESENTATIONS TO THE MUSEUM.

Mammals:

Tasmanian Porcupine (Echidna setosa), Master E. Hull.
Tasmanian Porcupine (Echidna setosa), Mr. C. H. Lindley.
Tasmanian Porcupine (Echidna setosa), Mr. Lovett.
Tasmanian Rat Kangaroo (Hypsyrymnus apicalis), Mr. J. Bradshaw.
Two Opossum Mice (Dormicia gliriformis), Mr. W. H. Cole.

Birds:

Australian Bittern (Botaurus australis), Mr. Perkins.
Australian Goshawk (Astur approximans), Mr. W. Peacock.
Collared Sparrow-hawk (Accipiter torquatus), Mr. Flexmore.
Summer Bird (Graucalus parvirostris), Mr. Geo. Hinsby.
Magnificent Rifle Bird (Ptilorhis alberti), adult male, young male and female. Queen Victoria's Rifle Bird (Ptilorhis victoriæ), male and female. Rifle Bird (Ptilorhis pardiseus), male and female, the Trustees Brisbane Museum.

Birds' Eggs:

A Collection of American Birds' Eggs, Mr. Geo. Hinsby.

Fishes:

Velvet Fish (Holoxenus cutaneus), Mr. Bissett.
Young English Salmon (Salmo salar); young California Trout (Salmo fontinalis), the Salmon Commissioners.
Parascyllium variolatum, Mr. J. J. McCluskey.

Reptiles:

Lizard (Grammatophora sp.), Mr. E. D. Swan.
Three do. (Grammatophora sp.), Mr. C. H. Lindley.
One do. (Hinulia whitei), Mr. E. B. Gawne.

Ethnology:

A Japanese suit of armour, Mrs. J. C. Hadley.

EARTHQUAKE SHOCKS.

Captain J. SHORTT, R.N., Meteorological Observer, made a few remarks on a paper on Earthquake Shocks, by Mr. A. B. Biggs, Launceston, read at the last Society's meeting. He said he wished first to point out the inconsistencies of Mr. Biggs in his many letters to the Press on the earthquake shocks that have been experienced both in Tasmania and on the Continent of Australia since April, 1883. He (Mr. Biggs) has given the centre of disturbance as occurring in Bass' Straits, in New Zealand, also 500 and 1,000 miles to the eastward of Tasmania, and by his letter, read at the October meeting, he would wish to infer from the shock of September 11th the centre was nearer Hobart than the East Coast of Tasmania. After comparing the time of the shock, as given by different observers in Tasmania, the speaker found that Falmouth is the only station that would give him the grounds for the supposition that the centre is not at some place in a line north or south of the centre. He (Capt. Shortt) consistently considered it to be, as at about 90 miles to the eastward of the North-East Coast of Tasmania, sometimes farther north of it, which has been the case during the last year, the shocks having reached Gabo Island earlier than Tasmania; and the time of those noted there can be depended upon as more reliable than at country places either in Victoria or Tasmania. Mr. Biggs speaks of the shock experienced in Victoria on September 8 as coming from S.W. in the North-Eastern districts. It would be reasonable to infer that places on the Southern Coast of Victoria ought to feel them with greater severity. In the monthly record of shocks felt at Gabo, the direction is always given as from south to north. Gabo Island is nearly north of the slope where the sea bottom suddenly slopes to a depth of over 2,000 fathoms, which the speaker thought we should attribute to the region of the great physical line of fault, and the origin of the disturbance. Observers are very easily deceived in the direction of shocks, as numbers of reports have been received at the observatory from the islands in Bass' Straits, also in Tasmania, as proceeding from N. to S., N.W. to S.E., and West to East, and *vice versa*; Mr. Biggs has also published an account of a shock as recorded by a seismometer as coming from N.W., so it is easily seen how difficult it is to judge correctly, (more especially by an observer feeling the earlier sensations), from what direction they really proceed; in fact, from Goose Island they have always given the direction as from N.W. to S.E., when it should be the reverse. In his letter Mr. Biggs acknowledges Professor Milne, of Japan, holds a premier position in seismology. That gentleman, subsequent to his late visit to Tasmania and after obtaining all possible information as to earthquakes felt both in Victoria and Tasmania, has written an article on the earth movements in Australia in the Melbourne *Argus* of October 10, in which he fully coincides with the speaker that the disturbance probably originates near to the edge of the 2,000 fathom line off the N.E. coast of Tasmania.

PAPERS.

An interesting paper was read, entitled "The scientific treatment of waste material," by Mr. W. H. Charpentier. The paper dealt chiefly with the utilisation of waste material now lost very day. As local instances he referred to the waste of tar from the gas works, and of refuse from the slaughter-house, which were allowed to go into the river, and showed how the utilisation of such

material became valuable industries in other countries. The paper led to an interesting discussion in which various members took part, particular mention being made of the destructive nature of the tar thus allowed to run to waste in destroying or tainting many of the fish in the wells of the fishermen's boats.

A paper by Mr. J. R. McClymont, M.A., Edin., entitled "Australian Topography: Edel's Land, De Witt's Land, and Carpentaria," was read by Mr. J. B. Walker. Mr. McClymont attempted to prove by references to Tasman's Letter of Instructions, 1644, and to early maps that the Land of Edel, on the west coast of Australia, was discovered in 1617, two years earlier than the date usually assigned to the discovery, and that1619 is only the date of a second visit. The paper also showed that the name Carpentaria is not met with before 1663, although a river emptying into the gulf received the name of the president of the Dutch East India Co. in Tasman's map of 1644, and possibly at a still earlier period. In concluding his notes, Mr. McClymont expressed his thanks to Mr. Justin Browne and Mr. J. B. Walker for the loan of books but stated as his opinion that "private collections can never supply the place of a public collection of works relating to Australian discovery. That if Australians are to become familiar with the beginnings of Australian history, the means of studying the sources whence that history is drawn must be placed within their reach—an end to be attained by the gradual and persistent acquisition in each colony of the books, maps, and manuscripts bearing on its own history, until an Australian library shall be established, rich in all procurable rarities of colonial history and discovery."

The CHAIRMAN said that a great many years ago a collection was made of old historical books which were put into the Franklin Museum, and were subsequently handed over to trustees for the benefit of the then projected college. He thought that it would not be out of place for the society to enter into negotiations with the representatives of those trustees with the view of getting them deposited in the Society's Library.

Mr. J. B. WALKER said that the books referred to were now in Christ's College Library, and stored in one of the rooms of the Town Hall, under the care of the Warden of the College.

Mr. JUSTIN BROWNE exhibited a copy of Tasman's map showing Tasmania and Australia as one large island, which was examined with much interest.

Bishop SANDFORD moved,—"That it be remitted to the council of the Royal Society to consider during the recess that steps should be taken to further the collection and preservation of records, books, documents, maps, etc., which may serve to illustrate the history of the colony in all its particulars, and to throw light on all that concerns the discovery, geography, and development of the colony, and to report to an early meeting of the society at its next session."

Mr. J. B. WALKER seconded, and the motion was unanimously passed.

Mr. T. STEPHENS, M.A., read a paper, entitled 'Notes on boring operations in search of coal in Tasmania, 1884" (continued).

In course of a short discussion that followed,

Mr. C. H. GRANT said that so recently as Saturday last he visited the coal district at Fingal, when it was brought under his notice that the coal at Mount Durham, situated at a distance of 2½ miles, seemed to be a continuation of the 8ft. seam now well exposed at Mount Nicholas. The value of the coal in that district seemed to be inconceivable, and he had no doubt that it would rival some of the coalfields of the Old World.

CLOSING ADDRESS.

The CHAIRMAN then said: Following the course which I adopted at the close of the session for 1884, I propose to detain you for a few moments while I pass under review the proceedings of the session which will terminate this evening. In the first place it is satisfactory to know that the number of Fellows on the roll of the Royal Society keeps steadily increasing, there having been an addition this year of 22 (of whom two, the Hon. W. Macleay, F.L.S., and E. Pierson Ramsay, F.R.S., E., F.L.S., of Sydney, were elected hon. members), while only two members have withdrawn. It may be fairly anticipated that, at no distant day, every person of education and culture living within the range of the society will seek to be included in its list of Fellows. The attendance at the evening meetings has also largely increased, and a deeper interest has been manifested in the proceedings, more especially when, by the kindness of various members, the aid of the microscope has been so freely given in the illustration of papers. The presentations to the Museum have been numerous and valuable, comprising specimens in almost every department of Natural Science; and there has also been, as usual, a large number of donations of a miscellaneous description. The contributions to the library have been many and valuable, in addition to the various sterling publications subscribed for by the Society; and there has been lately received from London a case of rare and choice volumes of a strictly scientific character, chiefly relating to ichthyology, being the first instalment which has been purchased by means of the interest derived from the Morton-Allport Memorial Fund. These books have been placed on the table for inspection. A catalogue of the extensive collection of books and pamphlets in the library has been prepared by the librarian to meet a long-felt necessity. Mr. Morton has deservedly received the acknowledgments of the Fellows for the admirable manner in which this work was performed. With regard to the papers read at the evening meetings, it may, I think, be affirmed that the work of this session will bear favourable comparison with that of any which have preceded it, both in respect to the number and variety of the subjects brought forward, as well as to their scientific value and importance. I would instance the comprehensive sketch of the "Zoology of Australia," by that eminent naturalist, our recently elected honorary member, the Hon. William Macleay, F.L.S., of Sydney, written for publication in Germany, but which that gentleman consented, at the request of our illustrious friend, Baron Von Mueller, should first appear in its original English in our Transactions before its translation into a foreign language. The several contributions by Mr. R. M. Johnston, F.L.S.,—(1) On the Silurian fossils of the Gordon limestone; (2) on new species of fossil leaves from the tertiary deposits of Mount Bischoff and elsewhere; and (3) on the classification of the upper palæozoic and mesozoic rocks of Tasmania, together with its coal plants, will be especially appreciated by geologists, both in the colonies and in Europe. A complete table of the stratified rocks of Tasmania, compared with the arrangement of similar rocks of other countries, imparts additional value to this paper. I should here mention that a geological sketch map of Tasmania, prepared by Mr. Sprent, Deputy Surveyor-General, in conjunction with Mr. R. M. Johnston, and lithographed at the Lands and Works Office by permission of the Hon. Nicholas J. Brown, has been presented to the Royal Society, and is likely to prove of considerable advantage, as a guide on the one hand and a beacon on the other, in the prosecution of mining and other enterprises. The able and exhaustive paper by Mr. W. F. Ward, A.R.S.M., Government Analyst, on the impurities of water in relation to typhoid fever, should command, from its great

practical importance, the thoughtful consideration of the community, from its bearing and influence on the public health. Much gratification, again, has been afforded by the interesting account of the mosses of Tasmania by our zealous co-worker, Mr. R. A. Bastow, a study which he has succeeded, aided by the microscope, in rendering both attractive and fascinating. Notes on different branches of science have also been read by Mr. W. Saville-Kent, F.L.S., F.Z.S., and by Mr. C. J. Atkins, and rendered, in both cases, of increased interest by means of the microscope. In selecting the foregoing for special mention, it is with no desire to under-rate the merits of the other excellent papers that have been read before the Royal Society, and which will be contained in our forthcoming volume of Papers and Proceedings. This retrospect would be incomplete were I not to mention that the present year will be memorable for the receipt of a handsome legacy of money and land, bequeathed to the Royal Society by the late Joseph Milligan, F.L.S., formerly one of its warmest supporters. This bequest has already been placed on record in the proceedings, and a portrait of the generous benefactor has been framed and placed in the library of the Society. I digress here to acknowledge our debt of gratitude to *The Mercury* for its liberality in devoting so much space in reporting the proceedings of the Society, and presenting so promptly, at next morning's breakfast table such a full and accurate epitome of the previous evening's meeting. (Applause.) Fellows are aware that an important fundamental change has taken place in the constitution of the Royal Society, by the withdrawal of the Museum and Gardens from its sole control, and establishing them as two separate public institutions under the management of certain official trustees, together with six others elected from the Council of the Royal Society. No doubt this has involved a surrender of private rights to some extent, and one which did not at first sight commend itself to all the Fellows, especially to those who, like myself, had been associated with the Royal Society from its inception. Any scruples, however, which had been called forth when the change was first proposed, soon yielded to the manifest solid advantages which must accrue to the people of Tasmania by placing those institutions on a permanent and national basis. (Hear, hear.) As an example, it is fair to expect that more ample funds in their support will be available than has hitherto been the case; for Parliament, while not feeling justified, perhaps, in voting more than the barest sums in subsidising a private, or at most a quasi-public society, must realise the obligation of adequately providing for the efficient working of these in common with other public establishments. Accordingly, additional means are already provided in the Act for the support and growth of the Museum; but, more important still, the sum of £3,000 has been voted for the erection of another wing to the Museum, urgently required to secure more ample accommodation for the rapidly increasing number of presentations. The Botanical gardens will also be rendered more attractive in future by the superintendent being less stinted as regards the supply of labour and appliances. Occasion has also been taken to give space for an art gallery for the reception of pictures and works of art, which will be at once recognised as calculated to diffuse a highly salutary influence upon public taste. But this is not all. It is designed, besides, to connect with this building a laboratory for the Government Analyst, which will enable analyses of mineral specimens and samples presented to the Museum to be made, as it were, on the spot. Accommodation in a hall for the delivery of courses of lectures on scientific subjects is also contemplated, and must prove of great public utility. In conclusion, I would simply remark that encouragement for the future may be fairly deduced from the success of the past; and that, with united action together with individual effort on the part of Fellows, good hopes may

be entertained that the Royal Society will continue its long and prosperous career with undimmed lustre. (Applause).

Bishop SANDFORD moved,—"That the members record their warmest thanks to the vice-president for the address which he had just delivered." He was very much afraid that they were trespassing a good deal on his consideration and kindness in regard to the change which had been carried on in connection with the Museum and Botanical Gardens, because they knew that those so long and so much interested in the society as the chairman had come to regard with dislike anything like a radical change in its constitution or management. Mr. Barnard, however, had shown that he could rise superior to such considerations, and had expressed warm appreciation of the advantages to be derived from the change. He proposed that they thank the chairman most cordially for the spirit and tone of his address; also that thanks be accorded to those who had read papers that night, and those who had forwarded presentations and donations.

Mr. C. J. ATKINS seconded, and the motion was passed.

The CHAIRMAN having acknowledged the compliment, the meeting separated.

LIST OF PRESENTATIONS TO THE MUSUEM FOR THE MONTHS OF NOVEMBER AND DECEMBER.

Mammals:

A Tasmanian Tiger, Thylacinus cynocephalus, the Hon. W. Gellibrand.
A Tasmanian Rat, Mr. Turvey.
Gunns. Bandicoot, Perameles Gunni, a Bat, Mr. Archer.

Birds.

A Gala Parrot, Mr. Bedelph.
White Fronted Falcon, Falco lunulatus, Mr. Massy,
Eagle Hawk, Aqiula Audax.
Australian Goshawk, Astur novæ hollandiæ, Mr. O. Flexmore.

Fishes.

A Saw Fish, Pristes cp., Mr. Johnston.
Dog Fish, Scyllium laticeps, Mr.
Elephant Fish, Callorhynchus antarcticus, Mr. G. Bridge.

Attendance at the Museum.

November, Week Days	1540.	Sundays,	550.
December, „ „	1557.	„	580.

Gardens, November, 6500; December, 6200

ZOOLOGY OF AUSTRALIA:

BY THE

HON. W. MACLEAY, M.L.C.

[Read April 14, 1885.]

THE Fauna of Australia is, taking the Animal Kingdom as a whole, extremely rich and varied; it is also more distinctively local in its general character than that of any other large area of the earth's surface. But, though the strictly Australian character exists throughout, the Fauna varies considerably in different parts of the country, the variations being evidently caused in some instances by differences in soil and climate, and in others by contiguity to other Zoological regions.

Those which are produced by soil and climate alone,—such, for instance, as the marked difference in the Fauna of the East Coast Districts and the huge basin of the interior west of the Coast range,—are evidently mere changes in the indigenous Fauna, brought about by the instrumentality of these causes exercised over an immense period of time; while the still more marked distinctions between the Zoological productions of the southern and temperate regions of Australia and the tropical northern parts, though, no doubt, also much influenced by climate, may also be traced to the vicinity of the Indo-Malayan islands and seas, from which, undoubtedly, many of the North Australian Birds, Butterflies, Fishes, &c. have been derived. Wallace, in his great work on "The Geographical Distribution of Animals," divides his Australian Region into—1, The Austro-Malayan; 2, The Australian; 3, The Polynesian; and 4, The New Zealand Sub-regions.

It is to the second of these only, the Australian—the Islands of New Holland and Tasmania—that the following observations will apply. But of the Zoology even of this limited portion of the whole region there is yet much to be learnt. Large portions of the north-west and centre of Australia are still a *terra incognita*, and even in the best known districts the smaller forms of Animal life have been but little investigated.

To begin with the Sub-kingdom *VERTEBRATA*. The Class first in rank and importance is the **Mammalian**, and in this Australia occupies certainly the most unique position in the universe. The absence of most of the Orders of this Class common in other parts of the world, and the prevailing

presence of Orders almost unknown except in Australia, are the most remarkable features of the Mammalian Fauna in Australia. The paucity of numbers is also a striking feature, the entire number of known species not exceeding 160 of all Orders.

The BIMANA are represented by a variety or species of the genus *Homo*, supposed to have migrated from countries north of Australia at some remote period. The Australian Blackfellow, as he is called, is believed to belong to the division of the human race known as the "Oceanic Negro," and though he does not present much resemblance to the Papuan, there can be little doubt but that both races emanate from the same source or centre.

The Order QUADRUMANA is entirely absent from Australia. The FERÆ are also unrepresented, with the exception of the Native Dog *(Canis dingo)*, which in all probability is only coeval with man as an inhabitant of Australia. The PINNIPEDIA are represented by a few species of Seals, common to other parts of the Pacific as well as the Australian Coasts.

The CETACEA are mostly of wide range, and can scarcely be said to belong to any country; but the seas round Australia abound in whales of several species, and the shores swarm with porpoises. One genus, however, is peculiar to the warm seas of Northern Australia,—a species of Manatee *(Halicore Dugong)*, an animal much valued for the medicinal qualities of the oil which it yields.

The important Order UNGULATA is entirely absent from Australia. There is not even a Native Pig, though two species are found on the adjacent island of New Guinea. Since the advent of the white man all, or nearly all, of the most useful animals of this Order have been successfully acclimatized. The Orders PROBOSCIDEA, EDENTATA, and INSECTIVORA are also totally unrepresented. The CHIROPTERA number about 30 species; of these five belong to the PTEROPODIDÆ or Frugiverous Bats, generally called Flying Foxes, and they are all probably importations from New Guinea and the islands of the Dutch Archipelago. The Insectivorous Bats are chiefly of the genera *Harpyia*, *Mollossus*, *Taphozous*, *Rhinolophus*, *Nyctophilus*, *Scotophilus*, *Vespertilio*, and *Nycticejus*.

The great Order of RODENTIA is limited in Australia to about 27 species of the Family MURIDÆ, and these are distributed thus:—15 species are placed in the genus *Mus*, nine in the genus *Hapalotis*, a genus only differing from *Mus* in the large ears and elongated tail, and three or four species of the genus *Hydromys*, the Beaver Rats of Australia and Tasmania.

But it is in the remaining two Orders of the Mammalia that Australia shows the greatest dissimilarity to the rest of the world.

The MONOTREMATA and MARSUPIALIA, the two Orders in question, comprise all the Implacental Mammalia known. The first of these, the MONOTREMATA, consists of two genera only—*Echidna* and *Ornithorhynchus*—the first *(Echidna)*, containing three species—one found in New Guinea; and the other *(Ornithorhynchus)* of one species, exclusively Australian. The embryology and true position of these animals have long been a puzzle to naturalists; but investigations lately made by Mr. Caldwell, Fellow of Caius College, Cambridge, are likely to set all doubts at rest for ever. The results of his labours have not yet been published, but it is known that he has ascertained beyond question that both genera are oviparous. Dr. Miklouho Macleay has also lately been making observations on the temperature of the body of living Monotremata, and has found it to be extremely low for the class of animals to which they seem to belong, the temperature of the Echnida being not over 85° Fahrenheit, and that of Ornithorhynchus about 10° less, or 75° Fahrenheit.

The MARSUPIALIA form the main mass of the Australian Mammalia, an Order unknown elsewhere among recent animals, except in the case of the DIDELPHIDÆ (Opossums) of North America. This Order, to judge from the Fossil remains, had a wide and comprehensive range over the surface of the earth during the period known to geologists as the Jurassic, and the inference therefrom is that while other portions of the globe have been submerged since that period, and re-inhabited by a later growth of living things, Australia, or the greater part of it, has remained unchanged, except to the extent produced by extensive denudation and deep alluvial or glacial deposits during countless ages. Geological discovery bears out this hypothesis, inasmuch as it has demonstrated the existence, in the filled-up cavities of the Silurian Limestone Rocks and the deep Pleistocene deposits found throughout Australia, numerous bones of Mammals of extinct species, and some of gigantic size, but all Marsupial.

The existing Marsupials of Australia number a little over 100 species, and these may be very naturally divided into five groups, which very faintly represent, or are supposed to represent, some of the missing Orders of the Placental Mammals. Thus the grass-eating Kangaroos are said to represent the UNGULATA; the Leaf-eaters—Opossums, Flying Squirrels, &c.—the RODENTS; the Entomaphaga, the INSECTIVORA; and the Sarcophaga, the FERÆ. However, these are only relations of analogy—there is no real affinity. The first of these groups,

the grass-eating Marsupials, or MACROPODIDÆ, number over 50 species, and comprise the genera *Macropus*, *Halmaturus*, *Petrogale*, *Dendrolagus*, *Oxychogalea*, *Lagorchestes*, *Bettongia*, *Hypsiprymnus*, and *Hypsiprymnodon*. The second group, the ENTOMOPHAGA, are burrowing animals, and comprise the genera *Parameles* or Bandicoot, *Chœropus*, and *Tarsipes*: they number only eight species. The PHALANGISTIDÆ include the Opossum tribe, numbering about 10 species, of the genera *Phalangista*, *Dromicia*, *Cuscus*, and *Dactylopsila*; and the Flying Squirrel tribe, about six species, of the genera *Petaurista*, *Belideus*, and *Acrobata*. The Leaf-eaters will also include the very peculiar Sloth-like form of the *Phascolarctos* or Native Bear.

The Sarcophaga, or Carnivorous Marsupials, should properly be limited to the *Dasyurus* or Native Cat of Australia, two species of *Thylacinus* or Tiger of Tasmania, found fossil in Australia, and the *Sarcophilus* or Tasmanian Devil. But there are also a number of smaller Carnivorous Marsupials throughout Australia which can scarcely be classed with these extremely ferocious animals: these are *Chætocercus*, 1 species; *Phascogale*, two species; *Antechinus*, about eight species; *Podabrus* six species, chiefly inhabitants of trees; and of non-arboreal genera, *Antechinomus*, and the very remarkable West Australian Anteater, *Myrmecobius*.

One very anomalous Australian Marsupial remains to be mentioned—"The Wombat." There are four species known to exist at the present day; they are root-eating animals of rather large size, burrow deep in the ground, and are nocturnal in their habits; the abundant fossil remains of *Diprotodon*, an allied genus, lead to the belief that the Wombats were once more numerous and larger than they are now. They are placed in the Marsupial Family of RHIZOPHAGA and the genus *Phascolomys*.

Class Aves.

The Birds of Australia are fairly numerous, and remarkable for the beauty of their plumage. The isolated character of the Fauna is less marked in this Class than in the Mammals, as might be expected from their superior powers of locomotion, but still it possesses a very distinctive character.

The most complete list of the Australian Birds is that of E. P. Ramsay, F.R.S.E., published in 1877 in the Proceedings of the Linnean Society of New South Wales. He gives there the number of the described Birds of the country as 744, and a few species added since brings the number up to 760, or about

one-sixteenth of the total number of known birds, estimated at 12,000 species.

The ACCIPITRES of Australia number about 40 species out of a total of 600, chiefly of the Family Falcondidæ. The STRIGIDÆ are not numerous, and the VULTURIDÆ are not represented at all. The most noticeable species in this Order are of the sub-genera *Gypoictimia* and *Lophoctinia*.

The Order VOLITORES, or the FISSIROSTRES, is well represented in some of its families; thus, the CAPRIMULGIDÆ number nearly 20 species, chiefly of the Australian genus *Podargus*, and the ALCEDINIDÆ about 15 species, those of the genus *Dacelo*—generally known as "Laughing Jackasses," from their peculiar cry—being of large size and peculiar to the Australian region. There are five species only of the HIRUNDINIDÆ, and one of the CYPSELIDÆ. A species of *Eurystomus* and a *Merops* are also found in the country, both summer visitants from New Guinea. The families CAPITONIDÆ, BUCEROTIDÆ, TROGONIDÆ, TROCHILIDÆ, &c. are entirely unknown.

The Order PICI is also unknown in Australia. The SCANSORES are represented by the CUCULIDÆ, of which Family there are 15 species, and some of the genera, such as *Scythrops*, *Eudynamys* and *Centropus*, are confined to the Australian region. The Order PSITTACI is distinguished for the variety and beauty of the Australian species. They number 70 out of a total of 560 species, or one-eighth of those of the whole world. Among the Cockatoos the genus *Calyptorhynchus*, or the Black Cockatoos, are the most characteristic forms. Among the Parrots the most populous genera are *Platycercus*, *Psephotus*, and *Euphemia*.

The Order PASSERES occupy in Australia, as in all the rest of the world, the most important position as regards numbers. Many families of them, familiar objects in other parts of the world, are here wanting, and those which are represented here are for the most part of distinct genera.

The NECTARINIDÆ count only 1 *Dicæum* and 1 *Cinnyris*. The MELIPHAGIDÆ, on the contrary, are a Family peculiar to Australia, seeming to occupy the position of the Trochilidæ in America and the Nectarinidæ of Asia. They are very numerous, consisting of 19 genera and nearly 200 species. The genus *Ptilotis* is the most numerous and most typical of the group.

The CERTHIDÆ and SITTIDÆ are represented by a few species of *Climacteris*, *Orthonyx*, and *Sittella*. The PITTIDÆ consist of one genus only, *Pitta*; four species are Australian, the others belong to the tropical regions north of Australia. Under the Family of ORIOLIDÆ may be classed a number of truly Australian Genera, including the singular Bower Bird, several

special species, the Regent Bird, and *Oreocincla* and *Cinclosoma*.

Among the large Family of AMPELIDÆ there is but one Australian genus, *Pardalotus*, but it constitutes a peculiar Australian group. In the family DICRURIDÆ the genus *Artamus* furnishes eight species, and is almost entirely Australian.

The LANIIDÆ, CAMPHEPHAGIDÆ, and MUSCICAPIDÆ are rich in species of the genera *Grauculus*, *Camphephaga*, *Pachycephala*, *Colluricincla*, *Falcunculus*, *Manucodia*, *Rhipidura*, *Seisura*, *Myiagra*, *Micræca*, *Monarcha*, *Gerygone*, *Smicornis*, *Petroica*, *Melanodryas*, *Pœcilodryas*, *Drymodes*, *Eopsoltria*, and *Menura*, the last the most remarkable of all Australian genera. The weaker forms of the DENTIROSTRES, which may be included in the Family SYLVIIDÆ, are also numerous, and the genera are almost entirely Australian ; they include the genus *Malurus*, *Cisticola*, *Acanthia*, *Geobasilea*, *Ephthianura*, &c. Of the ALAUDIDÆ there are only two species known ; of the STURNIDÆ one only. The FRINGILLIDÆ, the most numerous Family in other parts of the world, are almost unknown ; the few species there are belong to the *Ploceidæ* section and to the genera *Estrelda*, *Munia*, *Donacola*, *Emblema*, *Poephila*. Of the CORVIDÆ there are but four species, and these are of mostly strictly Australian genera. The lovely Family of the PARADISIDÆ does not, except in the instances of the three species of *Ptilorhis* (the Rifle Birds) reach so far south as Australia.

The Order COLUMBÆ is rather richly represented as to numbers, and remarkably so as to beauty of plumage. In the north or tropical parts, the Polynesian group comprised in the genus *Ptilopis* is represented by four species ; a few large fruit pigeons of varying genera are also found abundantly in Northern Queensland, while the more temperate parts of Australia possess a number of species of Ground Pigeons of the genera *Phaps*, *Geophaps*, *Lophophaps*, *Ocyphaps*, *Geophelia*, &c.

In the next Order, the GALLINÆ, Australia shows a greater departure from the rest of the world than in any other Order of the Aves. There is really nothing in common with any other country, except the possession of a few species of Quails, and these mostly are only occasional birds of passage, and come probably from Central Asia. The PTEROCLIDÆ, the TETRAONIDÆ, with the exception just mentioned, the PHASIANIDÆ, and all the well known GALLINÆ of other countries are entirely absent, and the Order is represented by a family of extraordinary appearance—the *Megapodidæ*, or Mound-builders. This family comprises three genera—*Leipoa*—one species inhabiting the arid wastes of the interior; *Talegalla*—one species confined to the East Coast, as far south as New South Wales ; and *Megapodius*—two species, limited to the extreme north. Of this last genus, species have been found on

many of the islands of the North Australian Coast and Polynesia.

The Order GRALLÆ, or Waders, numbers about 80 species, but they do not differ so much from those of the rest of the world as in the preceding Orders. The most noticeable genera are *Esacus*, *Porphyrio*, and *Tribonyx*.

The ANSERES, or Natatores, number about 150 species in Australia, but present few local or distinctive characters. The ANATIDÆ are represented by one Swan (a black one), and about 20 species of Ducks. The genus *Cereopsis* is Australian, and so is *Anseranas*. *Biziura* is also a remarkable form. The Gannets, Cormorants, Darter, and Pelican are, with the exception perhaps of the last, the same the wide world over. The Frigate and the Tropic Bird are found in the warm seas of the north. The *Procellaridæ* are numerous at sea, the *Laridæ* and *Sternidæ* on the shore. Divers and Grebes are numerous, and in the extreme south the Penguins make their appearance. Indeed it may be said that all the Ocean Birds, from the ALCIDÆ of the Antarctic Regions to the PHŒTODONLIDÆ of the Tropics, are to be found within the circuit of the Australian Seas.

The STRUTHIONES form an Order of which there are few living species; and of the five known living genera—*Struthio*, *Rhea*, *Dromaius*, *Casuarius*, and *Apteryx*—two are exclusively of the Australian Region. The genus *Dromaius* (the Emu) consists of two species, one of Eastern and one of Western Australia. The other genus, *Casuarius* (the Cassowary), comprising one Australian species, is also found in New Guinea and New Caledonia.

In the Third Class of the Vertebrata, the **Reptilia**, Australia sustains in a marked manner its distinctive character. The CHELONIA are, with the exception of the marine TESTUDINÆ, or Turtles, which are common to all the seas of the Tropical Ocean, of strictly Australian species, and are found in every river in the country; and though not so numerous in species as the Order appears to be in America, yet when well known they will be found to be much more numerous than is at present supposed. Eight species only are recorded in Krefft's "List of Australian Vertebrata," published several years ago, belonging to the genera *Chelodina*, *Chlamys*, *Elseya*, all solely Australian.

The CROCODILIA are limited in Australia to two species, so far as at present known. One of them, *Crocodilus porosus*, is common about the mouths of all the rivers of Australia within the line of the tropic, and indeed sometimes south of it. The other, *Tomistonia Krefftii*, a Gavial, has not been seen except in rivers in the vicinity of Rockingham Bay.

The Third Order of the recent Reptilia (for in this Class there are whole Orders known only in the fossil state) is the OPHIDIA. They are numerous in all parts of Australia, but the tropical districts are much the most productive. In a Census of the Snakes of Australia, by the Hon. W. Macleay, published in the Proceedings of the Linnean Society of New South Wales in 1884, the total number of species of the Order in Australia is put down at 108, and of these 73 are venomous; and deducting the species of *Hydrophidæ*, which, being Pelagic animals, are not limited to Australia, it leaves the number of venomous Land Snakes of Australia at 58, a number far in excess of those of India and America.

These are all Colubrine Snakes, of the Family ELAPIDÆ, with the exception of one genus, *Acanthophis* (represented by one species, known as the "Death Adder"), which shows some affinity to the VIPERIDÆ. The genera of these venomous Snakes (almost exclusively Australian) are *Diemenia*, *Pseudonaja*, *Pseudechis*, *Brachysoma*, *Furina*, *Rhinclaps*, *Brachyurophis*, *Petrodymon*, *Cacophis*, *Vermicella*, *Elapocranium*, *Hoplocephalus*, and *Tropidechis*.

There are 7 species of the TYPHLOPIDÆ known, and 11 species of the BOIDÆ, of the genera *Morelia*, *Liasis*, *Aspidiotes*, and *Nardoa*.

The COLUBRIDÆ are far from numerous. One species of the genus *Coronella* has been described, one of *Herbertophis*, one of *Zamenophis*, and two of *Tropidonotus*. Several species of DENDROPHIS are found in the tropical forests of the north; one species only extends into the temperate regions of New South Wales.

Three species of the DIPSADIDÆ have been noticed. The extreme north-west of the country has supplied single species of the genera *Cerberus*, *Myron*, and *Fordonia*, all of the family HOMALOPSIDÆ. The CROTALIDÆ are entirely unknown in Australia, and the VIPERIDÆ are represented by only one species, the "Death Adder," mentioned previously.

The SAURIA, or Lizards, are also numerous. The total number of species of the Order in the world may amount to 900, and of these about 150 are Australian, or one-sixth of the whole. The families AMPHISBÆNIDÆ, CHAMŒLEONIDÆ, IGUANIDÆ, LACERTIDÆ, AMEINIDÆ, CERCOSAURIDÆ, CHALCIDIDÆ, and ZONURIDÆ are entirely absent from the country.

The GEISSOSAURA are very numerous; indeed the families GYMNOPHTHALMIDÆ and SCINCIDÆ are chiefly Australian; the snake-like genera *Pygopus*, *Delma*, *Aprasia*, and *Lialis* are solely so. The same is the case with the Gymnophthalmic genera, *Cryptoblepharus*, *Moretria*, *Menelia*, *Miculia*, and *Serista*. The Australian genera of the Scincidæ are *Hinulia*, *Mocoa*, *Lygosoma*, *Tetradactylus*, *Hemiergis*, *Chelomeles*,

Omolepida, *Siaphos*, *Rhodona*, *Soridia*, *Trachydosaurus*, *Cyclodus*, *Silubosaurus*, *Egernia*, *Tropidoleipsma*.

The NYCTISAURA are also fairly numerous, and are represented by the genera *Acdura*, *Straphura*, *Diplodactylus*, *Peripia*, *Gehyra*, *Goniodactylus*, and the very peculiar and strictly Australian genus *Phyllurus*.

The tribe of the STROBILOSAURA is confined in Australia to the family AGAMIDÆ, and to the genera *Tiaris*, *Chelosauria*, *Gindalia*, *Physignathus*, *Chlamydosaurus*, *Lophognathus*, *Diporophora*, *Grammatophora* (many species), and the very remarkable genus, *Moloch*.

The Class **Amphibia** is limited in Australia to the one Order, the BATRACHIA SALIENTIA, or Tailless Amphibia. The *Cæcilidæ* and the *Urodela* are unknown. The number of described species is about 50, and nearly half of these belong to the family of *Hylidæ*, or Tree Frogs, and none of the genera of that family are peculiar to the country.

The RANIDÆ, on the other hand, exhibit a decidedly local character; the genera *Myzophyes*, *Lymnodynastes*, *Cryptolis*, *Crinia*, *Hyperolia*, *Cheiroleptis*, *Heleioporous*, *Pseudophryne*, *Notadon*, and *Myobatrachus* being strictly Australian.

The Fifth Class of the Vertebrata, the **Pisces**, are very numerous in Australia. They were catalogued by the Hon. W. Macleay, F.L.S., at 1291 species in 1883, and as over 100 species have since been described by Chas. de Vis, Director of the Queensland Museum, they may now be estimated at 1400, or one-seventh of the total number of species of fish on the globe, which may be roughly taken at 10,000. There is, as might be expected from the limitless nature of the element they inhabit, less speciality among the Fishes than among the Land Animals; but still there is sufficient to give an easily recognisable character to the Australian Fauna. The Fresh-water Fishes, though not numerous, are solely, or almost solely, of genera unknown elsewhere. The Fishes of the Sea Coast are to a much less degree distinct from those of other places, while the Ocean, or Deep-sea Fishes, seem to differ very little from those of the rest of the world.

There are among this Class also, as with the Birds, wide differences in the Fauna in different parts of Australia, arising from climate, temperature, currents, and other causes; thus the Fishes of the Victorian, South Australian, and Tasmanian Coasts are almost entirely different from those of the warm regions of the north, where the Polynesian type predominates; mixed towards the north-west with Indo-Malayan forms; while the coast of New South Wales, with its warm current, forms

the meeting-ground of the Fishes of both zones. The Fishes of the West Coast are but little known.

There are about 200 species of Percoid Fishes in Australia. Of the group PERCINA, there are a few species of *Lates*, which are the best fishes of the East Coast and Victorian rivers of strictly Australian genera—*Microperca* and *Enoplosus*. The SERRANINA or Rock Cod groups are numerous, the genus *Serranus* generally occupying the warmer seas, and *Plectropoma* the temperate; *Mesoprion* is also numerously represented. There are several other genera, but the most distinctive are *Myriodon* and *Glaucosoma*. There are two species of *Priacanthus* in Australian waters. The *Apogonina* are small fishes, and present no forms of a marked local character. The genus *Ambassis* is found in the north, but in other parts its place seems to be occupied by *Pseudo-ambassis*, a genus only found in Australia; *Edelia*, *Acanthoperca*, and *Mannoperca* are also Australian genera belonging to this group. Some species of the genera *Apogon* and *Apogonichthys* are inhabitants of fresh water, and Castelnau's genus *Gulliveria* is entirely a river fish. The group GRYSTINA consists, with a few exceptions, of freshwater fishes, mostly of considerable size and great value. The chief exception to this rule is the genus *Arripis*, of which there are two species; the one best known, *Arripis salar*, the Salmon of the Colonies, is a handsome fish of large size, which frequently appears on the coast of New South Wales and Victoria in large shoals, and is most destructive to other fish; it is of little value for food, and in form and habit resembles more one of the raptorial *Scombridæ* than a true perch. The Freshwater genera of this group are *Oligorus*, the genus of the far-famed "Murray Cod," of which some species are found in rivers on the Eastern Coast, and also in salt water. *Ctenolates*, several species, fine fish inhabiting the Murray system of rivers; *Murrayia*, the same; *Riverina*, the same; *Dules*, northern rivers; and *Therapon*, many species inhabiting all rivers, and some species Marine Fishes.

The group PRISTIPOMINA contains a number of species of the genera *Pristipoma*, *Dagrammo*, *Gerres*, *Scolopsis*, *Dentex*, *Apharens*, &c.; only two genera seem remarkable—*Hyperoglyphe* and *Histiophorus*: the latter contains two species, large fishes, and apparently very rare.

The SQUAMIPINNES are rare in the temperate parts of the Australian seas; but in the tropical regions the genera *Chætodon*, *Heniochus*, *Holacanthus*, and *Chelmo* become abundant. The genera *Scorpis* and *Atypus* placed in this family are almost exclusively Australian forms. The NANDIDÆ are only represented by a very few species of *Plesiops* and *Trachinops*, Australian forms, to which may be added the genus *Ruppellia* of Castelnau. The true NANDIDÆ (fresh-

water fishes), are unknown. The MULLIDÆ number about 12 species of the genera *Upeneus*, *Upeioides*, and *Mulloides;* they are most abundant in the warm seas.

The SPARIDÆ are numerous. The section of these which are vegetable feeders and have incisor teeth is largely represented by the genera *Girella* (Blackfish), *Pachymetopon*, *Tephræops*, and *Haplodactylus;* those with molar teeth embrace some of the most valuable food fishes of the country, including species of *Pagrus* (the Schnapper), *Chrysophrys* (the Black Bream), *Lethrinus*, and *Sphærodon*. The *Cirrhitidæ*, also very valuable as food fishes, are represented by genera entirely, or almost entirely, Australian; these are *Latris* (the Trumpeters), *Chilodactylus* (the Morwhangs), *Nemodactylus*, *Dactylophora*, *Psilocranium*, and *Mendosoma*,—this last a Chilian genus.

The SCORPÆNIDÆ are more remarkable than numerous; *Sebastes* and *Scorpæna* are widely distributed genera, but the others are for the most part confined to Australian waters, and are some of them of peculiar forms. Among these are *Glyptanchen*, *Pteros*, *Centropogon* (some of them river fish), *Holoxenus*, *Pentaroge* (the Forty-skew), *Agriopus*, *Aploactis*, and *Synancidium*.

The TEUTHIDIDÆ number about 10 species, with one or two exceptions all inhabitants of the coral reefs of the north, and of wide range. The BERYCIDÆ are few; there is a fine *Beryx* (the Nanygai), found on the East Coast. Three species of *Trachichthys* (a very extraordinary form, peculiar to Australia and New Zealand) are known. *Monocentris* is said to have been found, and the few species of *Myripristis* and *Holocentrum* included in the list of Australian Fishes are all from the tropical parts of the country.

There are five or six species of the KURTIDÆ, of the genera *Pempheris*, *Neopempheris*, and *Kurtus*. The POLYNEMIDÆ are met with chiefly in the estuaries of the Queensland rivers, and even in fresh water; there are in all six species known to be inhabitants of Australia, and some of these attain a great size.

Six or seven species of SCIÆNIDÆ are also found in Australia. The Sciæna of the Mediterranean is said to be the same as the Australian *Sciæna Antarctica*. *Otolithus*, or Teraglin, is a well-known Fish in Sydney. The other two genera, *Corvina* and *Umbrina*, seem to frequent the estuaries and river mouths of Queensland. The XIPHIIDÆ and TRICHIURIDÆ are represented, but being Fishes of enormous range they present no Australian peculiarity. The ACANTHURIDÆ are numerous, but inhabit chiefly the coral seas of the North and for the most are identical with the species of the Polynesian seas. The CARANGIDÆ are in Australia, as in some other parts of the world, a most

important family. They number about 40 Australian species, chiefly of the genus *Caran*, and are most abundant in the warm latitudes, while the genus *Seriola*, including the "King Fish" and "Samson Fish" of Sydney, and the "Yellow Tail" of Melbourne, fishes of very large size, are only found in the temperate zones. The genus *Neptonemus* is the only one of limited range, and that extends to New Zealand. The NOMEIDÆ, CORYPHÆNIDÆ, and CYTTIDÆ, everywhere families of small extent, are in Australia represented by two species each, *Nomens Gronovii* and *Platyslathens cultratum*, a genus limited to Norfolk Island and New Guinea, of the first of these families; *Coryphæna punctulata*, and *Brama Raii* of the second, and *Cyttus Australis* (John Dory) of the third. The SCOMBRIDÆ are all Ocean Fishes, and of unlimited range; they are therefore all found, as might be expected, in one or another part of the Australian seas. All, or nearly all, the genera are represented, and a few new species have been described, but there seem to be no marked or distinctive local characters. The TRACHINIDÆ include some very remarkable Australian forms. Among the group URANOSCOPINA are the extraordinary genera *Kathetostoma* and *Leptescopus*. Among the TRACHININA are *Percis*, *Sillago*, *Aphrites*, and *Bovichthys*,—almost exclusively Australian or South Pacific forms. *Opisthognathus* is another curious genus abundant in these seas, though not exclusively confined to them. The BATRACHIDÆ are represented by four species of the genus *Batrachus*. Of the PLEDICULATI there are 12 species of *Antennarius*, chiefly from the tropical regions of Queensland, and three species of the curious Tasmanian genus *Brachionichthys*. The COTTINA are richly represented by the genus *Platycephalus* (the Flatheads), which abound in all the Indian seas. Twenty species are found in Australia, some of them being among the most valuable food fishes of the country; the other Australian COTTINA are limited to a few species of *Trigla*, *Lepidotrigla*, and *Dactylopterus*. The GOBIIDÆ are numerous, but do not seem to differ much from those of other parts of the world. The species are chiefly of the genera *Gobius*, *Apocryptes*, *Gobiosoma*, *Gobiodon*, *Periopthalmus*, *Eleotris*, and *Callionymus*; the only entirely Australian genus is *Aristeus*, which Castelnau has placed with this family. It is found in rivers only. The BLENNIDÆ are numerous and some of them of eccentric appearance, the genus *Patæcus* most remarkably so. The genera richest in species are *Petroseirtes*, *Salarias*, and *Cristiceps*. There are several other genera, but with few species. The SPHYRÆNIDÆ are represented by two species of *Sphyræna* and a genus (strictly Australian) possessing one species, *Lanioperca mordax*, generally placed in this family.

The ATHERINIDÆ seem to be abundant about the river mouths in all parts of Australia, but only a small number have been described, and these, with the exception of the genus *Nematocentris*, present no remarkable features.

The MUGILIDÆ number about 25 species; they are to be seen sometimes in enormous shoals, and are inhabitants of the coasts, estuaries, and rivers. The species differ on different parts of the Coast, but they are everywhere fishes of the finest quality, and might be converted into a most valuable article of export. The genera are *Mugil*, *Agonostoma*, and *Myxus*, the last two solely Australian.

The curious Gasterosteiform fishes, the FISTULARIDÆ, are represented by one *Fistularia* and one *Aulostoma*; the CENTRISCIDÆ by two species of *Centriscus* and two of *Amphisile*. The GOBIOSCIDÆ possess two genera in Australia, the Tasmanian genus *Crepidogaster*, of which there are two species, and one species of *Gobiesox*.

The OPHIOCEPHALIDÆ are represented by one species only—*O. striatus*, *Bl.* The TRACHYPTERIDÆ are seldom seen. *Regalæcus gladius* is said to have been caught on the Tasmanian Coast. *Regalæcus Jacksonensis* has been described by Ramsay from Port Jackson from one specimen, and a specimen of *Trachypterus Alivelis Kner* has been lately taken on the East Coast of Tasmania. One species of the NOTACANTHI, *Notacanthus sexspinis*, has been taken in King George's Sound.

The POMACENTRIDÆ are numerous in the warm latitudes of North Australia. *Parma* and *Gliphydodon* are the only genera found in the temperate regions.

The LABRIDÆ must number quite 100 species in Australia. The genera are for the most part identical with those of the Indian Seas. There are 17 genera in all. The most numerous in species of those inhabiting tropical seas are *Chœrops* and *Pseudoscarus*. The most populous genus of the Southern Coasts is *Labrichthys*, which numbers nearly 40 species. A very extraordinary genus—*Siphonognathus*—perhaps the most marvellous looking fish in existence, is placed by Gunther in this family, and in the group ODACINA It is found on the South Australian Coast.

The next Order of Fishes—the ANACANTHINI—are not largely represented in Australia, but an Australian character is distinct throughout. The GADOPSIDÆ constitute a strictly Australian family, having only one genus and one species. It seems to form a link between the Acanthopteryginous fishes and the Gadidæ. It is found in most of the rivers of New South Wales, Victoria, Tasmania, and South Australia.

The LYCODIDÆ are represented by a single species of a single Australian genus, found in Northern Queensland. The GADIDÆ, which occupy such a prominent position in other

regions, both for their numbers and their value to the human race, are here few in number and unimportant, being limited to a few species of *Lotella*, *Physiculus*, and *Pseudophysis*. The OPHIDIDÆ are far from numerous, but are sufficiently interesting. A species of *Dinemolichthys* comes from the extreme North. A *Genypterus* (two feet long) is found in Hobson's Bay. *Typhlonus* and *Aphyonus* are genera found at great depths ("Challenger") on the North-east Coast, and *Fierasper* and *Congrogadus* come from the coral reefs of the North. The MACRURIDÆ of Australia consists of one species of *Macrurus* and three of *Coryphænoides*, all from the South Coast, one at a depth of 2000 fathoms ("Challenger.")

The PLEURONECTIDÆ of Australia number about 40 species. They are probably much more numerous, as the use of the trawl net, the only means of catching them, has never been introduced into the country. The well-known genera and species of this family in the European seas are represented in Australia by different genera for the most part, but there is nothing conspicuously distinctive. The SILURIDÆ are not numerous. Several genera are found in the fresh waters of the northern portion of Australia, and a fine species of *Copidoglanis* is abundant in most of the inland rivers. The genus *Cnidoglanis* is abundant on the East Coast. Species of *Arius* are found among the coral reefs.

The SCOPELIDÆ are deep sea fishes, and probably widely distributed. The genera chiefly represented in Australia are *Saurus* and *Saurida*. The beautiful *Aulopus* (Sergeant Baker) is not uncommon. *Scopelus* and *Alœpidosaurus* are also found occasionally. Of the STOMIATIDÆ two species have been found at depths of over 2000 fathoms, one on the North-west, the others on the South Coast ("Challenger.")

The great family of SALMONIDÆ is entirely unknown in Australia, with the exception of two very curious genera, each of one species, found in the rivers of the colder regions of the south. These are the genera *Prototoctres*, a small fish found in the Victorian and Tasmanian rivers, and *Retropinna*, also found in New Zealand rivers. The GALAXIDÆ constitute a family remarkable in many respects. They are found only in the rivers of the extreme south of South America, of the Falkland Islands, of the South of New Zealand, of Tasmania, of Victoria, and the rivers of New South Wales flowing from the great mountain range of the country. The peculiar distribution of these very peculiar fishes gives support to the belief held by many scientific men that a great Antarctic Continent at one time extended from America to Australia. About 20 species of the one genus *Galaxias* have been described from Australia.

All the genera of the SCOMBRESCODIÆ are found in

Australasia. One genus—*Hemirhampus*—containing several species, all known as "Gar Fish," is highly valued as an edible fish. The large families of CYPRINIDÆ and CYPRINODONTIDÆ are unrepresented in Australia. One species of the GONORHYNCHIDÆ is found on the South Coast. In the northern rivers of Queensland a large fish of a semi-Ganoid character is found; it is the *Burramundi* of the Aborigines, and is of the genus *Osteoglossum*, a genus known to exist also in rivers of tropical America and the East Indies. It is one of the most remarkable of Australian fishes.

The CLUPEIDÆ are rather numerous; about 25 species are recorded in Macleay's catalogue. They are chiefly of the genera *Engraulis* and *Clupea*, and several of them frequent fresh water. One species—*Clupea sagax*—almost identical with the English Pilchard, visits the coasts of Victoria and New South Wales at certain seasons in vast shoals, but no attempt has ever been made to catch and utilise them. A species of the ALEPOCEPHALIDÆ was dredged by the "Challenger" naturalists from a depth of 1400 fathoms in North Australian waters. The SYMBRANCHIDÆ of Australia consists of one species of *Symbranchus* and two of *Chilobranchus*, a genus peculiar to Australia. The MURÆNIDÆ are abundant in the seas and many of the rivers of the country. The genus *Muræna* is most numerous about the coral seas of the north. The two very remarkable, though very distinct forms, *Leptocephalus* and *Pegasus*, generally ranked with the "TELEOSTEI," are found in Australia.

The Order LOPHOBRANCHII is nearly Australian; that is, out of a total for the world of about 100 species there are nearly 50 Australian. Most of the genera known in other parts are represented, while there are several genera known only from Australia.

The Order PLECTOGNATHI is also of a decidedly Australian character. The SCLERODERMI, out of a total of about 100 species, number over 50 Australian, chiefly of the genus *Monacanthus* and *Ostracion*; while the GYMNODONTES, out of a total of 80 species, number quite 30, and several of the genera are solely Australian.

A species of *Orthogariscus* seems to attain an enormous size in the Australian Ocean.

The GANOIDIÆ, if represented at all, are represented by a very anomalous fish, peculiar to the Burnett and Dawson Rivers of Queensland. It is of the family Sirenoideæ, and is the analogue of the *Protopterus* of the rivers of tropical Africa, and of the *Lepidosiren* of the River Amazon of South America. Mr. Krefft first discovered its affinity to the fossil genus *Ceratodus*, of Agassiz, and named the genus *Ceratodus Forsteri*. The Embryology and mode of reproduction of this curious fish

has been investigated lately by Mr. Caldwell, a distinguished science student of Cambridge, and he has found its affinity in these respects to the Newt extremely close.

One species of the CHIMÆRIDÆ, of the genus *Callorhynchus* is found in the cold seas of the south. The PLAGIOSTOMATA occupy a marked place in the Fauna of Australia. The SELACHOIDEI, or Sharks, number about 40 species, in a total of about 126. All the main groups or families are included in the 40 species, and one family, consisting of the genus *Heterodontus*, may be regarded as almost an Australian form. It seems to have been common in the Jurassic period, but the only species known at the present day are two species Australian, one Californian, one Japanese, and one Galipago Islands. It is known in Australia as the "Port Jackson Shark." A remarkable discovery has lately been made of a large specimen of the Arctic Basking Shark (*Selache maxima*) on the South Coast of Victoria, near Portland Bay.

The BATOIDEI are not quite so proportionally numerous in Australia, being only about 25 species in a total of 140, but still a large proportion. All the families are represented, and some of the species are of great size. A specimen of *Ceratoptera* in the Australian Museum, Sydney, is of gigantic dimensions.

Of the Order MARSIPOBRANCHII, the Family PETROMYZONIDÆ is represented by a species of *Mordacia*, a genus found also on the Chilian Coast, a species of *Neomordacia* exclusively Australian, three species of *Geotria*, a genus also found on the Chilian Coast, and one species of a strictly Australian genus *Yarra*, all from fresh or brackish water on the South Coast. One species of the Australian *Amphioxus*, or Lancelot, may be readily obtained on almost all parts of the Coast of Victoria and New South Wales by dredging at some depth on a sandy bottom.

SUB-KINGDOM MOLLUSCA.

The Mollusca of the entire world must number nearly, if not quite 30,000 fossil and recent species. The number of Australian species is about 5000. This is a large percentage (1-6th) for Australia; but the climate, the large sea-frontage, the nature of the coast-line, all combine to make Australia a favourable resort for this sub-kingdom.

There is less, however, in the Mollusca than in any other sub-kingdom of the Animalia of a peculiarly Australian character to be observed,—in fact, except in one or two not very important peculiarities, there is nothing to separate the region from the rest of the world. Of the Class BRANCHIOPODA there are only about 80 existing species. Of these eight are Australian, one of the CRANIIDÆ, the rest TEREBRATULIDÆ; six of them found in Port Jackson. The Class LAMELLI-

BRANCHIATA, which includes nearly all the Bivalves, is said to number in all, Recent and Fossil, 14,000 species, and as it is calculated that there are quite 2000 species of existing species of this Class, it is evident that they must be proportionally exceedingly numerous in Australia. Almost all the Families are represented, those most conspicuously so being the PECTINIDÆ, AVICULIDÆ, MYTILIDÆ, ARCIDÆ (including the Australian genus *Trigonia)*, UNIONIDÆ, TELLINIDÆ, SOLENIDÆ, and MACTRIDÆ. Of the Class PTEROPODA nearly every Family is represented, but there are not more than 15 Australian species known in all. The Class GASTROPODA, everywhere numerous, quite keeps up its character in that respect in Australia. The Order SCAPHOPODA is represented by 15 species of the DENTALIDÆ. The Order OPISTHOBRANCHIA is well represented. Of the Section ABRANCHIA there are six species. Of the NUDIBRANCHIA 125 species, of all the families. Of the INFEROBRANCHIA three species of *Plyllidia* ; and of the TECTOBRANCHIA about 50 species, belonging to all the families. Of the next Order of the Gastropods, the PSOROBRANCHIA, there are little short of 1500 species in Australia against a total of 12,000. All the Families are to be found in Australia, but some in more than average abundance. The VOLUTIDÆ alone number 200 species, and Australia is considered the metropolis of the genus VOLUTA ; the CYPRINIDÆ, CONIDÆ, TEREBRIDÆ, and MURICIDÆ are also very numerous. A species of the LITTORINIDÆ of the genus *Raulinia* is found alive in New South Wales, while another species of the same genus is found fossil in the Paris Basin. The last Order of the Gastropods, the PULMENIFERA, are sufficiently numerous, but only two of the five families are included in the Australian Fauna,—the AURICULIDÆ, of which there are about 100 species, and the HELICIDÆ, numbering in Australia nearly 400 species. Australia is regarded as the true home of the genus *Helix*. Of the small class of HETEROPODA, few in number everywhere, there are in all eight Australian species, belonging to the genera *Janthina* and *Reclusia*.

The CEPHALOPODA are abundant on the Australian Coasts. There are two species of *Nautilus*, one of *Spirula*, four of *Sepia*, two of *Sepiola*, ten of the *Loliginidæ*, three of *Octopus*, and three of the *Argonautidæ*. The Class TUNICATA are apparently very numerous, the ASCIDIOIDIA particularly, but they have never been much studied, and really very little is known about them. Of the BIPHORA there are four species of the *Salpidæ*.

The third Sub-kingdom of the Animalia, the ARTHROPODA is, as in all parts of the world, exceedingly numerous

in species. Pascoe calculates their numbers at 200,000. Of the four classes into which the Sub-kingdom is divided, the Insecta are very much the most numerous, and the position they occupy in the Australian Fauna will be best ascertained by taking the different Orders in succession.

Though all or nearly all of the most important Families of the various Orders are well represented, yet the genera are as a rule so distinct from those of other parts of the world, that anyone having the slightest acquaintance with Entomology would at a mere glance recognise an Australian collection.

The Order COLEOPTERA is the most numerous and best worked out in Australia of all the Orders of Insecta. The numbers of this Order for the whole world are estimated at 80,000, and of these quite 10,000 may be quoted for Australia, and it is probable that in a few years' time thousands may be added to that estimate.

The CICINDELIDÆ are not very numerous, and the most noticeable feature about them is the appearance of the African genus *Megacephala* and the South American genus *Tetracha*. The Family of the CARABIDE is a very large one, and presents marked peculiarities. The true CARABIDÆ, containing the genera *Carabus*, *Tefflus*, *Cychrus*, *Leistus*, *Nebria*, *Elophrus*, *Omophron*, &c., are entirely unrepresented, except by two species of *Calosoma* and the Australian genus *Pamborus*.

The TRUNCATIPENNES are also very numerous, but they differ very much from the Truncatipennes of other countries. A numerous group, the *Helluonidæ*, are almost exclusively Australian, as are also the genera *Xanthophlæa*, *Homothes*, *Sarathrocrepis*, *Philophlæns*, *Agonochila*, *Cataseopus*, *Scopodes*, *Silphomorpha*, and *Adelotopus*.

The MORIO group is fairly numerous, and includes the largest known Carabideous insect *(Campylœnemis Schrœtten.)* The BIPARTITI are numerously represented in Australia by a section of the Sub-Family of SCARITIDÆ, originally all contained in the Fabrician genus *Carenum*. It is now divided into ten genera, and comprises over 200 species. The FERONIDÆ and HARPALIDÆ are also numerous, but are, with a few exceptions, very like insects of the same families elsewhere. The BEMBIDIIDÆ seem to be few, but is not unlikely that their small size may have caused them to escape the notice of collectors. The Families DYTISCIDÆ and GYRINIDÆ are not numerously represented, and exhibit no peculiar characteristics.

The PALPICORNIA are few in species, but all the families are represented.

The STAPHYLINIDÆ are remarkably few in number; the PSELAPHIDÆ seem to be abundant. The Clavicorn Beetles are not very numerous, but most of the families have their

representatives—the PAUSSIDÆ, in the genus *Arthropterus*, 40 species; the SCYDMÆNIDÆ in the genera *Scydmænus*, *Heterognathus*, &c., in all 16 species; the SILPHIDÆ, in one species of *Ptomaphila* and two of *Choleva;* and the SCAPHIDIDÆ, by six species.

The HISTERIDÆ number 25 species; the PHALACRIDÆ one species; the NITIDULIDÆ 30 species, chiefly of the genera *Brachypeplus* and *Carpophilus*. The TROGOSITIDÆ are represented by the curious genus *Leperina*. The PASSALINI are well represented; the COLYDIIDÆ by *Meryx*, *Deretraphus*, *Bothrideres*, and other genera, in all about 40 species. The CUCUJIDÆ and all the other families are sparingly represented. The LUCANIDÆ are not numerous, the prevailing forms being of the genera *Rhyssonotus*, *Lamprima*, *Dorcus*, *Lissotes*, *Figulus*, &c.

The LAMELLICORNIA are not numerous, but they possess in a marked degree a distinct Australian character. The country is singularly deficient in the large COPRIDÆ, though there are a good number of such genera as *Onthophagus* and the entirely Australian genera *Cephalodesmius* and *Tesserodon*. The Sub-Family CETONIIDÆ are few in species; they consist for the most part of beautiful insects of the almost entirely Australian genus *Schizorhina*, though in the Northern districts the Indo-Malayan genus *Lomaptera* makes its appearance. The RUTELIDÆ of other parts of the world are here represented by the very showy genera *Anoplognathus*, *Repsimus*, and *Calloodes*. The MELOLONTHIDÆ are very numerous, the most characteristic Australian genera being *Diphucephala*, *Phyllotocus*, *Mæchidius*, *Liparetrus*, &c. The DYNASTIDÆ are not numerous, but there are a few large and remarkable species of the family found in the country. The genera *Bolhoceras*, *Tro*, and the remarkable Australian genus *Cryptodus*, abound in species.

The STERNOXI are as abundant in Australia as inany part of the world. The BUPRESTIDÆ are enormously numerous, the most characteristic Australian genus *Stigmodera* possessing over 220 described species. The THROSCIDÆ and EUCNEMIDÆ are few in number. The ELATERIDÆ are very numerous, the chief genera being *Alaus*, *Tetralobus*, and *Monocrepidius*.

Of the MALOCODERMES Australia possesses no CEBRIONIDÆ; several RHIPICERIDÆ of the genera *Rhipicera*, and *Callirhipis;* two species of the DASCILLIDÆ; and of the TELEPHORIDÆ a very limited number, chiefly of the genera *Metriorrhynchus*, *Telephorus*, *Laius*, and *Carphurus*. The CLERIDÆ number over 100 species, many of them of genera almost entirely Australian. The other families of the Malocodermes are very sparingly represented.

The TETRAMERA are abundant, but show a remark-

able absence of some of the most populous groups of other parts of the world; thus the TENEBRIONIDÆ in Australia, though numerous enough, show few of the European, American, and African Sub-Families, and are chiefly represented by the genera *Amarygnus*, *Adelium*, *Cephaleus*, *Heleus*, and genera allied to them. The genus *Zopherosis* is one of the most remarkable of the Australian forms. All the Trachelidous families of the Heteromera are present, but some, as the CANTHARIDÆ and MELANDRYIDÆ, very sparingly.

The TETRAMERA are very numerous. The RHYNCOPHARA alone must number in Australia quite 2000 species; the groups formed of the genera *Leptops*, *Catasarcus*, *Amycterus*, *Psalidura*, *Gonipterus*, *Rhinaria*, and the host of genera formed out of them, are among the many characteristic Australian forms in this division of the Tetramera.

The XYLOPHAGA are few in number.

The LONGICORNIA, on the other hand, abound. About 550 species have been described, chiefly by Mr. Pascoe; the genus *Phoracantha* among the CERAMBYCIDÆ, and *Symphelletes* and *Penthea* among the LAMIIDÆ, form the largest Australian groups. The PHYTOPHOGA are extremely numerous as a whole, particularly the families CRYPTOCEPHALIDÆ and CHRYSOMELIDÆ; in the latter family the genus *Paropsis*, an Australian form, numbers over 200 species. The EUPODIDÆ are few, but include the noticeable genera *Carpophagus* and *Megamerus*. The CASSIDIDÆ and HISPIDÆ are very few in number. The HATTICIDÆ and GALERUCIDÆ are fairly numerous. The EROTYLIDÆ are limited to about 10 species, mostly of the genus *Episcapha*. The Australian Trimerous Beetles consist of a few of the APHIDIPHAGA, of the genus *Epilachna*, and a very few of the *Fungicola*.

The next Order, the HYMENOPTERA, have not been so much attended to as the Coleoptera, so that no estimate can be formed of their numbers, but they are undoubtedly very numerous. The CYNIPIDÆ, CHALCIDIDÆ, PROTOTRUPIDÆ, and ICHNEUMONIDÆ are not only numerous, but they present some very remarkable forms. The FORMICIDÆ are still more abundant. The FOSSORES are also very numerous, the genus *Thynnus* constituting the most strictly Australian group. The APIDÆ are not very numerous. The TENTHRIDINIDÆ are represented only by the genera *Perga* and *Nematus*.

The Order ORTHOPTERA is, if not so numerous as the other Orders, quite as remarkable. BLATTIDÆ are numerous; the MANTIDÆ and PHASMATIDÆ of Australia are remarkable for their size and beauty. The GRYLLIDÆ contain species of very singular forms, and the ACRIDIIDÆ include some very destructive species of *Ædipoda* or Locusts. The EUPLEXOPTERA (Earwigs) are also numerous.

The NEUROPTERA and TRICHOPTERA have been little studied in Australia, and, with the exception of the large-sized species, are little known, but they are certainly rather numerous on the whole, the EPHEMERIDÆ being the least numerous, and the TERMITIDÆ the most so.

The LEPIDOPTERA form everywhere a very populous Order, and nowhere more so than in Australia. It is difficult to guess even at their probable numbers; but Mr. Meyrick, who has been engaged upon the Microlepidoptera for some years, estimates their number at many thousand species. The Diurnal Butterflies of Australia consist, according to Masters's Catalogue, of 200 species, but the greatest number of these are from Northern Queensland, and are evidently originally migrants from the Indo-Malayan region; among these may be ranked the magnificent genus *Ornithoptera*, of which four species or varieties are found in Australia.

The readiness with which some Butterflies change their residence is exemplified by the passage of an American Butterfly (*Danais Erippus*, Cram.), of late years from the west coast of America to Australia, and its now complete voluntary acclimatization in that country. *Euryeus* is the only entirely Australian genus among the PAPILIONIDÆ; but among the Day-flying Moths there are several, such as *Synemon*, *Euschemon*, *Damias*, and *Agarista*. The SPHINGIDÆ, BOMBYCIDÆ, NOCTUIDIÆ, and GEOMETRIDÆ are numerous, handsome, and many of them of large size. The MICROLEPIDOPTERA seem to be in incalculable numbers. Mr. Meyrick calculates the ŒCEPHORIDÆ alone at 2000 species.

The DIPTERA is also an Order extremely rich in numbers, but the smaller and more numerous of the Australian groups have never been studied. Schiner, in "The Diptera of the Novara," estimates the Diptera of the world at 19,449 species, and of these he gives only 1056 to Australia. Three times that number would probably be under the mark. The CECYDOMYIDÆ, for instance, are very numerous in Australia, and yet only three species have been described.

The JABANIDÆ, ASILIDÆ, ACROCERIDÆ, BOMBYLIIDÆ, and MUSCIDÆ are very numerous, and present some local peculiarities. SYRPHIDÆ, on the contrary, are rare, and the ŒSTRIDÆ are unknown.

The HEMIPTERA and HOMOPTERA are numerous, and most of the families are represented. Of the first of these Orders the REDUVIIDÆ are the most largely distributed. The Hemiptera are not only numerous but are most peculiar and interesting; most of the families however, more particularly the COCCIDÆ and PSYLLIDÆ, are almost unknown.

The Class ARACHNIDÆ are numerous proportionally to the rest of the world. The PHALANGIIDÆ are very few, but

the CHELIFERA and Scorpions abound; the Spiders are extremely numerous, and of many families, and the ACARIDÆ, IXODIDÆ, TROMBIDÆ, GAMASIDÆ, &c. abound throughout the country. The Class MYRIOPODA comprises in Australia numbers of JULIDÆ, and an amazing number of species of SCOLOPENDIDÆ.

The CRUSTACEA, the last Class of the Anthropoda, are, as far as the Malacostracea are concerned, well known. Mr. Haswell, M.A.,B.Sc., having lately completed an excellent catalogue of them. The number of species by that catalogue is 538, which, with others described since, will probably bring the total to 600. Mr. Haswell has also lately published a paper on the PYCNOGONIDÆ of Australia, about eight in number.

The other Sub-classes of the Crustacea, the ENTOMOSTRACA, EPIZOA, and CIRREPEPIA, are undoubtedly numerous, but they have been very little studied.

The VERMES, the fourth Sub-kingdom of Animals, are in all their heterogeneous Classes well represented in Australia, but with the exception of some groups of the ANNELIDÆ and POLYZOA, are very little known. Mr. Haswell has lately described a number of the Australian forms of the Order CHÆTOPODA. The OLIGOCHÆTA are few in number, but comprise one at least giant species. HIRUDINIDÆ are numerous. The SCOLECIDA are probably as numerous in Australia as in any part of the world, but no one has paid much attention to them. All the Mammals, Birds, and Fishes seem to be well stocked with them, all probably distinct species; but the genera seem to be the same as in other places. All, or nearly all, the Entozoa of man and the domestic animals are found in Australia, but they probably came with the European.

The ROTIFERA are believed to abound. *Sagitta* is found.

The Fifth Sub-kingdom of Animalia, the ECHINODERMATA, are exclusively Marine Animals, and in a country with an extensive seaboard and a favourable climate like Australia, might be expected to hold a predominating position, and they do so.

The vast mass of coral reefs and islands known as the Barrier Reef, extending from the latitude of about 25° to 8° south, or until it reaches New Guinea, skirting the East Coast of Australia for over 1000 miles at a distance varying from three to ten miles from the coast, enclosing a smooth and warm sea, and receiving through numerous passages the clear waters of the ocean without, offers for all Marine Animals a haven of the most tempting character, and

the Echinodermata seem to have availed themselves of it to an unprecedented extent. But the prevalence of Echinoderm life is not confined to such favoured regions,—throughout all the Australian seas it appears in various forms. The four Classes CRINOIDEA, ECHINOIDEA, STELLARIA, and HOLUTHUROIDEA are all very numerously represented in proportion to their numbers throughout the rest of the world. Some of the species of one of these Classes, the HOLUTHURIDÆ, furnish a valuable article of commerce to China known as "trepang" or "bêche-de-mer."

The Sub-kingdom CŒLENTERATA is evidently largely represented in Australia, but as yet but little has been done in the examination of it. Dr. Von Lendenfeld has lately been investigating the Class of SPONGIA, which he has found so numerous and peculiar on the Australian Coasts as to necessitate a change in nomenclature and classification.

The Order CALCAREA or CALCISPONGIA he has found to number 53 species, and three of the families—HOMODERMIDÆ, LEUCOPSIDÆ, and TRICHONIDÆ—are peculiar to Australia. The MYSOSPONGIÆ are few in number; but there is an interesting genus, BAJATUS, peculiar to Australia.

The CERAOSPONGIÆ are found by Dr. Lendenfeld to be richer in species in Australia than in the rest of the world united.

The MONATICERÆ also predominate in Australian waters.

The HEXACTINELLIDÆ and TETRACTINELLIDÆ are few in species.

The MONACTIPHALEÆ are numerous enough, but not proportionally so as compared with other parts of the world.

The Class ANTHOZOA is also well represented. Of the Order ALCYONARIA, five PENNATULIDÆ are found, and GORGONIDÆ are abundant.

Of the ZOANTHARIA, the ACTINIIDÆ are chiefly found in the cool waters of the temperate regions, the SCLERODERMATA in the tropical parts, the MEDREPORIDÆ forming the chief part of the extensive coral reefs which surround the North Coast.

The Class HYDROZOA are, as a whole, also abundant. The HYDROMEDUSÆ of Australia number 243 species, the Polyp-colonies, with chitinous skeletons, predominate; the Australian SERTULARIDÆ and PLUMULARIDÆ exceed in number those of the rest of the world added together; the ephemerous EUCAPILLIDÆ are peculiar to Australia. Large TRACHOMEDUSÆ are comparatively rare.

The *Hydra* is found in Australian rivers. The SYPONOPHARA are rare, and show no peculiar forms.

Of the Order SCYPHOMEDUSÆ only 26 Australian species are known, but additional species may be expected from better acquaintance with the productions of the seas on the north coast. The very curious genus *Pseudorhiza* is peculiar to Australia. The RHIZOSTOMÆ constitute the chief Australian group. The CTENOPHORA are present in Australia, but in very small numbers, as far as at present known. The Orders EURYSTOMATA, SACCATÆ, and TÆNIATÆ are each represented by one or two species. A very beautiful Beroid has been described from Port Jackson.

The last Sub-kingdom of the Animalia, the PROTOZOA, may be passed over: they are much the same everywhere. The Australian representatives of the various classes comprising the Sub-kingdom have never been investigated.

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

ECLIPSE OF MARCH 30-31, 1885.

By A. B. Biggs, Launceston

(*Read April* 14, 1885.)

Before giving my notes of the recent partial eclipse of the moon, I wish to refer to the total lunar eclipse of last October (not visible here). Reports from observers of that event nearly all agree in laying stress upon one particular characteristic, namely, the absence on that occasion of the usual faint coppery illumination (caused by the refraction of the sun's rays into the earth's shadow by our atmosphere), by which the moon continues conspicuously visible throughout the phase of totality. The darkened moon was also unusually dark, and was by some described as invisible.

In consideration of the above circumstances, the recent eclipse, although not total, was so nearly so that it was looked forward to with particular interest, and I determined to make the best of the opportunity, with special reference to the moon's appearance in shadow. Fortunately, the circumstances were most favourable, the moon being free from clouds throughout. I commenced observing shortly after midnight. The penumbra was then gradually creeping over the south-east limb, though more apparent to the naked eye than in the telescope. The ruggedness of this portion of the moon's surface was at this time distinctly visible even in the profile of the full orb (in the telescope, of course). At 0h. 48min, this ruggedness vanished on the approach of the shadow, and seven minutes later this portion of the outline itself was lost. As the shadow advanced, that part within the moon's outline, adjacent to the point of intersection, on each side appeared considerably lighter than the general shadow, gradually deepening into the shadow resting on the body of the moon. About 1h. 10min. about fifteen degrees of the moon's outline on each side was visible *within the shadow.* This increased, during the middle of the eclipse, to what I judged to be about twenty-five degrees, this portion of the edge appearing as a sharp faint rim of light, gradually fading away into the shadow. With the above exception, all within the shadow was *utterly obliterated*—lost in the dead slaty tint of the sky. I could not discover a single crater or feature after it was fairly within the shadow, although on other occasions, even while totally eclipsed, I have been able to distinguish clearly all the principal features of the moon. *There was not the slightest trace of the coppery tint discernible throughout this eclipse.*

The shadow advanced until at 2h. 20min. it bisected the crater Plato, remaining stationary until 2h. 23½min. At 2h. 25min. Plato had emerged from shadow, and the middle of the eclipse had passed.

FRESH CONTRIBUTION TO OUR KNOWLEDGE OF THE CHARACTER AND THE RELATIONSHIP OF THE UPPER PALÆOZOIC AND MESOZOIC FORMATIONS OF TASMANIA WITH THE ASSOCIATED DIABASIC ROCKS.

By Robt. M. Johnston, F.L.S.

(Read April 14, 1885.*)*

Recently I have devoted a considerable portion of my time to the renewed study of the relation of the prevailing diabasic rocks of the Southern portion of Tasmania, for which I have also recently had further opportunities afforded me by Webster, who most kindly took me in his yacht Ella to many places of interest in the numerous bays, channels, and arms of the sea towards the Southern part of the Derwent and Huon.

The relations of the lower marine beds to the diabasic greenstone between Passage Point and Long Bay in the accompanying diagrams unmistakeably show that the greater mass of the greenstone, as also shown by the recent bore test at the Cascades, is older than the overlying mudstones which quietly repose upon it. In one section, however, opposite Half-moon Bay, both the older greenstone and the mudstones are penetrated by an intrusive sheet of greenstone of later date. After abruptly ascending through the older greenstone, the later eruptive rock suddenly bends round, and forms a horizontal sheet of considerable extent between, and exactly parallel to the horizontal bedding of the mudstone and limestone series. This is the best example with which I am acquainted of the relation of the older and newer intrusive rocks with the marine sedimentary formation of upper palæozoic age.

I have also examined carefully the line of country between Hobart, Richmond, Constitution Hill, and Spring Hill. In many sections between the two latter places, the upper coal measures repose quietly upon the underlying diabase. The best example of this nature occurs in a cutting of the main road near Lovely Banks, where the unaltered shales and sandstones are seen to repose upon the diabase. The only exception noticed by me in this district occurs at the head of Spring Hill, where the later intrusive greenstone, apparently identical in character with the older, bursts through, dislocates, and overspreads certains beds of sandstone, which I believe to belong to the lower part of the coal measures.

At a section immediately beyond Mr. Bisdee's residence, at the foot of Spring Hill, Mr. T. R. Atkinson and myself

discovered a very interesting series of finely laminated carbonaceous shales, which proved to be rich in plant remains. Various species of ferns of a new and interesting character were obtained belonging to the genera Pecopteris, Thinnfeldia, Odontopteris, Tæniopteris. One splendid specimen, with ovate lanceolate pinnules, which have peculiar laciniate margins, is peculiarly interesting, and may prove to belong to the genus Otopteris.

The distribution shows nothing but the remains of Phyllotheca and Zeugophyllites in certain beds and localities, while in contiguous or closely related beds hardly any other forms than those of Pecopteris, Thinnfeldia, and Tæniopteris, therefore great caution must be exercised for the present in separating beds of this system upon the evidence of organic remains only.

The restriction of particular forms to particular beds may only indicate a slight local difference in vegetation rather than difference in age or even horizon. However, on a future occasion, I will deal more fully with this important subject, for which I am now provided with many rich and interesting materials.

In conclusion, I draw attention to figures of some of the new plant forms from Spring Hill, Porter Hill, and the lower coal measures of the Mersey. The large imperfect frond from the Porter Hill beds, cythere shales, appears to belong either to the genus Cyclopteris or Gangamopteris. The spathulate frond found associated with Glossopteris Browniana from the lower coal measures of the Mersey is, I believe, identical with Noeggerathiopsis media of New South Wales.

The large equisetaceous impression from the same place, at the Mersey, is closely allied, if not identical, with a form of Schizoneura, figured by Feistmantel from the Lower Gondwana series, India.

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*JUNGERMANNIA RETICULATA.

By R. A. Bastow.

(*Read April* 14, 1885.)

The specimen now submitted for your observation under the microscope was gathered from the Springs on the side of Mount Wellington, on the 10th March last, close to a clear

*This genus is named in honour of Louis Jungermann, a German botanist.

but somewhat rapid stream. After a protracted examination of the specimen, in its dry state, when moistened, as an opaque object, and as a transparent one mounted in glycerine medium, it appears to be different to any species of Jungermannia yet identified in Tasmania, and unlike any described in Flora Tasmania. It does, however, closely resemble *Jungermannia reticulata* as described in the Hepaticæ of Campbell's Islands, in No. 1, Vol. 1, of Flora Antarctica; the specimen is, therefore, rightly; or wrongly so named. Both a siccate and a mounted specimen of the plant have been submitted to Baron von Mueller, in order to obtain his opinion of the correctness of its classification. He referred me, in a long, kind, and encouraging reply, to the treatises by specialists in this Library, and which, in the meantime, I had carefully consulted, with the result just recorded.

This Jungermannia grows as a low tuft, from 2in. to 3in. wide, and close to the ground. The stems are much entangled, and in general aspect are nearly black. As closely as I can make out, the direction of the leaves succubous, and there are remarkable auricular growths at their bases, in form reminding one of the clubs in which gymnasts take delight. These curious auricles appear also to proceed from the stem, as well as from the bases of the leaves, and probably take the place of the stipule lobes, as has been suggested by Sir J. Hooker with regard to similar appendages on plants of this and other genera. The appearance of the plant is beautiful under the microscope, and to those who have not made Hepaticæ a special study, it is extraordinary, especially as an opaque moist object, the club-shaped auricles then appear to advantage. The areolation of the leaves is very lax and pellucid, the cell-walls being clearly visible with a low power; the stem leaves appear to be entire or nearly so, and the upper ones are ciliated; the cilia are also very distinct with a low power. The colour of the leaves is from reddish-brown at the bases to yellowish green at the apices.

It may be assumed that beetles, ants, and such-like small creatures behold these minute forms as large growths, in like manner as we behold the lovely Acacia or the sombre Eucalyptus. To such small creatures the J. reticulata must offer a charming retreat, screening them, as it does, from the stronger light by its many-tinted diaphanous network of cell-structure, and its ruby evascular stems. They must, indeed, enjoy themselves, and live lives of pleasure as they luxuriate

"Beneath Hepatic's golden-pencilled shield,
Whose fronds of varied hue a close protection yield."

NOTE REGARDING THE SILURIAN FOSSILS OF THE GORDON LIMESTONES, WITH GENERIC DESCRIPTIONS, AND A SPECIFIC LIST OF THE ORGANISMS ALREADY NAMED AND CLASSIFIED, BY VARIOUS AUTHORS.

By Robt. M. Johnston, F.L.S.

[*Read May* 12, 1885.]

Over thirty years ago the late Dr. Milligan obtained a very interesting series of Silurian Fossils from the Gordon River, in the vicinity of the Macquarie Harbour, which was subsequently lodged in the Society's Museum. This collection was supplemented by a suite of specimens obtained from the same locality by Mr. C. Gould in the year 1862. Prior to the year 1866, Mr. Gould made a selection of the most typical specimens, which he submitted to the judgment of Prof. M'Coy, who, according to Mr. Gould's account, "immediately identified several of the species and most of the generic forms." It is most unfortunate that in the account referred to, Mr. Gould, from want cf access to his notes, was unable to give a complete list of the species so determined, and I have failed to find any trace of such list elsewhere in any of our local records. Mr. Gould, however, stated generally that the fossils belonged principally to the family *Orthoceratidæ*, together with corals *Murchisoniæ*, and species of *Raphistoma*, and that from such evidence the position of the Gordon limestones was referred to, "the very base of the lower Silurian of Europe, anterior to the described fossiliferous beds of Victoria, as well as to the Calymene, containing beds of the Eldon Valley," in Tasmania. In the year 1862, however, Mr. Gould gave a more definite enumeration of the more characteristic fossils then collected by him, as follows:—*Orthoceratites*, 2 sp.; *Lituites*, 1 sp.; *Halysites*, 1 sp.; *Favosites*, 2 sp.; *Raphistoma*, 1 sp.; *Orthis*, 1 sp.; *Rhynconella*, 1 sp.; *Euomphalus*, 2 sp.; *Murchisonia*, 3 sp.; in all 14 species so enumerated.

It is interesting to note, from his remarks at the time, that though the fossils are very abundant, and especially observable in sections of the limestone rock exposed to the action of running water, the different beds or zones in the formation are not equally fossiliferous, and that certain species are more or less limited in their distribution; corals abounding in certain beds, and univalve shells and large chambered orthocerata in others.

From that most valuable catalogue of Australian Fossils, by Rob. Etheridge, jun., I find a further and more extended series of specimens from *Tasmania West* (no doubt from the Gordon), was submitted to Prof. Salter prior to the

year 1868. I have not yet ascertained by whom or from whence these fossils were transmitted to Mr. Salter, but it is of importance to note that 28 species were named and classified by him, and afterwards included in Bigsby's Thesaurus Sil., 1868. The following is a detailed list of the species, as enumerated in this work, and in Mr. Etheridge's catalogue :—

BRACHIOPODA.

Retzia	mima	*Salter* (M.S.)

MOLLUSCA PROPER.

Cyrtodonta	auriculata	*Salter* (M.S.)
,,	compressa	,,
,,	distorta	,,
,,	gibbosula	,,
,,	inflata	,,
,,	obliquata	,,
,,	pinguis	,,
,,	reversa	,,
Tellinomya	amygdala	,,
,,	antipoda	,,
Bellerophon	pugnus	,,
Eunema (?)	æmula	,,
Helicotoma	Milligani	,,
,,	pusilla	,,
Holopaea	mumia	,,
Hormotoma	nerinæa	,,
,,	usitata	,,
Murchisonia	Franklinii	,,
,,	mimetica	,,
Raphistoma	æterna	,,
Scalites	Australis	,,
Trochonema	Bigsbyana	,,
Lituites	Gouldii	,,
Orthoceras	antilope	,,
,,	Murchisoni	,,
,,	Theca	,,
,,	Youngii	,,

Here, again, it is to be feared, from (M.S.) references against each name, that the specific descriptions are not recorded, and, consequently, from this want we are unable to determine to what extent the species still preserved in the Society's Museum are included in the list so named and classified.

To add to our difficulty, there is no copy of Bigsby's useful work in the Society's Library, a want which should, if possible, be supplied.

It is clear, however, that the Society's collection of fossil Mollusca only contains a portion of the species classified by Mr. Salter, and it is most probable that the latter includes

nearly all the species still remaining in the Society's collection. I also notice in the latter the following fossils, which do not seem to be included in Salter's list, namely:—Phragmoceras, 1 sp.; Pleurotomaria, 2 sp.; Euomphalus, 1 or 2 sp.; Orthis, 1 or 2 sp.; Rhynconella, 1 sp.; Corals, several species.

It is also worthy of record in this place that I have obtained fragments of a limestone rock similar in character to that of the Gordon and Point Hibbs from the New River, immediately to the south of the Craycroft, among which is the well preserved remains of a coral allied to the genus *Strombodes.*

Before any more specimens are sent away from the Society's collection for description or identification, I submit that it is most desirable to obtain detail descriptions of the larger collections classified already in the hands of European authorities or in European collections. With this end in view, and to aid me in dealing more satisfactorily with this subject in the work now under preparation by me for the Government of Tasmania, I had some time ago requested Mr. Robert Etheridge, jun., to furnish me, if possible, with full descriptions and figures of the species already referred to as contained in Bigsby's Thesaurus Sil. When Mr. Etheridge supplies this most necessary information, we will be all the better prepared to select for further determination such fossils still in the Society's collection as may have not been already described. To send away another typical collection at present would deprive local workers of the only source of reference available to them, and at the same time, as regards the greater number of species, only duplicate specimens already at the command of European authorities.

In the meantime, to facilitate reference to the species contained in the Society's collection, and to aid others who may not be in possession of works of reference, I have in the following part of my paper, with one or two exceptions, given a full description of all the genera which have been referred to in this paper as contained in the Silurian limestones of the Gordon River, in Tasmania. Prof. McCoy may, if applied to, be able to throw some light as regards the species identified by him in the collection submitted to his judgment by Mr. Gould about the year 1866.

Description of Certain Genera found Fossil in the Silurian Limestone of the Western Part of Tasmania.

Class Brachiopoda, (*Spiriferid.æ*)

Retzia, *King*, 1850.

Bigsby's Thes. Sil. 1868; Eth. Cat. Aust. Fossils, P.; Tryon, iii., p. 324.

Shell punctuate, Terebratula shaped, beak truncated by a

round foramen, rendered complete by a distinct deltidium; hinge area small, triangular sharply defined; interior with diverging shelly spires. (Silur-Trias.)

Retzia mima, Salter, M.S. Tasmania West.

Class PELECYPODA (Lamellibranchiata or Conchifera.)

Cyrtodonta *Billings* (*Cypricardites*, Conrad.)

Bigsby's Thesaurus. Sil 1868. Eth. Cat. p. 23. Austr. Fossils.

Shell ventricose, suborbicular or broad ovate in outline, with an external flattened ligamental area; cardinal teeth four to five; short oblique; lateral teeth two or more oblique; muscular impressions two (anterior one single ?); pallial line simple. (Tryon.)

C. auriculata. Salter (M.S.) Tasmania, West.
C. compressa. ,, ,,
C. distorta. ,, ,,
C. gibbulosa. ,, ,,
C. inflata. ,, ,,
C. obliquata. ,, ,,
C. penguis. ,, ,,
C. reversa. ,, ,,

Eunema. *Salter.*

Bigby's Thes. Sil. 1868; Eth. Cat. Austr. Fossils, p. 24.

E. æmula. *Salter*, M.S. Tasmania West.

Straparollus, *Montfort*, 1816.

Euomphalus Sowb.,; *Helicotoma*, Salter.
Bigsby's Thes. Sil., p. 868; Eth. Cat. Austr. Fossils, p. 24. Tryon ii., p. 218.

Shell depressed; Whorls, angular or carinated; aperture, sub-quadrangular; umbilicus wide, conical; operculum shelly, multi-spiral. (Tryon.) Lower Silurian to Trias. United States, Europe, Australia.

S. æmula. *Salter* (M.S.) Tasmania, West.
S. (Helicotoma). Milligani ,, ,,
S. ,, pusilla ,, ,,

Raphistoma. *Hall*, 1847.

Bigsby's Thes. Sil., 1868. Eth. Cat. Austr. Fossils, p. 25. Tryon II., p. 219.

Shell, lenticular, or orbicular; whorls, flattened, with a carination above; umbilicus, moderate; outer lip, with slight sinus at the keel. (Tryon.)

R. æterna. *Salter* (M.S.) Tasmania, West.
R. (Holopaea)

Scalites. (Conrad M.S.) Emmons, 1842.
Bigsby's Thes. Sil.. 1868; Eth. Cat. Austr. Fossils, p. 25. Tryon ii., p. 223.

Shell, turriculated; whorls, flattened above, angulated at the shoulder and convex below; outer lip, sinuous; umbilicus, none, or very small. Silurian. United States, Australia. (Tryon.)

S. (Holopea). Mumia. *Salter* (M.S.) Tasmania, West.
S. Australis, ditto ,,

CLASS GASTEROPODA.

Bellerophon, De Montfort, 1808.

Microceras. Hall; Bigsby's Thes. Sil., 1868, Eth. Cat. Aust. Fossils, p. 24. Tryon II., p 322.

Shell, symmetrically convoluted, globular, or discoidal; strong, few-whorled; whorls often sculptured; dorsally keeled; aperture, sinuated, and deeply notched on the dorsal side.

Cambrian to Carboniferous; North America, Europe, Australia, India. (Tryon.)

B. pugnus. *Salter* (M.S.) Tasmania, West.

Trochonema. *Salter*, 1859.

Trochonemopsis, Meek; Bigsby's Thes. Sil., 1869. Eth. Cat. Aust. Fossils, p. 25. Tryon II., p. 309.

Shell, delphinula-like, with wide umbilicus. (Tryon.) Sil. Europe, America, Australasia.

Hormotoma. *Salter*, 1859.

Bigsby's Thes. Sil., 1868. Eth. Cat. Aust. Fossils, p. 25.

H. nerinæa. *Salter* (M.S.) Lower Sil. Tasmania, West.

Murchisonia, *D'Archiac* and *De Verneuil*, 1841.

Bigsby's Thes. Sil., 1868. Eth. Cat. Aust. Fossils, p. 25.

Shell, elongated; many whorled; whorls, variously sculptured, and zoned, like Pleurotomaria; aperture, slightly channeled in front; outer lip, deeply notched. L. Silurian to Permian; North America, Europe, Australasia. (Tryon.)

M. Franklin. *Salter* (M.S.) Gordon Limestone, Tas.
M. mimetica. ,, ,, ,, ,,

Tellinomya, *Hall*, 1847.

Ctenodonta, Salter, 1851.

Tryon iii., p. 260; Bigsby's Thes. Sil. 1868, p. 144. Eth. Cat. Austr. Foss. p. 25.

Shell elongately oval, sub equilateral, smooth, or finely concentrically striate; valves moderately convex; hinge represented by two diverging comb-like denticulated margins, without a special hinge area between them and the beak, and below the latter, not interrupted by a pit; ligament apparently external, posterior to the beak. (Tryon.)

Silurian—Carboniferous. Europe, Bolivia, Australia.

T. amygdala, *Salter*, (M.S.) Tasmania, West.

T. antipoda, *Salter*, (M.S.) Tasmania, West.

Class Cephalopoda.

Lituites, *Breynius*, 1732.

Bigsby's Thes. Sil. 1869; Eth. Cat. Aust. Fossils, p. 26; Tryon ii., p. 56.

Shell planorbiform, the whorls close or separate; the last chamber produced in a straight or outwardly curved line; lateral margins of the aperture extended and curved towards the interior of the shell, contracting the aperture into two distinct orifices.

Silurian. North America, Europe, Australasia. (Tryon.)

L. Gouldii.

Orthoceras. *Breynius*, 1732.

Bigby's Thes. Sil. 1868; Eth. Cat. Aust. Fossils, p. 26; Tryon ii., p. 51.

Shell straight, aperture sometimes contracted. (Tryon.)

L. Silurian to Triassic. N. America, Europe, Australasia.

O. antilope. Salter. M.S. Gordon Limestone, Tas.

O. Murchisoni. „ „ „

O. Theca. „ „ „

O. Youngii. „ „ „

Phragmoceras. *Brod.* 1839.

Tryon ii., p. 55.

Shell compressed on the sides, curved; aperture contracted in the middle; last chamber large; siphuncle dorsal, with radiations; septa simple.

Silurian to Devonian. Europe, N. America, Australasia.

One sp. in the Museum of the Tasmanian Royal Society.

TASMANIAN MOSSES, THEIR IDENTIFICATION, &c.,

By R. A. Bastow.

[*Read May* 12, 1885.]

The Mosses of this and the neighbouring colonies are, like the fauna, singular and peculiar, presenting genera and species analogous in many respects to those of the British Isles, and yet many of them have some peculiarity of structure rendering them unique. In "Hooker's Flora Tasmaniæ" we have a great number of Tasmanian Mosses carefully described, and beautiful drawings of many of them are therein contained.

In turning over the plates of Mosses in that large and magnificent work, it will be seen that the plants vary in colour from the palest green, as in some Hypna, to almost black, as in Andreœa, and after a little thorough Moss hunting, we are able to form a fair idea of the genus to which the tuft belongs by its colour, its habit, and its locality. For instance, the sombre-looking Andreœa Petrophila loves the bleak rock, the feathery Hypnum selects to slumber in the sylvan shade, whilst the scarlet fringed Splachnum may rarely be found, except on decayed animal substances.

But closer observation than the above mentioned is required in order to precisely identify the genus to which a Moss Plant belongs, and this leads me to call your attention to the key to genera of Mosses of Tasmania now submitted to your notice. It will be observed that I have therein followed the principle that "the characters must all be derived from the number, form, proportion, and situation of the organs of fructification," and in so doing I only follow in the wake of eminent muscologists, such as Hedwig, Hooker, Schimper, Muller, Wilson, and Mitten.

In this key the Mosses are in the first place divided into terminal fruiting and lateral fruiting plants; this division at once ridding us of a host of genera as we proceed to identify. When a Moss has been carefully classed, as, for example, a laterally fruiting Moss, then the microscope must be brought into requisition to decide the remaining characters. They are as follows:—

The capsule, or theca of a Moss Plant, is supported on a pedicel or footstalk, called the seta. This is in some genera very long, and in others very short, and frequently forms a specific as well as a generic character.

The supported capsule varys in size and form, and is composed externally and internally of strongly marked parts. The capsules of Bartramia, or Apple Moss, are generally spherical; the Phascum capsule is ovate and bursts irregularly when ripe; Campylopus gracefully bends its neck and buries its oblong urn amongst its foliage; Tortula is elongated, and twisted in parts, whilst the robust Polytrichum is erect and quadrangular.

The capsules of many are furrowed, others are spotted, whilst the Hypna, and other genera growing in shaded nooks, are more frequently of slight fabric and smooth.

This graceful form of fruit is protected by a calyptra, or veil, in some genera dimidiate, and in others mitriform. From the character of the veil important generic distinctions are derived. If we gently raise the veil, the operculum becomes at once visible, and forms a tiny but perfect close fitting lid to the capsule. It is very long beaked in some genera, and scarcely convex in

others; and forms another generic character. But the most interesting part of the capsule is the beautiful appendage, styled the peristome. It is a fringe of scarlet, pale yellow, purple, or intermediate shade. according to the genus to which the plant belongs. The peristome is divided into 8, 16, 32, or 64 segments or teeth. These numbers never deviate, a certain number of teeth are invariably found in a certain genus, they are always regular in number, and thus we have again strong characters for distinguishing genera.

In many of the Mosses the peristome is double, the inner one being much paler in colour than the outer, and in some few genera cilia may be found interposited with the teeth of the inner peristome. These are all abiding characters, and with the forms and arrangement of the leaves and habits of the plants, arranged, illustrated, and generically described as they are in the key before us, will be found sufficient in most cases to identify the genus to which the plant belongs.

May we be allowed to enter a plea for the Mosses of Tasmania which we so ruthlessly uproot from our garden walks and trample down by the road side; their forms are exquisite, their habits are in the charming corners and glades, as well as on the face of the mountain crag, their study is pure and refining, and there remains an insight to the student of contrivance, system, wisdom, Infinite Wisdom, and a source of infinite admiration.

NEW SPECIES OF TASMANIAN MARINE SHELLS,

By W. F. Petterd.

[*Read May* 12, 1885.]

1. Pecten aktinos, n. sp.

Shell of moderate thickness, irregularly, elongately, and somewhat obliquely orbicular, depressed, marked with irregular prominent lines of growth, ornamented with numerous—fourteen to eighteen—radiating perceptibly imbricated riblets, which are alternatley large and small, and again covered with smaller liræ; cellular structure, distinctly visible under the lens, towards the base; ears unequal, moderately prominent; colour, pink to bright rose, with irregular light or dark bands, and again peculiarly marked with numerous small sharply angular patches of white to pink, shaded with deep brownish-red; interior, shining

pinkish-white, with exterior colouration faintly showing through.

Long.—42 mill.
Lat.—36 ,,
Alt.—15 ,,

Habitat.—North-West Coast.

Though very distinct from the other Tasmanian forms, this species shows an approach to the common *P. asperrimus Lam*, but may be at once recognised by its form, smaller size, and very different colouration. It appears to be of rare occurrence, for, although I have seen numerous valves, but two perfect examples have come under my notice. It is probably a deep water form.

2. Diaphanna nivea, n. sp.

Shell, globose, very thin, semi-transparent, milky-white, shining; whorls, 4; spire, small, scarcely projecting, longitudinally streaked with fine lines of growth; aperture, narrowly ovate, inflated.

Long.—14 mill.
Lat.—7 ,,

Habitat.—Near River Leven (Miss Lodder). An unique example of a new genus to our Marine Molluscan fauna.

3. Cassis tumida, n. sp.

Shell, thick, white, dull, globose, marked with a few prominent lines of growth; whorls, 5; rounded, minutely, regularly, transversely lirate; spire, small, short, rather acute, apical whorls, smooth, suture emarginate; callus deposit, thin, striate, and shining; aperture ovate, inflated; outer lip, sub-reflexed, and slightly prominently thickened outside.

Long.—30 mill.
Lat.—18 ,,

Habitat.—Near River Leven (Miss Lodder). A single specimen collected of this small but distinct specie.

DESCRIPTIONS OF NEW SPECIES OF FOSSIL LEAVES FROM THE TERTIARY DEPOSITS OF MOUNT BISCHOFF BELONGING TO THE GENERA EUCALYPTUS, LAURUS, QUERCUS, CYCADITES, ETC.

By Robt. M. Johnston, F.L.S.

[*Read June* 9, 1885.]

To Mr. Sprent, who is now taking a very active part in arousing the interest of Surveyors, and others throughout the island, in all matters connected with local geology, I am indebted for the opportunity afforded me for the examination of a very valuable collection of Fossil Leaf impressions collected by Mr. Kayser, the very able manager of the Mount Bischoff Tin Mining Company's works at Mount Bischoff. The fossil impressions are very numerous and well defined, in a somewhat greyish sandstone, whose position, I learn from Mr. Kayser, underlies that recent basaltic sheet, which, with associated tuffs, occupies a considerable portion of the country in and around Mount Bischoff, and also extends more or less uninterruptedly over a considerable portion of the Surrey and Hampshire Hills, and towards Emu Bay, where a fine exposed headland exhibits basaltic columns, remarkable for their prismatic form and regularity. These tertiary beds repose upon or flank the tin-bearing eurite porphyries and the older associated slates, which, with their detritus, form the principal elevated boss of Mount Bischoff. The mount in itself is not very conspicuous at a distance, as it rises from the great elevated undulating plateau, stretching throughout a very considerable portion of the west and north-west part of the island. The level of this plateau maintains a general altitude above the sea of from 1,500 to to 2,000 feet all along the western flanks of the greater inland greenstone plateau of the Lake Country, and for a considerable extent towards the northern and western coast line, towards which it ultimately slopes more or less gradually.

The leaf beds at Mount Bischoff, therefore, are at a very much higher level than those with which we are already familiar in the Tamar and Derwent Basins, which latter range in altitude from sea level to 600 feet. The collection made by Mr. Kayser is a very interesting one, as not only do all the forms discovered appear to belong to new species, but in some cases to genera not before discovered fossil in Tasmania. The prevailing form appears to be a species of *Oak*, allied to *Quercus drymejoides* Ettingshausen, found at Dalton, near Gunning, New South Wales. One of the most striking and beautiful forms, however, is a species of *Laurus*, 7 inches long and 2 inches wide, which I have described and named *L. Sprentii*, in honour of Mr. C. Sprent, Deputy Surveyor-

General, whose kindly help in matters relating to the study of the Geology of Tasmania I take this opportunity of gratefully acknowledging. Another form, a species of *Eucalyptus*, is of singular interest, as it is undoubtedly the first fossil indication which I have yet seen in Tasmania of a representative of our existing gum trees, which so peculiarly characterise the existing vegetation of this island. The fossil *Eucalyptus* is very distinct from *E. Pluti* M'Coy, found similarly in Victoria. The Mount Bischoff form I have named *E. Kayseri*, in honour of the discoverer. Many of the plant remains are imperfect, although I can with certainty make out 15 or 16 distinct new species, the greater number of which has been figured by me for this paper.

Figures, in the meantime, for comparative purposes, are the best guides.

There are not sufficient characters to enable me with confidence to refer the most of the forms to known genera, although I have satisfied myself that some of them can with safety be referred to the genera Eucalyptus, Quercus, Laurus, Cycadites, and Ulmus, while others closely approach forms occurring in similar rock under the basalt at Breadalbane and at One Tree Point, which have been referred to the genera Lomatia, Ceratopetalum, and Ficonium, by Baron Von Ettingshausen. The determination of these doubtful forms I intend to submit to Baron Von Ettingshausen and to Baron Sir Ferd. Von Mueller, who have already elaborated a great number of our Fossil Tertiary vegetable remains.

The prevalence of the Oak, Laurel, and Elm, associated with the Gum tree in this tertiary deposit at Mount Bischoff, is of the greatest interest, as it substantiates the opinions advanced by Baron Von Ettingshausen, and mentioned with approval by Baron Sir Ferd. Von Mueller, viz., "that the whole existing vegetation of the world can in its development be traced to an universal flora in bygone geologic ages," and, therefore, such evidence is in perfect accord with the evolution hypothesis. It is, nevertheless, somewhat strange to find that a great number of the prevailing forms in our tertiary deposits (Oak, Birch, Elm, Alder, and Beech), should show a closer alliance to the existing flora of Europe than to the existing flora of Tasmania.

So far as it appears the Tertiary Flora of Tasmania is extremely rich and varied, and its development is worthy of our closest attention.

Eucalyptus Kayseri, n.s. Fig. 4.

Leaf lanceolate acuminate, slightly bent, and very attenuate towards the acute apex; base rounded and tapering, about $4\frac{3}{4}$ inches long and 21 millimetres wide; substance evidently thin;

mid-rib well marked; lateral veins numerous and very delicate, sub-parallel, almost horizontal near mid-rib, the most prominent becoming very indistinct and curving upwards at junction with intra-marginal vein, the least prominent usually anastomising before reaching the same vein; intra-marginal vein delicate, wavy, following moderately close to the edge.

This form is easily distinguished by its most delicate, close, and almost horizontal veins, and by its extremely acuminate apex. Named in honour of Mr. Kayser, the discoverer of many new fossil leaf forms at Mount Bischoff. Found in Tertiary Sandstones, underlying basalt, Mount Bischoff.

Laurus Sprentii, n.s. Fig. 1.

Leaf coriaceous, rigid, oblong, about 7 inches long. and 2 inches wide below the middle; base imperfect, but evidently acutely tapering; apex somewhat mucronate; margin simple, very slightly and irregularly undulating; mid-rib strong; lateral ribs (eight pairs), somewhat thick near mid-rib, first three sub-equal, upper pairs lessening; lateral ribs emerge at an angle of 70 to 80 degrees, gradually becoming extremely fine as they gently curve upwards and outwards towards margin, into which they run at a very acute angle; tertiary veins inconspicuous. From base to 1st secondary vein, 25 mil.; 1st to 2nd, 16 mil.; 2nd to 3rd, 25 mil.; 3rd to 4th, 19 mil; 4th to 5th, 13 mil.; 5th to 6th, 12 mil.; 6th to 7th, 14 mil.; 7th to 8th, 10 mil. Nervules very indistinct, evidently forming a fine oblong reticulation transverse to secondary veins.

Cycadites microphylla, n.s. Fig. 8.

Leaf imperfect, simply pinnate; pinnæ, with scarcely visible mid-rib, very minute, flat, linear-subulate, inserted obliquely on the margin of rhacis, at an angle of about 25 degrees, contracted at the base, falcate obtuse or pungent pointed, about 12 millimetres long, and 2 broad at base.

Quercus Bischoffensis, n.s. Fig. 5 6.

Leaf ovate-acuminate, ; mid-rib and secondary nerves valid, raised, the latter (about 14 pairs) regular, simple, emerging from mid-rib at an angle of from 45 to 50 degrees, and scarcely curved as they proceed directly upwards and outwards to margin, where each nerve terminates in the sinus or apex of a minute serrature; margin minutely and somewhat irregularly serrated, from two to four serratures between the extremities of secondary nerves. Mature specimens about 5½in. long and 2in. broad.

This handsome form occurs in the greatest abundance in tertiary sandstone of Mount Bischoff. It is distinguished from *Q. drymejoides*, Ettingshausen, which it resembles in

some respects, by its more ovate shape and its peculiarly serrated margin.

Ulmus Tasmanicus, n.s. Fig. 7.

Leaf ovate-lanceolate; base somewhat imperfect in the only specimen obtained, but evidently rounded; mid-rib strong towards base, and rapidly diminishing towards acuminate apex, where it is extremely delicate though sharply raised; secondary nerves simple or furcate (about 12 pairs) emerging from mid-rib at an angle of about 60 degrees, and proceeding upwards and outwards more or less irregularly straight or curved, terminating in a marginal tooth or serrature; margin somewhat coarsely and irregularly serrate, one or two serratures between extremities of secondary nerves. Viewed from the exposed lower surface of leaf, the left side has the fourth and sixth, and the right side the fifth, seventh, and eighth secondary nerves, furcate: Tertiary nerves at right angles to the secondary rare and very delicate, losing themselves in an extremely fine reticulation.

Length, about 5in.; greatest breadth, about $1\frac{3}{4}$in.; distance between each of the lowest four secondary nerves at base about 12 milimetres, the spaces gradually lessening upwards. Tertiary Sandstone, Mount Bischoff.

Although it is somewhat hazardous to determine the true position of a plant in the absence of fruit, I have referred the above leaf to the genus *Ulmus*, on account of the very characteristic form and neuration. I have frequently observed winged seed-impressions very like that of the Elm at One Tree Point.

Figs. 2, 3, 9, 10, 11 represent leaf impressions found associated with those described from the Tertiary Sandstones, Mount Bischoff, but whose position is as yet undetermined.

THE TASMANIAN EARTH TREMORS, 1883-4-5.

By A. B. Biggs.

(*Read 9th June*, 1885.)

The minute earth-shocks which have, during the past two years, been adding a new chapter to the history of our island, have been to me from the first a special subject of observation and study. The principal points which I set myself, if possible, to ascertain, were—First.—To arrive at an estimate of the actual magnitude of the surface-motion of the earth; and second.—To gain some idea of the position of the source, or focus, of the disturbance. I soon found, however, that the subject was much more difficult than I anti-

cipated, from (a) the extreme minuteness of the actual earth movement, and (b) the large discrepancies in the reports from different localities, both as to the *time* and the *direction* of the shocks.

I have referred to the *minuteness* of these shocks. As the result of my experiments in the way of measurement I am satisfied that a greatly exaggerated notion of their magnitude generally prevails. To correct this notion, I offer a brief description of some of the apparatus which I have employed in the detection and measurement of the tremors. I at first tried some of the most approved forms of seismometer, amongst others the crossed U tubes of mercury—also a plate of glass, smoked on its upper surface, resting on three marbles, free to roll on a level glass slab. A pin point rested lightly on the smoked surface. This has recorded only once. I also tried a saucer of mercury, covered with a layer of treacle. Of the above, and other forms of apparatus unsuccessfully tried, a fuller description is given in my original MS. in the Society's library. The *negative* evidence furnished by these failures has, however, an important bearing upon the question. The fact that a small wooden style about 3in. in length, stood on one end, reduced to a base of $\frac{1}{10}$in. in diameter, has been overturned by only a few of the strongest shocks, speaks volumes.

It was evident that, for positive results, I must contrive something far more sensitive than the foregoing.

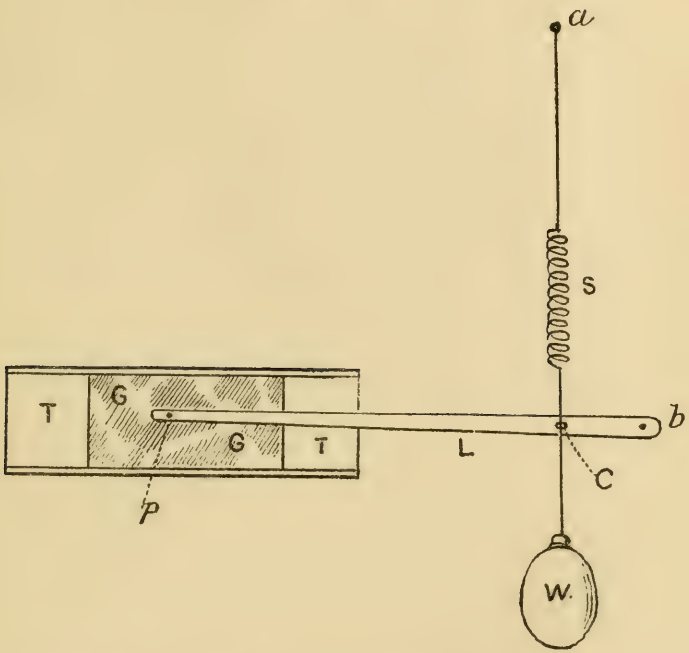
The following apparatus, which I now employ, I have found fairly successful :—

For Time Signal.—A free pendulum is suspended by copper wire, the end projecting below the bob and passing through a loop of platinum wire, this loop being only just large enough to allow the pendulum wire to pass through freely, without touching. The loop and pendulum wire each form part of an electric circuit. The least oscillation of the pendulum brings it into contact with the loop, thereby closing the circuit. This rings an electric bell, and at the same instant breaks the current which drives an electric clock, thereby showing the time of shock.

So sensitive is this apparatus, that, although fixed against a solid brick wall, it will respond to a moderate push against the wall with the hand. Of course this is affected only by horizontal movements. The pendulum is about 10in. in length. I at first tried a much longer one, about 7ft. or 8ft., but this seldom acted, in fact only indicated the very strongest tremors.

My signal apparatus for *vertical* earth movement consists of a delicate coiled spring of great elasticity, suspending a small weight through which the spring wire passes, the end

VERTICAL SEISMOMETER



S..... Coiled spring, suspended at a.

L..... Lever, pivoted at b, and connected with spring wire at c.

P..... Pin, through end of lever, the point resting against glass..... G.

T..... Tin slide, turned over at edges for glass (G) to slide in.

of the wire being almost in contact with the surface of mercury contained in a small metallic cup. The least vertical jar brings the lower point of the spring into contact with the mercury, thus completing an electric current and recording the signal. Although I adjust this so that I can scarcely see space between the end of the wire and its reflected image in the mercury, many sensible tremors occur which it fails to register. I find by experiment that the floor of the room near the wall responds to a foot-fall through a space six times that for which the instrument is set as above, the floor being a good solid one; the actual measures of adjustment being ·005in. for tremors, and ·03in. for floor.

I have now to describe what may be more properly designated as my *seismometers*. For *horizontal* earth-movement I have a free pendulum, with a bob of about 4lb. weight. Projecting perpendicularly under the bob is a fine tube, in which slides a pin, point downwards. The point of the pin rests, by its own weight, upon the smoked surface of a piece of glass, which is elevated to the pin by three screws underneath. Any oscillation of the pendulum, or rather of the glass itself (as it is really the tablet, and not the style, that partakes of the earth motion) will of course record itself on the glass. The marks are afterwards measured by micrometer and the direction noted. By far the largest reading of this instrument was recorded on 13th July, last year; namely, 0·28in. (whole oscillation), the next largest being 0·09in. on 7th December, 1883.

My *vertical* seismometer is on the same principle as the electric vertical signal (described before) namely, a weight suspended by a coiled spring. Between the spring and the weight is a horizontal lever, attached at one-fifth of its length from the pivotted end; the free end carrying a pin point which traverses the surface of a piece of smoked glass. The motion is thus multiplied 5 times. The highest reading of this instrument occurred on the same date as that of the other, being 0·15in., on 13th July, 1884. (This to be divided by 5 for actual motion).

The transit instrument should be a most delicate indicator of any permament displacement. I have, from time to time, had to make minute readjustments, necessitated probably by the operation of the tremors. The cause is, however, uncertain, and the indications extremely minute.

The Rev. Canon Brownrigg, by a fortunate chance, obtained an *optical* observation of one of these tremors in the telescope. He was observing a star, when he noticed that the image began to dance in the field of view. He was puzzled as to what had shaken the telescope, until, on going into the house, he learned that a shock had occurred at about the time he

was observing. By a necessarily rough judgment, the angular motion as compared with the angular value of the field-bar, would be about 1 minute of arc. This is as if a flag-pole 20ft. in height vibrated through a space of $\frac{1}{14}$in. at the top.

Now, in apparent opposition to the conclusion to be drawn from the foregoing as to the minuteness of the shocks, we have certain well avouched facts. I first take the somewhat startling circumstance reported in the Launceston papers by Mr. Geo. T. Hudson, as observed by him during the strong tremor of 13th December, 1883. He says:—"Our attention was directed particularly to the mud-flat" (in the river) . . . "which was a state of rapid agitation, moving apparently up and down in a most remarkable and alarming manner, the motion apparently coming from beneath, and from N.W. to. S.E. The rapid motion continued for fully one minute, and then gradually lessened, until it finally ceased. The wave motion was exceedingly severe, the tide being very low, etc." It is not surprising that such a sight as this should impress the beholder with the idea that it must be caused by some very violent agitation. I think, however, that it may be explained without any such inference. The tide was low, the mud-flat was still wet and glistening, and of course it reflected vividly the rays of sunlight. Under these circumstances the smallest motion of the surface would be immensely magnified, the magnification increasing with the distance from which it was viewed, in addition to the fact that the deviation of the reflected ray would be doubled by reflection. On this very occasion I was with a party taking tea, in a summer-house in a garden almost adjoining the spot from which Mr. Hudson viewed the phenomenon, and yet the tremor passed totally unperceived by any of us.

The shake of 13th July, 1884, was unquestionably by far the greatest shock of the whole series, and the only one that I know of that furnished any permanent and unquestionable exhibition of its violence. The principal tokens it left behind, in Launceston, were the throwing down a finial from the top of one of St. Andrew's Church spires, and the displacement of the masonry of another by about an inch, the throwing down of the newly-erected chimney of a bakery, also the top brick or tile of the chimney of Mr. Lay's house. All these effects however, may, I think, be accounted for without supposing anything more than a very minute shaking. (See M.S.)

On the day following, I visited some of the china and glass warehouses, where I saw goods so piled that I should have thought that merely walking heavily across the shop would cause a smash; yet I was told that nothing had been disturbed. In fact, I was informed at Mr. Hubbard's establish-

ment, that the rumbling of the carts along the street caused more commotion amongst the crockery than the generality of the tremors.

I have dwelt at considerable length upon this branch of the subject, namely, the extreme actual minuteness of the earth-movement, because I have to combat an almost universal impression that is directly opposed to my deductions. The question will naturally arise—How are we to account for this impression? I am inclined to think these tremors are *vibrational*—our nerve-system is peculiarly sensitive to vibrations. The vibration of a great organ pipe may be felt as well as heard. A tap with a walking stick upon the end of a 20ft. log will be distinctly felt by a person sitting on the other end. I have, while reclining on a spring sofa, felt the vibration from a passing cart during its passage along the whole length of the block.

Mr. Jackson, machinist, of Patterson-street, Launceston, informs me that he spent some years in Japan, having left only recently, where he was employed mechanically in the construction of Mr. Milne's successful seismometers. He assures me that our tremors are very insignificant in comparison with those prevalent in Japan, our strongest shocks only being comparable to their weak ones.

With regard to the *position of the focus*, I assumed that there were two modes of arriving at a solution of the question, the one being a careful analysis of *the lines of direction*, and the other a *comparison of the times* at which the shock was felt in different localities. The first method, however, was found to fail in practice, probably owing chiefly to the fact that the molecular motion of a body in vibration is distinct and different from the actual wave progression. The second mode was rendered difficult and uncertain by the fact that the time quotations were evidently in many cases inaccurate and inconsistent.

Undoubtedly the tremor of 13th July, last year was, as I have said, by far the greatest of the series, and, from the wide range over which it was felt, was the first to furnish sufficient data from which to form anything like an approximate estimate of the position of its focus. I made a very careful analysis of the time records of this wave, which was published in the *Launceston Examiner* of 22nd July. The principle which I applied to this investigation I more particularly specified in a subsequent communication to the same paper, dated September 2, 1884, as follows:—I assumed that the earth-wave "should progress in a more or less irregular expanding circle, having the focus of disturbance in the centre; consequently there should be points situated all round

the circle where the tremor should be felt at the same instant, just as a ripple from a stone thrown into a pond progresses all round from the centre outwards." Of course, difference of conductivity in different strata would tend to distort, more or less, the supposed circle; still, over long distances, I think we may fairly assume a pretty nearly equal average in different directions.

In applying this principle, it was necessary to first "smooth" the time curves, by averaging the different time reports from contiguous localities (I had 54 to work upon). I now quote from the article referred to (22 July):—

"It would appear that the wave first struck the coast line of N.S. Wales, from Sydney to Eden, nearly simultaneously, at 2 p.m. (1·44 p.m. our time). It next reaches Ringarooma at 1·55. A nearly synchronous line next passes through Wilson's Promontory, George Town, Launceston, Midland, Hobart, and the Huon, at 1·57. Lastly, it reaches Bischoff at 2·1. Now, the nearest focus I can find for these synchronous curves is about the East Coast of New Zealand. Setting one leg of a pair of compasses upon Mount Egmont, the other leg would strike these curves with considerable accuracy. These curves are separated by a distance of about 260 miles (roughly) from inner to outer. An earthwave has been estimated to travel at from 1200 to 1800 miles per hour. The shock reached Sydney 17 minutes before it reached Bischoff. This, at 20 miles per minute, would give 340 miles. But I think we have good reason for estimating the progress of the wave at a much slower rate, inasmuch as nearly all reports agree in describing the sound as *preceding* the shock, showing that the earth wave was slower than the sound wave. Taking this circumstance into account, I think the time taken in passing from curve to curve is not inconsistent with the foregoing hypothesis."

In this analysis I am, of course, not responsible for the correctness of the data, only for the conclusions deduced therefrom.

Next in importance, both as to strength of shock, and also with regard to the area over which it is traceable with reasonable precision, is that of 19th September last. Applying the same principles of investigation as before, it would appear that this wave first reached the N. East Coast at about 8·30 p.m.; then Launceston at 8·37½; Longford, Corners, Campbell Town, and Ross, at 8·38; and Prahran and Cape Schanck, at 8·39 (our time). A synchronous curve of 8·39 would pass through Prahran, Cape Schanck, and George Town,—a little west of Launceston, by Campbell Town, and somewhat east of Hobart. The focus of such a

curve would be about 500 miles east of Cape Howe. (See my notes, *Launceston Examiner*, 2nd October).

So far then as the time record of these two great shocks may be relied on, they agree in indicating a focus far away to the eastward, and that the supposition that *these* emanated from anywhere near the Straits Islands is quite untenable.

Although, as I think, the conclusion at which I have arrived with reference to these particular shocks is inevitable from their time record, I by no means contend for a general application of that conclusion to the whole series. I have long felt a strong leaning to the probability that the home of a great proportion of these shocks is somewhere in the vicinity of the N.E. of Tasmania. But I am inclined to think it not only possible, but even probable, *that they do not necessarily spring from any one point in particular.* It is noteworthy that indications of direction have been extremely varied and perplexing. For some time after the commencement of these tremors, the prevailing direction appeared to be from somewhere near North-West, suggesting Sunda as their source. The time record, especially from August to the beginning of December, 1883, showed a prevailing progression towards the East and South, the shocks most frequently reaching Launceston before the East Coast and Hobart. Then there appeared a general change of direction, and from about April or May, 1884, as a general rule, they struck the N.E. Coast first. In my published meteorological remarks for May, 1884, I wrote as follows :—" I have observed during the past two or three months a marked change in the character of these tremors, inasmuch as they now appear to proceed from no direction in particular, and frequently give indications of a *twisting* motion." This would appear to indicate the transition stage.

Mr. Arthur Green, from whom I have received valuable assistance, has an ingenious and effective little pendulum seismometer, whose indications were frequently confirmatory of the above-mentioned peculiarity of motion. Its tracings about the time mentioned above often exhibited a more or less circular figure, as if actuated by simultaneous transverse forces. The shock of 21st March last exhibited a somewhat similar characteristic. My seismometer (horizontal) record was a circular mark of about $\frac{1}{20}$ inch diameter, which a magnifier showed to be crossed and re-crossed in all directions.

On the question as to the origin of these tremors, it appears to me that three hypotheses present themselves for consideration :—

1. The operation of *local volcanic* forces—that is, that the source is under our feet.

2. The *vibrations from some distant centre,* or centres, of volcanic activity.

3. Minor forces, comparatively local, excited into *sympathetic activity,* by some distant or general disturbance.

The first of these, I think, we may dismiss. As I remarked in discussing the 13th July tremor, "immediately over the focus of the disturbance the motion would be *vertical,* the earth-wave becoming more and more inclined as it recedes from that point.

Now, my seismometer readings indicate *great inclination,* or very minute vertical motion in comparison with the horizontal. This has been the general indication of my seismometers.

The *second* hypothesis is rather favoured by the records of the great shocks 13th July, and 19th September; but, against that, we have no knowledge of any sudden or violent convulsion in the direction indicated. Still, that there are forces at work in that direction is evidenced by the boiling springs, as well as at least one active volcano in New Zealand. It is, I think, not improbable that deep subterranean action of no great violence might propagate its vibrations to a long distance.

The *third* hypothesis fits in with the fact, which should not be overlooked, that during the whole period of these tremors, the entire globe has been in a state of abnormal disquiet. Within the period, there have been terrible earthquakes at Ischia and Sunda, besides lesser in Persia, Asia Minor, Spain, England and other places; also numerous volcanoes abnormally active, and new ones breaking out in all directions from Iceland and Alaska northwards, to New Zealand at least southwards. (Those at the extreme south we do not know about.) If the origin of our tremors were some fixed centre, I think we should not have had so much trouble in determining its position. After making all allowance for errors in time, I think the indications go to show that the minor tremors at least proceed from various directions. This again favours the third hypothesis.

If we might admit the probability of our being affected by shocks from the antipodes, it would almost seem as if our tremors had some indirect connection with earthquakes that have occurred the other side of the world. For comparison, I give below the dates of earthquakes in other places, with the nearest period of special activity in Tasmania:—

On 28th July, 1883, occurred the earthquake of *Naples,* and on 30th we had several tremors during the day, some of them felt generally throughout the island.

On the 26th August was the outbreak at *Sunda.*

We had an increase on 28th, culminating on 30th.

October 19th.—*Asia Minor.* Maximum in Tasmania on 26th, 27th, 28th. (Nothing very special.)

December 22.—Severe shock at *Lisbon.* 24th.—Launceston (several tremors), and New Zealand.

February 10, 1884.—*Asiatic Turkey* (severe). *Tasmania,* for several consecutive days, both before and after, culminating in a violent one on the 14th, with several minor shocks same day.

April 22.—*England.* Tasmania, all through the month; strong ones on 12th, 14th, 24th, 25th, and 26th; and on 27th my electric signal was going repeatedly, almost continuously.

May 19.—*Persia.*—Severe. Tasmania.—Repeated and almost continuous signals on 21st, 22nd, and 23rd.

January 26, 1885.—*Alhama* (Spain).—"Severe." "Tremendous report. One person killed."

27, 28.—*Southern Syria.*

27.—*Valparaiso* (morning).—Severe and long.

31.—*Algiers.*—Eight houses destroyed.

30-31.—*Tasmania* (midnight).—Strong, after a month or more of comparative quietness.

It will be seen by the foregoing list that a considerable interval elapses between the earthquakes elsewhere and their apparent effect upon us, far too long to admit of the supposition that it is the *direct* wave that reaches us. But may we not reasonably conceive of intermediate sources of energy (whatever may be their nature, for I am not going to commit myself to any volcanic theory in particular) which require only the slightest jar to disturb into operation, such, for instance, as fissures ready to collapse, or internal reservoirs of water, or gases, just ready to burst their bounds? I simply throw out these suggestions for what they are worth; I will not presume to dogmatise.

From the circumstance that very few of these shakings are felt down in the mines, the opinion has been pretty widely entertained, that they are merely superficial. I cannot accept this inference. In the mines the men are engaged about their work on solid ground with nothing but solid rock or earth around them—nothing to clatter or shake, or to give any indication of slight movement. On the contrary, above ground we are probably comfortably reclining, in the quiet of evening (when a great proportion of these tremors are noticed) perhaps on a spring sofa, in a more or less shaky tenement, and surrounded with glassware and nick-nacks that vibrate and respond to the slightest motion. No wonder, therefore, that minute shakings, totally unperceived by workers underground, are obstrusively apparent to us.

It has been observed that earth-shocks have frequently been

associated with sudden and sometimes violent barometrical disturbance, from which I have been led to examine our own barometrical readings in connection with our periods of special telluric disturbance. I have failed however to discover any relationship between them. These periods appear to be associated indifferently with high or low, rising or falling barometer.

I have on my notes several other points which I believe would have been of interest, but I must forego them, as I fear this paper will be deemed too long already.

I would take this opportunity of thanking my numerous correspondents, who have from time to time assisted me by their communications.

NOTES ON JEAN JULIEN HOUTEN DE LABILLARDIERE.

By Baron F. Von Mueller, K.C.M.G.

(*Read 14th July*, 1885.)

Jean Julien Houton de LaBillardiere, born in Alengon (Orne), 28th October, 1755; died in Paris, 8th January, 1834. He graduated in medicine in the University of Montpellier, but subsequently devoted his studies almost exclusively to botany. For this purpose he traversed first the European Alps, and travelled, then, through some portion of Britain. In 1786 and 1788 he was sent by Louis XVI. on a botanic exploration of Syria, which brought him also to the Lebanon. The literary result of this journey was his work, "Icones plantarum Syriæ rariores," the first part of which appeared in 1791. When in 1792 the first search expedition was sent out under Admiral d'Entrecasteaux to ascertain the fate of Count La Pérouse and his crew, M. de LaBillardiere became botanist of the expedition, and had thus the splendid opportunity of rendering known much of the vast vegetation of South-west Australia (King George's Sound having only in the year before been discovered by Captain Vancouver), and also of the southern part of Tasmania, he being the first to explore phytologially the region where now the town of Hobart stands, although Bruni Island was visited during Cook's second and third expeditions in 1773 and 1777 already. At the war time LaBillardiere's collections were confiscated in Java; but on his return to France were restored to him through the influence of Sir Joseph

Banks, an act of generosity on which particular stress was laid in the necrology of Banks in the French Academy. The results of LaBillardiere's researches during D' Entrecasteaux's expedition are largely contained in the two folio volumes, "Novae Hollandiæ plantarum specimen," 1804-6; in the "Relation du voyage a la recherche de La Perouse," 1799, of which soon subsequently an English translation appeared. Further, in the illustrated quarto publication, "Sextum Austro-Caledonium" (1824-5), his three weeks' stay in New Caledonia during D'Entrecasteaux's voyage affording La Billardiere the opportunity to shed almost the first scientific light on the largely endemic vegetation of that island, but very little having been elucidated of that flora by the two Forsters previously.

Sir James Smith having already, in 1793, dedicated the genus Billardiere to the botanical companion of D'Entrecasteaux, it being founded on the widely distributed south-east Australian Billardiere scandens, to which, curiously enough, LaBillardiere was able to add in Tasmania the graceful and elegant B. longi flora De Candolle, described a third in 1824, Bentham a fourth in 1863, while in late years four species more were added to the genus by myself. (See Census of Australian plants, p. 7.) It seems, however, not likely that the genus will receive further additions to its eight now known species.

DESCRIPTION OF TWO NEW SPECIES OF TERTIARY FOSSIL PLANTS BELONGING TO THE GENERA *EUCALYPTUS* and *TAXITES*.

By Robert M. Johnston, F.L.S.

[*Read August* 10, 1885.]

Among a very interesting collection of Fossil Plants, now in the Royal Society's Museum, I have discovered a new species of Eucalyptus. This collection contains numerous impressions of leaves belonging to the genera Laurus, Cinnamomum, Fagus, Magnolia, and others more difficult to determine. The general character of these remains (at one time carefully numbered) as well as the species *Cinnamomum polymorphoides*, McCoy indicate that they probably belong to the same horizon as the lower zone of the Launceston Tertiary Basin.

The locality whence they were obtained, however, is not known to me, although I had made enquiries of the late Messrs. R. Gunn, and Roblin, and also of Mr. T. Stephens, and others who might be expected to throw light upon the matter. I am inclined to the opinion that they were collected by the late Dr. Milligan from the Tertiary Leaf Beds at Macquarie Harbour. A fresh collection from this place might satisfactorily set this doubt at rest.

The species of *Taxites* with fragmentary coniferous and other plant impressions, too imperfect for determination, was kindly forwarded to me by G. Thureau, F.G.S., Inspector of Mines, who collected them in clayey beds underlying and intercalated between the basalt sheets at Mount Bischoff. Mr. Thureau states that these clays overlie and are intimately associated with the tin drift deposits at this place, and he thinks that the clay sediments were derived from the volcanic tuffs and other ejecta.

The species of Eucalyptus I have named in honour of Dr. Milligan, who was the first local worker in Tasmania who contributed largely to our knowledge of Tasmanian geology. The species of Taxites I have named in honour of Mr. Thureau, who has afforded us, in his many official reports, much valuable information regarding the mineralogy and stratigraphy of the important mining localities.

The following is a description of the species referred to :—

Taxites. *Brogniart.*

Leaves linear, narrow, or sub-falcate, obtuse, coriaceous, fleshy, with a median rib ending in a minute mucrone, flat, furnished with a half twisted pedicel which is briefly decurrent.

Taxites Thureaui, nov. sp.

Branchlets narrow, leaflets numerous, linear, somewhat falcate, alternate, bilaterally and closely disposed, emerging from the axis of branchlet at an acute angle; extremites pointed and slightly incurved; decurrent pedicels nearly as broad as leaves, and forming an imbricated appearance along the axis of branchlets which is very fine; branchlets terminating in imbricated broad scaly heads, probably containing the fruit. Leaflet 2 millimetres long. Breadth across branchlet measuring from tip to tip of bilateral leaflets 10 millimetres.

Locality—Tertiary leaf Beds, Mount Bischoff.

Eucalyptus Milligani, nov. sp.

Leaves ovate-lanceolate or lanceolate, mucronate acute, with very numerous fine transverse parallel veins, the intramarginal one scarcely distant from the edge. The lateral parallel veins emerge and radiate gently outwards and upwards. This

species more closely approaches the existing *Eucalyptus ficifolia* of Western Australia than to existing species in Tasmania, or to the described fossil species *E. Kayseri*, mihi, and *E. Pluti* M'Coy. Large specimens 9 inches long when perfect, and $2\frac{5}{8}$ inches broad at greatest diameter.

Supposed locality—Tertiary Leaf Beds, Macquarie Harbour.

MOSS FLOWERS, SPLIT-MOSS, BOG-MOSS, AND EARTH-MOSS.

By R. A. Bastow,

[*Read August* 10, 1885.]

Moss Flowers.

In a paper on Mosses, read before this Society on the 12th of last May, the more easily distinguished generic characters of that natural order were described, and amongst them the peristomes or fringes of teeth surrounding the mouths of the fruit capsules, which deck their summits as with jewelled crowns. The inflorescence of these tiny plants was not referred to at that time; nevertheless, a brief description thereof is essential to the study of bryology, and it may interest the Fellows of the Royal Society.

The male inflorescence consists of *antheridia*, minute oblong bodies intermixed with a number of jointed filaments, or *paraphyses*. These are enclosed by leaves, and altogether form a small bud-like flower (*flos gemmaceus, Mitt.*), or they are sometimes surrounded by short spreading leaves, and, consequently, with the antheridia visible from above (*flos discoideus, Mitt.*). Some species of these latter flowers cannot fail to attract the attention of the most casual observer, appearing, as they do, to the unassisted vision, even at the distance of two or three yards, as glittering green or reddish stars dotted about on the darker green velvety masses of moss that cushion the moist and clayey bank.

The female inflorescence consists of *archegonia*, small bodies of an oblong form and swollen at the base. Individually, they are not unlike a flask in appearance, the upper portion or neck being in some respects analogous to the style and stigma in a phanerogamous plant. These are also mixed with jointed filaments or paraphyses, and in some species they may be found with antheridia in the same flower, they are then *synoicous*.

In order to minutely examine the antheridia and archegonia, they should be denuded of the perigonal leaves as closely as possible by means of a pair of a tweezers; they may then be laid on a glass slide with a drop of water and be finely divided with a sharp knife, they should afterwards be spread out a little with a needle point and be covered with a thin covering class. They should first be examined with a half-inch objective, and again with an eighth of an inch objective.

The archegonia never develope into fruit unless they are in the neighbourhood of antheridia, any botanist paying attention to the growth of mosses will be able to produce instances to prove that dioicous mosses (mosses that have the male and female inflorescence on separate plants), in whose neighbourhood no male plants of the same species occur, produce perfect archegonia, but never fruit. Fertilization must take place before fruit can be developed. The contents of the antheridia being probably of vital importance to the commencement of growth of the *germen* in the archegonia, they become interesting objects for investigation with the microscope. When thus examined it is observed that as the antheridia become ripe they open at the upper extremity, and from thence flows a granular substance composed of innumerable cells. If one of these cells is closely examined, an antherozoid will be observed coiled up in its centre; each of the innumerable cells contain each an antherozoid, these become free in a short time and roll about the field of vision by means of cilia, sometimes for three or four hours. Similar moving bodies may be observed in the paraphyses.

Unger, Pritchard, Griffiths, Mitten, Hofmeister, and others have borne testimony in their several works to this singular phenomenon. Hofmeister, in his work on the Higher Cryptogams, p. 156, says: "I have not succeeded in finding spermatozoa (antherozoids) in the central cell of the archegonium of mosses, near the germinal vesicle as I have in ferns. I have, however, seen in Funaria, a moving spermatozoon, which has penetrated through the third part of the length of the neck of an archegonium which was ready for impregnation."

When the archegonium has been fertilised, the interior seed-vessel rapidly advances in growth, and the young seta, or fruit stalk, may be seen to be developed at the base, its summit gradually forcing the seed-vessel upwards. As the young capsule rises, the strain on the outer coating of the archegonium is so great as to rupture it transversely, the upper part adhering to the young capsule in its ascension, and forming the beautiful object known as the veil or calyptra which adorns the ripe capsule.

In thus briefly glancing at their life history, how strange it is that this lovely though lowly order of plants should produce,

shall we say animalculæ, and that when, by insects or by the gentle breeze, these are carried to the ripe archegonia, each organism should develope into, not one, but a multitude of eggs or spores, and each egg or spore, under favourable conditions, capable of developing into a perfect plant. The note which the Poet Laureate strikes, elicits a sympathetic vibration as he pens in song :—

> " Flower in the crannied wall,
> I pluck you out of the crannies ;
> Hold you here in my hand,
> Little flower, root and all.
> And if I could understand
> What you are, roots and all, and all in all,
> I should know what God and man is."

Sub-order 1. Andreæaceæ. Split Mosses.

Genus 1. Andreæa.

The golden margined and black-brown centred tuft of Andreæa, the only genus in the sub-order Andreæaceæ, affects not " the mossy fountains sedgy sides," nor yet " the limpid bubbling rill," disdainful of such poetic corners, it aspires to great altitudes, and finding a congenial home on the face of the ancient storm-worn escarpment, there it luxuriates and attains perfection. Bridel, in his "Muscologia Universa," informs us that is found on the Alps at the line of perpetual snow, and that it is rarely found on low elevations or on plains. Mitten, in the 12th Vol. of the Journal of the Linneæn Society, defines its habitat at an elevation of from 11,000 to 14,000 feet above the sea for the continent of South America ; and Hobkirk, in his Synopsis of British Mosses, places it at Alpine and sub-Alpine heights. It has, however, been obtained within one mile of Hobart, and R. M. Johnston, Esq., has observed it near the sea level on the northern shores of Tasmania.

If we proceed along the quarry road which skirts the southern base of Knocklofty, the first great moss-covered and lime-stained crags that arrest our attention on the right, are clothed in parts with fruited tufts of this genus. These, with Bartramia and Frullania, give richly varied tints to the face of the cliff.

This singular genus is the connecting link of the two natural orders Musci and Hepaticæ, and is therefore very interesting. The capsule is small and erect, and bursts by four or more vertical slits when it is ripe. In this character it closely resembles a Jungermannia, but in other respects it is truly a moss.

There are only five species described in Flora Tasmaniæ as native of this Island, and the number has not been increased in Mitten's recent catalogue of Australian mosses ; but it is highly probable that other species will be found on the slopes

of our lofty ranges. The beautiful Andreæa Wilsoni may yet be discovered for Tasmania, and this would indeed be a reward for all the fatigue endured by the young botanist in search of new species.

Sub-order 2. Sphagnaceæ. Bog Mosses.

Genus 2. Sphagnum.

The name of this genus, the only genus in the Sub-order, was used by Pliny to designate the lemon-coloured tufts of Usnea (Lichen) that mantled the trunks and branches of trees in Italian forests, a growth by no means unfamiliar to us in Tasmania at the present day. According to Bridel, Dillenius first gave this name to the bog mosses, and Linneæus and Hedwig perpetuated it. Sphagnum may be found all the world over; in Lapland, the careful mother gathers and weaves the snowy tufts into a comfortable bed for her baby, it is so soft and spongy, so beautiful and pure, and when lined with eider down as it often is, it is a comfortable and cosy nest for the as yet unhardened inhabitant of that bitterly cold country.

The Sphagnum bogs cover extensive areas in Great Britain, and one of the greatest difficulties that George Stephenson had to encounter in making the Lancashire and Yorkshire Railway was the great bog known as Chat Moss. The Sphagnum plants in that bog reach down to an enormous depth.

When the Sphagnum bog becomes filled up and consolidated it forms peat, a substance as useful to the Skye-crofter or to the isolated inhabitants of England, Ireland, and Wales as wood or coal is to the Hobartian.

In the economy of nature the Sphagnum bog plays no unimportant part; the waterlogged depression is its home, there it luxuriates and multiplies, levying new substance from the surrounding light and air; the depression in the fulness of time becomes filled up, and in its turn is ready to yield to the husbandman produce for his toil. There are seven species of this genus described in Flora Tasmaniæ; to these may be added other two species, viz: S. Novæ Zealandiæ (Mitten), from Mitten's recent catalogue, and S. Moss-manianum (C. Muller). A specimen of this last may be seen in Mr. Archer's collection of mosses in the Royal Society's possession. Patches of this moss may be found at the top of Mount Wellington and near the Springs. Mr. Abbott, of the Royal Society's gardens obtains large quantities near Brown's River; it is so plentiful there that the carts back into the bogs almost to the depths of the wheels, and the sphagnum is forked into the cart as though it were hay, it is then sent away to fulfil some useful purpose.

The species are distinguished by the thickness of the cortical layer surrounding the stem; this is in some species constituted of five layers of cells, in others of three layers, and in yet others of one layer only. This specific character, in conjunction with the form of the leaf, is sufficient to identify the few species as yet known in Tasmania. The capsule is nearly globose and is sessile on the seta or fruit stalk, and the mouth of the capsule is destitute of peristome or teeth. It is, notwithstanding, an elegant form, and can be easily examined with a pocket lens. The leaves are remarkable for their singular cellular structure, and each cell contains a formation which Robert M. Stark in his "British Mosses" designates "a spiral fibre."

Sub-Order 3. Bryaceæ.

Section 1. *Fruit terminal.*

Tribe 1. Phascæ. Earth Mosses.—Genus 3.—Phascum. The plants of this genus are the smallest of all mosses, and probably the smallest of all flowering plants, some of the species not exceeding the size of an ordinary pin's head, roots, stem, leaves, and fruit included. All are perfect after their kind, and as varied and beautiful as flowering plants of larger growth and more easily observed.

These tiny plants must be looked for on the beds of dried up pools and on clayey or chalky banks; it will even be necessary to kneel down with pocket lens in hand and carefully examine the surface of the soil to detect the presence of some species. The capsule of Phascum bursts irregularly when ripe, and in this character it differs from all other mosses. The brightly coloured capsule, the intensely green leaves, the flowers, and the marked cellular structure combine to make this plant an interesting object for dark ground illumination with the microscope, one which may justly lead us to reflect on the mystic *Vital Force*, that of one primordial cell, developes, in its own peculiar way, and by two generations, into a minute but perfect Phascum plant; and of another to all appearance exactly similar cell, in its own peculiar but very diverse way, into a giant Pine or Eucalyptus.

DESCRIPTION OF TWO APPARENTLY NEW SPECIES OF GENUS ANCILLARIA. *LAM.*

By W. F. Petterd, C.M.Z.S.

[*Read September* 7, 1885.]

Ancillaria Fusiformis, n. sp. Shell fusiform, somewhat thin, white to pale chestnut, shining; spire produced milky-white with thin layer of callous, spirally striated above and below the suture, which is margined below with a broad zone of the same appearance, bounded with a distinct spiral line; base of body-whorl milky-white, bilined; columella thinly callous, extending on to body-whorl, obliquely striated at base; aperture elongately orate; outer lip thin.

Long. 20; lat. 9 mil. Apert. long. 10; lat. 4 mil.

Habitat.—Swan Island, Bass' Straits.

This shell is much smaller and more fusiform than its nearest ally *A. Marginata Lam* or its *var. Tasmanica T. Woods*; it also differs in colour and general structure. So far I have only obtained it from the locality given, but in all probability its range extends to the other islands in the vicinity or even to the mainland. The examples are not in very good condition, but quite sufficient to show its distinct specific characters from the more widely distributed and abundant form. Like the *olives*, all the species are much of the same structure, but, unlike that genus, they are very constant in specific characters.

Ancillaria Obtusa, n. sp. Shell ovate, thick, shining, white to pale fulvous; whorls about 5; spire short, rounded, lined, covered with a thick callous deposit, apex obtuse, blunt; body-whorl margined above and below with a broad milky zone, and lined at the base; columella with a thick layer of enamel extending on to the body-whorl, perceptibly wrinkled and twisted at the canal; outer lip thin, acute.

Long. 17; lat. 8 mil. Apert. long. 10½; lat. 4 mil.

Habitat.—North-West Coast.

This is comparatively a small stout form, with a short swollen and rounded spire, caused by its rather thick deposit of enamel. It is very distinct from the preceding specie, and equally constant in form, colour, and general structure. I submitted examples to Professor Tate's critical examination, and his opinion is that it is quite separate from our other species. From its small size it has probably been passed over as a stunted *var.* of *A. marginata.* Like many of our more recently discovered species it appears to be local in habitat, although not by any means rare, in favourable localities, between Tamar Heads and Table Cape.

GENERAL OBSERVATIONS REGARDING THE CLASSIFICATION OF THE UPPER PALÆOZOIC AND MESOZOIC ROCKS OF TASMANIA, TOGETHER WITH A FULL DESCRIPTION OF ALL THE KNOWN TASMANIAN COAL PLANTS, INCLUDING A CONSIDERABLE NUMBER OF NEW SPECIES.

By Robt. M. Johnston, F.L.S., Etc.

[*Read September 9th*, 1885.]

Carboniferous System (Up. Pal.)

By common consent the name given to this system, in Europe especially, applies to a vast series of rocks, well represented in every division of the globe, composed principally of alternating beds of sandstone, shale, fireclay, ironstone, coal, and limestone. In Europe and America the beds of the system pass insensibly into the underlying Devonian, although its principal members are most markedly distinguished from the latter by its peculiarly rich and characteristic vegetable deposits. It is to this profusion of vegetable remains that the system owes its name. Although in Europe the upper limits of the Carboniferous system can, with some degree of satisfaction, be separated from the lower limits of the succeeding system, known as the Permian, or Dyas, which according to artificial classification is deemed to close the Palæozoic age, it is not as yet always possible in other countries, especially in Australasia, to find special stratigraphic or organic characters, whereby the divisions between the two periods can even be most distantly approximated. The two systems for the purposes of this paper are therefore grouped as one under the term *Carboniferous system.*

The difficulties of any attempt to define the equivalents of the Carboniferous and Permian systems in Australasia may perhaps be unfelt or overlooked to a great extent by many Palæontologists, whose observations are often based upon collections made in the field by other hands, but it is otherwise with the field geologist, who must needs correlate locally stratigraphy with palæontology, and therefore cannot so easily ignore the evidences of the former when dealing with the latter. The field worker, therefore, finds much greater difficulty than the Palæontologist, as such, in any attempt to break into minor systematic sub-divisions, the various formations of any local group which seem to run insensibly into each other. Divisions of systems are, at the best, artificial and imaginary as regards the whole succession of

rocks on the earth's surface—a fact which is too often overlooked—and they are only of local value where the breaks or limits of characteristic life and stratigraphical connection can be seen to coincide.

Conclusions from Palæontology, based upon the association of typical organisms with typical rocks in one part of the earths surface, certainly form a strong presumption in favour of their application in a distant part of the earth where such combined associations seem to harmonise, and no doubt in a large measure this holds good, but they are also apt, by force of preconception, to mislead the Palæontologist where the evidences of Stratigraphy are obscure or in conflict. Nothing has so strongly demonstrated the value of Jukes' cautions as a field geologist, in the consideration of such matters, as the discovery of the existence in Australia of a land flora of European Mesozoic aspect, interstratified with a marine fauna of a distinctly marked European Palæozoic facies. It is not without advantage that mistakes were made by Palæontologists over this question, for it has profitably warned us that, in all such matters, we are too apt to crystalise opinion; to fall back upon an old locally useful generalisation, rather than be at the trouble to readjust the true relations of fresh facts and fresh combinations in areas far removed from the centre where the first generalisation was formed, and where, probably, it still holds good. Much unnecessary warmth of controversy between able and well-informed authorities might have been obviated hitherto if questions regarding centres of origin had received due attention in a broad and philosophical spirit when discussing the new facts and relations in Stratigraphy and Palæontology, which at first sight seemed to be evidences of "conflicting testimonies of the rocks." It cannot be too frequently asserted that the associated facts of stratigraphic and organic relation in one part of the world can never be severed or successfully subordinated by generalisations or deductions, however skilfully made, from dissimiliarly associated facts or relation in another distant part of the world; and it is this conviction, enforced by the difficulties of local experience in the investigation of Tasmanian geology, extending now over a period of 15 years, which induces me to concur with Mr. Jukes (p. 22, "Sketch of the Physical Structure of Australia, 1850") in the statement that, before we can rest satisfied with "existing classification of the rocks of Carboniferous, Permian, or Mesozoic age, we must study more thoroughly many questions, such as the original centre of production of the animals (or plants), and the time necessary for their migration and general spreading over the globe. Whether they might not have become extinct at the spot where they first began to exist before they

could spread in vast numbers over the opposite hemisphere."

"Questions like these have yet to be answered before we can determine whether or no strict synchronism (or homotaxial relation for that matter) can be deduced from the fact of the fossils in opposite hemispheres being representative of, or even, if it turns out so, identical with each other. At all events, we must not trust too implicitly to single or isolated facts. We must get the series of formations in each case and compare them with each other, and endeavour to trace out some common starting point of time before we shall be able to draw clear geological horizons, establish definite chronological epochs common to the whole earth."

With these observations of so thoughtful a geologist as the late Mr. Jukes I am still in complete accord, notwithstanding the valuable contributions made to our knowledge since that time by the combined labours of men of such genius and skill as McCoy, De Koninck, Ettingshausen, Müeller, Feistmantel, Tenison-Woods, Tate, R. Etheridge, jun., and many more.

It does not follow that because Glossopteris and other fossil genera of Mesozoic facies have been demonstrated (by W. B. Clark, Daintree, Feistmantel, and other authorites) to have their beginning in Australasia in the Palæozoic age, that these alone are to be regarded as having made their appearance in Australasian rocks anterior to their appearance in India and Europe. From evidences available there is a presumption that other typical genera may also have appeared in Australasian rocks anterior to the period, in which they or their congeners make their appearance in the rocks of countries widely separated from Australia; and hence we cannot as yet confidently accept classifications recently proposed by some authors who divide with too much artificial precision many closely related formations in Australasia whose stratigraphic relationships are still too obscure or uncertain to warrant the finer subdivisions of the Palæontologist. Palæontology divorced from facts of local Stratigraphy s unsatisfactory. Huxley forcibly observes ("Lay Sermons," p. 234) "There seems, then, no escape from the admission that neither Physical Geology nor Palæontology possesses any method by which the absolute synchronism of two strata can be demonstrated. All that Geology can prove is *local order of succession.*" It cannot be overlooked also that the materials upon which the Palæontologist works are often deceptive and unsatisfactory. There is not the connection between essential parts of classification nor the means of frequent verification, as in the study of living plants and animals, which also has its difficulties, and hence it too frequently happens that a great number of the generic and

specific creations of Palæontologists are of necessity artificial, as they are formed upon trivial characters which, on fuller knowledge regarding fruit and other essentials, may to a large extent prove to be individual variation rather than distinctly specific. Professor W. C. Williamson, in his opening address to the Geological Section of the British Association at Southport, in 1883, has strongly commented upon dangers to true and natural classification from this source. In his remarks, under the section FERNS, he states (see p. 524, "Nature," Sept., 1883) "The older taxonomic of Palæozoic Fern-life is with few exceptions, of little scientific value. Hooker and others have uttered in vain wise protests against the system that has been pursued. Small fragments have had generic and specific names assigned to them with supreme indifference to the study of morphological variability amongst living types. The undifferentiated tip of a terminal pinnule has had its special name, whilst the more developed structures, forming the lower part of the frond, have supplied two or three species. Then the distinct forms of the fertile fonds may have furnished additional ones whilst a further cause of confusion is seen in the wide difference existing between a young half-developed seedling and the same plant at an advanced stage of growth."

Since these observations were written Professor F. W. Hutton has contributed a most interesting article bearing upon subject ("Geological Nomenclature," pp. 59-61, *Geol. Mag.*, 1885) in which he very ably supports similar ideas. He states that it is quite impossible to squeeze the rock systems of other regions into those found in the European. They will not fit, and he therefore justly contends that all designations of sub-divisions of systems in Europe, as well as elsewhere, should have a local application only, and that in tabular or other comparisons the several local sub-divisions of a great system or era, such as the Palæozoic, should simply be treated as independent local groupings of the local sequence, against, or between which, may be approximately related the equivalent or complementary systems of distant regions. The necessity for these distinctions, although recognised by Dr. Geikie (pp. 634 636, "Text Book of Geology"), is not sufficiently appreciated by him as regards the world-wide application of European sub-divisions of great systems. For he still believes that regional names (European statedly), whatever may have been their origin, are upon the whole best adapted for general use; and accordingly he cites Cambrian, Silurian, Devonian, Permian, and Jurassic as types of this class of divisional names as having been adopted all over the globe.

Undoubtedly, so far as the three first-named systems are

concerned, his remarks are perfectly true, but as regards the two latter there are difficulties in the way of their being adopted in Australasia. Professor Hutton again aptly observes (*Geol. Mag.*, Feb., 1885, p. 60). "We can always speak of the 'Palæozoic' or the 'Mesozoic' rocks of a country with all the accuracy required when using such terms, while we cannot always do the same with sufficient accuracy when referring to rocks belonging to the shorter periods or epochs. For example," he goes on to say, "I can speak of the Mesozoic rocks of New Zealand because the term is wide and makes no pretension to accuracy, but I cannot speak of Jurassic or Cretaceous rocks of New Zealand with any approach to accuracy, although our present immethodical nomenclature often compels me to do so."

These difficulties have also been pointed out by W. T. Blanford, F.R.S. (in "Classification of Sedimentary Strata," pp. 318-9, *Geol Mag.*, July, 1884). He expressly states that, "so far as the Geology of India has been studied, it appears doubtful whether the sedimentary formations of that country can be accurately classified by means of the European sub-divisions. The difficulty, it is true, is partly due to the paucity of fossils in Indian rocks, but partly also to the circumstance that *the breaks in the sequence do not correspond with those especially remarkable in Europe.*" He elsewhere remarks that the same objection applies to other parts of the world.

If the stratigraphic breaks in India do not harmonise with those of Europe, what likelihood is there in finding corresponding breaks in the rocks of Australasia? I have, therefore, advanced good reasons for the course adopted by me hereafter in refraining to refer local rocks to sub-divisions of the Mesozoic Period, and also for merging the Carboniferous and Permian locally into one group, in harmony with the known facts of stratigraphy.

The Carboniferous System in Tasmania, as thus defined, is marked, stratigraphically and organically, in its lower limits by an important break, so far as its relation with the uppermost members of the clay-slates of Lower Palæozoic age can be ascertained. Whether the Upper Devonian of Europe can in Tasmania be separated from the continuous Upper Palæozoic rocks, and the Lower Devonian from the Upper Silurian slates is a matter which has yet to be decided.

Mr. Gould considered that the soft clay-slates of Fingal immediately and unconformably overlying similar clay-slates, but presenting special characters, and similarly related to the lower members of the carboniferous marine beds above, were the highest members of the Lower Palæozoic rocks known to

him. No fossils, however, were found in them by him, and he classed them as the uppermost members of the Silurian age, provisionally as follows. (See p. 29, "Proceedings Royal Society of Tasmania, 1866.")

1. Fingal Beds.....Clay-slates, sand-stones, and grits.

2. Eldon Valley	Mudstones and Clay-slates.	Calymene, Orthis, Cardiola, etc.	Thin quartz reefs not abundant.

3. Gordon Beds
- Limestones
- Slates
- Limestones
- Conglomerates
- Quartzose Sandstone

It is singular that in a piece of the uppermost clay-slates sent to me some years ago, I discovered a very well preserved species of *Anodonta*, on breaking up the specimen, also fragmentary impressions of the bark of some forms of vegetation. The species of Anodonta (which I shall for reference sake here call *A. Gouldii*, in honour of Mr. Charles Gould, who, perhaps, more than other person, contributed to our knowledge of the earlier rocks of Tasmania) is almost identical with the well known *Anodonta Jukesii*, one of the most characteristic fossils, if not the only fresh-water lammelibranch of the Lower Devonian rocks of Ireland.

The organisms, therefore, point clearly to a fresh-water origin, and the stratigraphical break above and below, also falls exactly into the position of Devonian rocks, as defined by Jukes in the following terms (p. 491, "Text Book"):—

"All rocks which were formed after the uppermost of those which can be called Silurian, and before the lowest of any which can be called Carboniferous, may be classed as Devonian rocks, and looked upon as records of Devonian time." The Upper Fingal clay and arenacious slates exactly fit into this definition, and the fresh-water organisms, *A. Gouldii*, and the vegetable impression strongly incline me to regard these slates as Devonian.

Here stratigraphy and palæontology are in harmony. The evidences collected by me from various parts of the island, respecting the sequence of the Carboniferous rocks of Tasmania, are so numerous that it would be beyond the purposes of this sketch to attempt to cite them in detail.

The characteristic rocks of the Carboniferous System in Australia and Tasmania consist primarily of thin regular bands of siliceous conglomerates, blue slaty shales, limestones, argillo-calcareous and argillo-arenaceous rocks of a yellow or white appearance, with intercalated bands near its uppermost

limits, composed of fine greyish laminated shales, bituminous shales and thin coal seams. The members are, for the most part, extremely rich in fossils, of which the following is a list of the more typical forms:—

PLANTAE, *Glossopteris Browniana*, Brong; *Gangamopteris spathulata*, McCoy; *Tasmanites punctatus*, Newton; *Noeggerathiopsis spathulata*, Dana; *Vertebraria australis*, M'Coy; *Cordaites* sp.; *Schizoneura*, sp.; Silicified trunks of Conifers in profusion, etc.

CRUSTACEA, *Cythere Tasmanica*, mihi.

POLYZOA, *Fenestella internata*, Lonsdale; *T. plebeia*, M'Coy; *Protoretepora ampla*, Lonsdale; *Stenopora Tasmaniensis*.

BRACHIOPODA.—*Leptæna*, sp.; *Orthis Mitchelini*, L'Eveillé; *Orthotetes crenistria*, Phillips; *Productus brachythyœrus*, G. Sowerby; *P. cora*, D'Orbigny; *P. fimbriatus*, J. *de* C. Sowerby; *P. fragilis*, Dana; *P. murchisonianus*, De Koninck; *P. punctatus*, Martin; *P. pustulosus*, Phillip; *P. scrabiculus*, Martin; *P. semireticulatus* (?), Martin; *P. subquadratus*, Morris; *P. undatus*, Defrance; *Rhynconella pleurodon*; *Strophalosia Clarkei*, De Koninck; *S. Jukesii*, Etheridge, Jun.; *Spirifera convoluta*, Phill.; *S. crassicostata*, Jukes; *S. Darwinii*, Morris; *S. glabra*, Martin; *S. lata*, M'Coy; *S. oviformis*, M'Coy; *S. Stokesii*, King; *S. Strezeleckii*, De Koninck; *S. Tasmaniensis*, Morris; *S. trigonalis* (?), Martin; *S. vespertilio*, G. Sowerby; *Terebratula sacculus*, Martin.

MOLLUSCA, proper—*Allorisma curvatum*, Morris; *Aviculopecten Fittoni*, Morris; *A. Hardyi*, De Koninck; *A. Illawarensis*, Morris; *A. limœformis*, Morris; *A. ptychotis*, M'Coy; *A. squamuliferus*, Morris; *A. Tasmaniensis*, M'Coy (m.s.); *A. tesselatus*, Phillips; *Cardiamorpha striatella* (?), De Koninck; *Edmondia striatocostata*, M'Coy; *Eurydesma sacculus*, M'Coy; *Modiolo crassissima* (?), M'Coy; *Modiolopsis*, sp; *Notomya*, sp; *Orthonata compressa*, Morris; *Pachydomus carinatus*, Morris; *P. globosus*, J. de C. Sowerby; *P. ovalis*, M'Coy; *P pusillus* (?), M'Coy; *Pterinea macroptera*, Morris; *Pteronites latus*, M'Coy; *Sanguinolites Etheridgei*, De Koninck; *Tellinomya Clarkei*, De Koninck; *Bellerophon convolutus*, De Koninck; *Capulus*, sp.; *Euomphalus catillus*, Martin; *E. Bigsbyi*, De Koninck; *E. minimus* (?), M'Coy; *Pleurotomaria*, *Morrisiana* M'Coy; *P. Woodsii*, Johnston; *Connularia* sp.; *Theca lanceolata*, Morris; *Cameroceras Phillipsii* (?), De Koninck; *Goniatites micromphalus*, Morris.

To these might be added many more examples now awaiting determination in my collection. In the greater number of cases it will be observed that the species are identical with those given in similar formations in New South Wales,

where owing to the energy of the late Rev. W. B. Clarke, and to the skill of De Koninck, the fossils of that country have been worked out more fully and systematically.

As regards New South Wales, De Koninck tablulates 316 species of fossils, as follows :—

	Genera.	Species.
Upper Silurian	43	62
Devonian	38	74
Carboniferous	73	180
Total	154	316

Of the fauna, 81 species at least are common to the Palæozoic formations of Europe, while many of the typical plants of the Carboniferous coal measures of Australasia are at least generically identical with those found in India in rocks of supposed Mesozoic age.

The various members of the Carboniferous System in Tasmania, are more or less horizontally disposed, although greatly dislocated by more recent intrusions of greenstone and secular upheaval, and subsequently subjected to great long continued denudation. The varying altitudes at which apparently the same members are found, together with the valleys of erosion so common throughout the country, show the vastness of the dynamical agencies which have operated upon them since their deposition.

Generally its members are so intimately associated with the older and newer diabasic greenstones that they cannot very well be considered apart in any attempt to describe them. It will be observed from the Geological sketch, recently prepared by Mr. Sprent and myself, that the diabasic greenstones form the elevated plateaus and mountains, as well as the principal minor dividing ranges throughout a great part of the Midland, Northern, Eastern, and South-Eastern parts of the island, and that they may be said to be comparatively, if not wholly, absent from the extreme western part, where the older Silurian and Metamorphic rocks prevail with their associated granites and porphyries.

The great central greenstone plateau of the Lake Country, in its Northern part especially, preserves a general rugged or undulating level of about 4,000 feet altitude, and its higher bosses and peaks, and its valleys do not vary much more than 1,000 feet above or below this uniform level. From the Picton to Gad's Hill, a distance northerly of over 100 miles its westerly limit may be roughly traced, forming a bold and widely undulating margin relative to the western country, whose immediate general upland surface ranges between 2,000 and 3,000 feet above sea level. This margin is markedly

broken by the elevated outlying spur forming the Eldon Range near Lake St. Clair. From Gad's Hill in a south-easterly direction to the Table Mountain, a distance of not less than 90 miles, its similarly indented margin presents a still bolder character as it approaches and contrasts with the lower fertile plains and valleys of the Meander and South Esk, which seldom exceeds an altitude from 600 to 700 feet above sea level. At the great Northern and Southern water divide, in the neighbourhood of the Table Mountain, it suddenly recedes and contracts, forming a large bight in the direction of the Upper Derwent tributaries, notably the rivers Nive and Ouse, from which its level tends to fall, and its marginal boundaries, though frequently rising into high mountain ridges towards Mount Wellington, no longer maintains the uniform boldness of outline which characterises it in its northerly aspect.

With the exception of Ben Lomond, which attains an altitude of 5,010 feet, the remaining isolated or ramifying greenstone dividing ranges, distributed throughout the basin of the Tamar, Derwent, and Coal River, and along the broken or deeply indented coast line of the East, are tame in character when compared with the elevated far-extending tiers of the Great Central Plateau.

Nearly everywhere along and against this plateau, and the greenstone crests of Ben Lomond, Mount Dromedary, Mount Nicholas, Eldon Range, Mount Gell, Grass Tree Hill, Constitution Hill, and most of the more elevated South-Eastern dividing ranges, the various members of the Carboniferous and Mesozoic rocks are seen to repose invariably almost in an horizontal position, or, at most, with a very slight dip towards or away from them. This general character is best appreciated by following the dark-grey color bands of the Upper Palæozoic and Mesozoic rocks as described in the sketch map referred to.

In my opinion it would seem probable that the greater part of the greenstone rocks were erupted prior to the deposition even of the lower members of the Carboniferous mudstones, and at a time when, from secular causes, the older rocks of the South-Eastern and Central parts of the island, after long subærial exposure, were slowly being submerged below the level of the Upper Palæozoic sea. So far as existing evidences show, it seems to me that this depression must have occurred towards the close of the Devonian, or at the commencement of the Carboniferous, period. Strzelecki, who was the first observer who graphically described these rocks, thought that the main masses of greenstone forming the Western and such mountain chains as Mount Wellington and Ben Lomond, were erupted subsequent to the deposition of the

Mesozoic rocks, and that the former were intruded through the latter and formed vast sheets, which, as overspreading caps, protected them in a large measure from the great denudation which undoubtedly occurred subsequently and of which there is the most abundant evidence throughout the plains and valleys lying within the limits of the Upper Palæozoic and Mesozoic Systems.

Dr. Milligan and Chas. Gould also followed Strzelecki in this opinion, as all of these writers in their ideal sections picture the sedimentary formations as dipping continuously under the elevated greenstone mountains and tiers, against which they have already been described as abutting more or less horizontally. Jukes, however, was doubtful of this relationship, and discussed the probability of certain greenstone masses being of older date than the sedimentary rocks. In the latter case we would have to assume that the narrow lineal strips of Carboniferous sedimentary rocks, as also the overlying coal measures, with their denuded and precipitous faces, flanking the main greenstone tiers and mountain ranges are, with the wasted members of the lower valleys and plains, only the mere remnant of a once greatly extended sedimentary formation, which, by long-continued action of subærial erosive agencies, were cut and wasted away in the formation of later deposits, and whatever elevation and dislocation has taken place locally subsequent to their deposition the earlier eruptive greenstone upon which they flank or rest may also have been similarly affected by them. The consequences of this assumption would therefore lead one to infer that the vertical faces at the higher levels abutting against the greenstone slopes are mainly the result of denudation rather than dislocation. No doubt, repeated general elevation movements in later times may account for some of the examples. At any rate, the greater elevation would intensify the erosive agencies. This assumption, although seriously affecting our prospects as regards the extension of our coal seams beneath the tiers in various parts of the island, has been demonstrated to be perfectly true so far as the greenstone and sedimentary rocks on the flanks of Mount Wellington are concerned. A section at the Cascades on the flank of Mount Wellington was practically tested by the Government during the previous year for the purpose of determining whether the Lower Coal measures as represented in the Mersey Basin, existed beneath the fossiliferous marine mudstones and limestones which occur at the place named, and which appear to dip gently in the direction of Mount Wellington. After the diamond-drill penetrated through 600 feet of alternating layers of calcareous mudstones and limestones, without discovering the existence of the lower coal measures, it pierced immediately

some feet into the massive diabasic greenstone, similar in character to that forming the cap of Mount Wellington. It is further of significance that the absence of any appearance of change of the mudstones at point of contact, and the porphyritic and coarse crystalisation of the upper surface of the greenstone as compared with that where the greatest depth was reached indicate that the mass of greenstone was not a later lateral thrust along the plane of the bedding of the mudstone, but in all probability the mudstones were originally deposited against and upon the greenstones of Mount Wellington soon after their eruption.

In various places along the Coast line of the Lower Derwent, as I have already shown, many natural sections occur where the fossiliferous mudstones, unaltered at point of contact, without doubt, repose quietly in horizontal beds, which naturally fill up the uneven surface of the underlying older greenstone I have already exhibited a sketch of a very fine section, which continually shows this relation for several miles between Blackman's Bay and Passage Point. One section in particular not only shows in an unmistakable manner that the fossiliferous mudstones are more recent than the main mass of the older greenstone upon which they rest, but that both are older than a minor dyke or sheet of greenstone of a somewhat similar character to the older. This intrusive greenstone, after bursting vertically through the older greenstone and the lower beds of sedimentary limestone, suddenly bends back and forms a sheet about seven feet thick, running parallel and intercalated between the stratified planes of the marine mudstones and limestones. At Constitution Hill and Lovely Banks, towards the central part of the island, there are also two or three fine sections in the cuttings of the Main Road, clearly showing the Mesozoic sedimentary rocks reposing upon the older greenstone. On the other hand a splendid section at the head of Spring Hill as clearly shows that a massive greenstone (not basalt) has been erupted later than the carbonaceous sandstones of Mesozoic age, as the greenstone mass forming the ridge at this place can be seen to have intruded through the former, dislocating the sedimentary rocks, and spreading over them in great massive caps. It is clear therefore that there are greenstones anterior to the lowest members of the Carboniferous System, and similar intrusive rocks of later date than certain of the members belonging to the Mesozoic Coal Measures.

I am however, at present, if anything, inclined to the opinion that the massive greenstones occupying the more elevated mountain ranges as well as the greater part of the dividing ranges within the system, have all been erupted prior to the deposit even of lower members of the Carbon-

iferous System, and that only certain minor ridges, like that at Spring Hill, represent diabasic greenstones of a later date. There is little difficulty in distinguishing these Upper Palaeozoic and Mesozoic greenstones from the sheets of basalt, which, with their associated tufts, so frequently overspread the Tertiary lignites and leaf beds, and which probably mark the close of the Tertiary Palæogene period in Tasmania.

The rocks of the Carboniferous System invariably present a very uniform character throughout the southern part of Tasmania. In the Basin of the Mersey there is greater variation, caused by a temporary local elevation and subsequent depression of the floor of an old arm of the Upper Palæozoic sea, between which elevation and depression sedimentary. deposits of carbonaceous matter of considerable thickness were formed, derived from a luxuriant land vegetation consisting of Club mosses, from which the spores of *Tasmanites punctatus* were no doubt derived. Ferns and Equisetaceæ were also abundant, as indicated by the remains of Glossopteris Gangamopteris and Schizoneura.

The bituminous Tasmanite shales were deposited in an arm of the sea, not in fresh water, as shown by the abundance of the remains of marine mollusca found in the Tasmanite notably *Aviculopecten squamuliferus*, *A. Fittoni*, *Pleurotomaria*, *Woodsii*, *Pachydomous*, *Pterinea lata*, s.p. and several other forms common to the marine beds above and below the Mersey Coal Measures.

Until very recently, I was in doubt whether the marine mudstones and limestones in the neighbourhood of Hobart, and in the South generally, represented the lower marine beds only, or whether they represented in one continuous series the upper and lower marine beds as developed in the Mersey Basin. The possible existence of the Lower Coal Measures underlying the marine mudstones made this a very important question, and it was this consideration which induced the Government to make the test at the Cascades already described, but which demonstrated the fact that no coal existed beneath the mudstones at this point. Before this practical test, little value could be attached to conclusions formed upon the partial evidence of marine fossil organisms alone, because a considerable per-centage of the species of the the marine organisms common to the mudstone series overlying the Mersey Coal Measures was also common to the underlying or lower marine beds, and also to the Tasmanite group. Among the fossils common to these deposits are the well-known forms:—*Spirifera Tasmaniensis*, *S. Darwinii Terebratula sacculus*, *Productus brachythyœrus*, *Pterinea lata*, *Sanguinolites Etheridgei*, *Pecten Fittoni*, *P. squamuliferus*, *P.*

Illawarra, Pleurotomaria Morrisiana, P. Woodsii, Tellinomya Clarkei, Theca lanceolata, and many others. With such equivocal information the evidences based upon a few marine organisms taken by themselves were of little value. Some, however, thought that the test of the diamond-drill, showing the absence of coal seams, indicated that the lower marine group alone were represented in the neighbourhood of Hobart. With this view, I was not prepared to concur as may be learned from the following remarks made at the time before the members of this Society :—

"If, therefore, it be allowed that the Mersey and Southern and Eastern coal deposits represent different horizons, the evidences from marine organisms, taken by themselves with our present knowledge, are absolutely valueless, at any rate neutral. It is from an examination of the plant remains, associated with the respective coal measures, that we have any grounds for separating them into different groups, as representing different periods. Thus the prevailing plant remains of the Coal Measures of the Mersey, which are the equivalents of the Stony Creek, Anvil Creek, and other coal seams in New South Wales, are *Glossopteris Browniana;* equisetaceous stalks, broadly and flatly ribbed, allied to the genus *Schizoneura;* a curious orbicular form allied to *Actinopteris;* and numerous impressions of a form closely allied to *Noeggerathiopsis media.* On the other hand, the Midland, Southern, and Eastern coal measures of Tasmania have generally as prevailing forms *Alethopteris Australis, P. odontopteroides, Phyllotheca Hookeri, Phyllotheca ramosa, Sphenopteris alata, Zeugophyllites elongatus*, and *Glossopteris linearis*, and, therefore, the beds may, without doubt, as already shown by Feistmantel, Rev. W. B. Clarke, R. Etheridge, junr., and others, be regarded as the equivalents of the Upper Coal Measures of New South Wales. Regarded from an evolutionist's point of view, it is very difficult to recognise any break, stratigraphic, or organic, between the upper and lower mudstone series of Australia, so far as the marine organisms of undoubted Palæozoic facies gave any evidence. If these subdivision were to be classed as Upper Palæozoic, and the Upper Coal Measures, according to various authorities, as Permian, Oolitic, Dias, or Mesozoic, the separation must be doubtful and purely one of local convenience. I am not prepared to concur in regarding the sandy and calcareous fossiliferous rocks occurring in the neighbourhood of Hobart, and in other localities in the South and East, *wholly* as the equivalents of the Lower Marine Beds of New South Wales, for it was not only conceivable but, unfortunately, probable that the Southern Marine beds of Tasmania were formed in situations more remotely

removed from the oscillation of the land which produced the conditions favourable to the deposits of the Lower Coal Measures in such places as the Don, Mersey, Stony Creek, and Anvil Creek basins; that while these carbonaceous deposits intercalcating and interrupting the series of marine beds were being formed in situations adjacent to the shores of the old Palæozoic mainland, the marine areas, more remote from the land, still continued to deposit their marine sediments with an uninterrupted chain of marine organic life; and it is quite conceivable, and, indeed, in harmony with existing evidence, that the Southern and Eastern Marine Beds of Tasmania cover in one unbroken series the whole period represented in Australia and in Northern Tasmania by the Lower Marine Beds, Lower Coal Measures, and Upper Marine Beds; and that the final oscillation of land, producing conditions favourable to the deposits of the Upper Coal Measures of Australia and Tasmania, was the only one which extended as far as the South and East of Tasmania."

The suggestion that the marine beds in the neighbourhood of Hobart cover in one unbroken series, the whole period represented elsewhere by the Lower Marine Beds the Lower Coal Measure, and the Upper Marine Beds, has since been amply confirmed by my discovery of the Cythere and Gangamopteris beds at Porter Hill, near Hobart. The beds at this place, unmistakably show a gradual transition upwards, without stratigraphical break of any kind, from the common limestones restricted to marine organisms to fine sandy shales where the marine organisms have altogether disappeared with the exception of a minute ostracod. These upper beds are replete with plant remains of ferns, chiefly belonging to the genus Gangamopteris. The fossiliferous marine limestones and mudstones replete with the common forms belonging to the genera Stenopora. Protoretepora, Fenestella, Spirifera, Strophalosia, Terebratula, etc., are followed by thin passage beds of alternating soft dark-brown sandstones, and friable shales where most of the common lower forms disappear with the exception of *Spirifera Tasmaniensis* and *S. Darwinii.*

In these shales a species of *Cythere* swarms in the greatest number, together with species belonging to the genera *Modiolopsis, Tellinomya,* and *Theca.* In the same beds, also, the plant remains referred to begin to make their appearance, and in the uppermost shales the plant remains and an occasional *Cythere,* together with the articulated spines, probably of a species of *Ichthyodorulites,* alone are to be found. There is little doubt, therefore, that these upper beds are the equivalents of the Tasmanite stage or of the Upper Marine Beds of the Mersey.

The finest sections of the Marine Beds of the system are exposed at Maria Island, although anyone may get a very full acquaintance of all the known characteristic fossils and rocks, in the many exposed sections along the Huon Road, One Tree Point, and Shot Tower, in the vicinity of Hobart.

Generally, then, we may consider that the Carboniferous Marine Beds formed the sediment or floor of a strait or frith of the ancient Upper Palæozoic sea. So far as I can read existing evidences, it would seem most probable that, during this period, Tasmania was represented by three principal islands, and several detached groups of smaller islets. The largest of the former probably represented a narrow and irregular strip of land running obliquely and continuously North and South between the extremes of the granite headlands of the Hummock Island in the North East, to the bold schistose rocks towards South Cape. Towards the centre of the present land limits of Tasmania, and scarcely separate from the narrow strip of land to the West, what now forms the great inland greenstone plateau of the Lake Country probably formed an elevated island mass of considerable extent. Towards the North East and East the granites and metamorphic portion of the Furneaux Group, Portland, Ringarooma, Schoutens, together with the massive greenstone in the neighbourhood, Fingal, Swansea, Tasman and Forester's Peninsula, South Bruni, must have formed a somewhat irregular detached chain where not broken by the minor or isolated masses which must have formed rocky islands, such as Ben Lomond, Mount Victoria, Tower Hill, Mouut Nicholas, Eastern Tier, Black Tier, Mount Dromedary, Grass Tree Hill, Constitution Hill. The interspaces of the shallow elongate basin, now forming the major part of cultivated settlements, was occupied by the Upper Palæozoic sea, which would seem to have formed a comparatively broad strait between the the easterly detached chain of islets, and the two principal islands to the West, which were themselves divided by a very linear strip of water. It is hazardous to assume what may have been the altitude of the island masses relatively to this old sea level. But there is some ground for the opinion that the great central greenstone island, especially in its northerly limits, rose abruptly from the old sea level, and presented a bold escarpment of from two or three thousand feet altitude. The sediments of this old sea forming the greater part of our Carboniferous rocks, are new often found flanking the mountain-tiers, as at Mount Wellington, at altitudes of from 2,000 to 2,500 above the existing sea level. With the overlying Mesozoic Coal Measures, they everywhere give evidence of having been frequently disturbed by forces of upheaval or depression, and their members have been vastly denuded

throughout the limits of the basin, whose limits have been thus roughly sketched.

MESOZOIC ROCKS.

The Mesozoic Period has been aptly termed the "Age of Cycads," because of the abundance of plants of this type of the Mesozoic age. With the exception of the Mersey Coal Measures, it has now generally been admitted that the various coal seams, and associated shales, and variegated sandstones overlying the Upper Marine Beds of Carboniferous age in Tasmania, belonging to the Mesozoic Period. These rocks are mainly distributed throughout the Midland and South-eastern parts of the island, although the existence of coal at a great height, near the Eldon Range, on Coal Hill, with remains of the variegated sandstones flanking all the great western tiers, associated with the Carboniferous rocks, indicate that the numbers of the Mesozoic rocks were probably at one time conterminous with those of the Carboniferous rocks,

With the exception already named, therefore, the dark-grey shading of the sketch map, and perhaps a considerable portion concealed under the Launceston Tertiary's Basin colored yellow, make up the whole area within which the several basins of the Mesozoic rocks occur.

In a general way the existing evidence tends to show that, as the floor of the ancient Upper Palæozoic sea was gradually being elevated above its waters at the close of the Carboniferous period, æolian, atmospheric, and organic agencies immediately began to operate upon it in carving out valleys and river-channels, and in filling its many cup-shaped basins and irregular hollows with lakes and sediments. It is mainly from such waste, and by such agencies, modified by igneous intrusions, that the sediments and materials of the lower rocks of the Mesozoic period were deposited in Tasmania.

So far as my observations go, there is every reason to believe that the larger part of its surface, including that portion of the Upper Palæozoic rock underlying the Tertiary lake deposits (coloured yellow), has been permanently elevated above sea level since the close of the Upper Palæozoic age—that is, since the Upper Marine Beds, with their characteristic spirifers, fenestellæ, stenoporæ, etc., were elevated above the waters of the sea at the close of the Palæozoic Period in Tasmania.

If this be admitted—which can hardly be doubted—it follows that there should be found throughout the area now occupied by Secondary and Tertiary rocks a connected, although, perhaps necessarily, a greatly broken and wasted, representation of all the original rocks of the two great

divisions. It is not likely that the fluviatile and subærial agencies, however prolonged or intense, would altogether destroy the older deposits in the formation of the later rocks; and it is reasonable to assume, where there are no sudden breaks, such as occur elsewhere, by the sudden alternation of Marine and Terrestrial formations, that the transition, as even now indicated by the fossil flora, would be very gradual in the limited basins where sediments were deposited, which, probably, were again and again partly re-distributed, as successive formations in gradually lessening areas. Nor can it be reasonably expected, where such separate minor basins are so intimately related to each other, that marked breaks in the chain of organic life, should be apparent, and therefore it would be extremely hazardous to assume that the identity of even one or two species in separate basins was sufficient evidence to mark synchronism between them, especially so where the associated prevailing forms of the one basin differ materially from the other. On the other hand, different conditions, such as soil or altitude, might account for a considerable amount of difference between two widely separate basins, although the evidence in this latter direction would not be quite satisfactory where the two separate basins were only separated by a line from slightly unconformable beds in juxtaposition.

From considerations such as these, and while willing to recognise the fact that all the European subdivisions, may be represented by equivalents in Tasmanian Rocks, I still think it would be altogether unscientific to expect that the many little groups of our Mesozoic rocks, as a whole, will show the faintest correspondenc with the ternary sub-groups (Triassic, Jurassic, Cretaceous), as such. To attempt to make corresponding divisions in Tasmania, with our present knowledge respecting stratigraphy and palæontology, would be purely artificial and altogether misleading. In the meantime, I am of opinion that the stratigraphic and organic characteristics of each separate basin or group of rocks should first be carefully and fully marked and related to each other. Until some satisfactory limits have been determined, I think you will agree with me that it would be rash to refer the various local basins of Mesozoic age under any of the great sub-division groups of Europe. In harmony with these observations and as a practical contribution to the materials necessary to aid in the proper classification and correlation of our Mesozoic rocks, I have prepared a table, showing the distribution of all the Tasmanian plants of the system known to me, in which are included a considerable number of forms not hitherto known as occurring in Tasmanian rocks.

In addition to this, I have prepared a full description of each species, including a considerable number which I believe to be new to science.

Another table prepared for this paper illustrates the views advanced by me regarding the classification of stratified divisions.

TASMANIAN FOSSIL PLANTS OF THE UPPER PALÆOZOIC AND MESOZOIC COAL MEASURES.

DESCRIPTION.	Tasmania (Mesozoic).													Tas. Up. Pal.		N.S. Wales			Victoria.	
	New Town.	Richmond.	Campania.	Constitution Hill.	Jerusalem.	Spring Bay.	Impression Bay.	Seymour.	York Plains.	Fingal.	Ben Lomond.	Mt. Nicholas, Killymoon.	Longford.	Spring Hill.	Porter Hill.	Mersey.	Wianamatta Beds.	Upper Coal Measures.	Lower Coal Measures.	Up. Devonian.	Mesozoic Rocks.
Equisetaceæ.																					
Phyllotheca Australis, Brong	*	*	*	*	*	*	...	...	*	...	...	...	...	...	...	...	*	*	...	...	*
,, *ramosa*, M'Coy	*	*	*	*	*	...	...	...	*	...	...	...	...	...	...	...	...	*			
,, *Hookeri*, M'Coy	*	*	*	*	*	...	...	...	*	...	...	...	*	...	...	...	...	*			
Vertebraria Australis, M'Coy...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	*				
Filices.																					
Sphenopteris lobifolia, Morris	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
,, *alata*, Brong	*	...	...	...	...	*	...	...	...	...	...	...	...	...	...	...	...	*			
,, *elongata*, Carr	*	*	...	...	...	*	...	...	*	...	...	...	...	*							
,, *plumosa*, Brong	*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
Trichomanides Ettingshausenii, Johnston	...	...	...	...	...	...	...	...	...	...	...	...	...	*							
Cyclopteris cuneata, Carr	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*						
Gangamopteris angustifolia, M'Coy ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*					
Rhacopteris Feistmantelii, Johnston ...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	...	...	*	
,, *intermedia*, Feist...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	
,, *inaequilatera*, Goepp	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*			
Thinnfeldia obtusifolia ** Johnston ...	*	...	...	...	...	...	...	...	*	...	...	...	...	*							
,, *superba* ** Johnston	...	...	...	...	...	*															
,, *trilobita*, Johnston	...	...	...	...	...	*															
,, *media* ** Woods	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	*			
,, *odontopteroides*, Morris ...	...	...	...	...	*	...	...	...	...	...	...	...	*	...	...	...	*	*	...	...	*
Pecopteris tenuifolia, M'Coy	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	...	*				
,, *caudata* Johnston	...	...	...	...	...	*	...	...	*	...	...	...	*								
Alethopteris Australis Morr	*	...	...	...	...	*	*	...	*	...	*	...	*	...	...	...	...	...	...	...	*
Taeniopteris Tasmanica, Johnston ...	...	...	...	...	...	...	*	...	...	...	...	...	...	*							
,, *Morrisiana*, Johnston ...	...	...	...	...	...	...	...	...	...	...	...	...	*								
Glossopteris Browniana, Brong	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*		
,, *linearis*, M'Coy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*		
,, *ampla*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	*	...	...	*		
Gangamopteris spathulata, M'Coy. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*		
,, *obliqua*, M'Coy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*						
Sagenopteris Tasmanica, Feist	...	...	...	...	*																
Lycopodiaceæ.																					
Tasmanites punctatus, Newton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*					
Lepidostrobus Müelleri, Johnston... ...	...	...	*																		
Cycadaceæ.															*						
Podozamites Sp.	...	...	...	...	...	-	* ?														
Zeugophyllites elongatus, Morr.	*	*	...	...	*	...	*	*	*	...	*	...	*	...	...	...	...	...	*		
Noggerathiopsis spathulata, Dana ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	*	* ?	
Cordaites Sp.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*	...	...	...	*	
Coniferous Trunks of Trees	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					

** Considered to be merely varieties of the protean *T. Odontopteroides*. Morris.

LOCAL DISTRIBUTION.

The foregoing table will be useful to students who may be interested in the distribution of the Fossil Plants of the Upper and Lower Coal Measures of Tasmania.

Further particulars are given in the following summary:—

I.—Lower Coal Measures. (Upper Palæozoic.)

MERSEY COAL BASIN.

Don and Mersey Coal Measures.

Glossopteris Browniana, Brong., abundant.
Gangamopteris spathulata, M'Coy, abundant.
Gangamopteris angustifolia, M'Coy, abundant.
Gangamopteris obliqua, M'Coy, abundant.
Noeggerathiopsis media (?), common.
Noeggerathiopsis spathulata, common.
Schizoneura, sp. (?), rare.
Curious orbicular scale with marginal rim, and ornamented with curved furcate vein-like septæ as in Actinopteris, rare.
Carpolithes (?) Tasmanicus, mihi, abundant.

Tasmanite Beds.

Tasmanites punctatus, Newton, prolific.

Mersey Upper Marine Beds.

Gangamopteris angustifolia (?), M'Coy, rare.

Porter Hill Beds. Hobart.

Gangamopteris ampla (?), abundant.
Cyclopteris cuneata, Carr., rare.
Equisetaceous, stems abundant.

The apex of a pinnule was also obtained in these beds, which probably belongs to the genus *Pecopteris*. The Upper Marine Beds, at Porter Hill are remarkable as showing connection with the Lower Marine Beds in a complete unbroken series.

II.—Upper Coal Measures. (Mesozoic.)

New Town Coal Basin.

Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, abundant.
Alethopteris Australis, Morris, abundant.
Thinnfeldia odontopteroides, var., obtusifolia, Morris, common.
Sphenopteris alata, Brong., prevailing form.
Sphenopteris plumosa, Brong., common.
Sphenopteris lobifolia, Morris, common.
Sphenopteris elongata, Carr., common.
Sagenopteris (?), rare.

No species of Glossopteris or Tæniopteris observed.

Richmond Coal Basin.

Zeugophyllites elongatus, Morris, common.
Phyllotheca Hookeri, M'Coy, abundant.
Sphenopteris elongata, Carr., abundant.

Jerusalem Coal Basin.

Lepidostrobus Muellerii, Johnston, one specimen.
Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, abundant.
Phyllotheca Australis, Brong., abundant.
Alethopteris Australis, abundant.

Spring Bay Coal Beds.

Phyllotheca Australis, Morris, common.
Sphenopteris elongata, Carr., common.
Thinnfeldia superba, Johnston, common.
Thinnfeldia trilobita, Johnston, common.
Pecopteris caudata (?), Johnston, common.
Alethopteris Australis, Morris, common.

Impression Bay and Coal Mine Beds, Tasman's Peninsula.

Phyllotheca Australis, Brong., common.
Sphenopteris alata (?), Brong., common.
Alethopteris Australis, Morris, common.

Ben Lomond Coal Beds.

Zeugophyllites elongatus, Morris, abundant.
Alethopteris Australis, Morris, abundant.

No other form could be obtained in the shales where these two forms are so abundant.

Mount Nicholas Coal Beds. (Killymoon seam.)

Glossopteris linearis (?) M'Coy, common.
Zeugophyllites elongatus, Morris, abundant.

Seymour Coal Measures.

Zeugophyllites elongatus, Morris, abundant.
Alethopteris Australis, Morris, abundant.

Occur in the same way as at Ben Lomond.

Campania Sandstones and Shales.

Phyllotheca Hookeri, M'Coy, abundant.
Lepidostrobus Muellerii, Johnston, one specimen.
Minute, concentrically striated, winged scales, abundant.

Gravelly Beach.—Rosevear Sandstones. Tamar.

Phyllotheca Australis (?), common.
Thinnfeldia odontopteroides, Morris, common.
Silicified trunks of coniferous trees, abundant.

Constitution Hill Beds.

Broad, variable, coarsely marked stems of *Phyllotheca Australis*, and *Phyllotheca Hookeri*

Very abundant in many places in the sections along the main road. The absence of all other forms is very remarkable in these beds.

Spring Hill Beds.

Thinnfeldia odontopteroides, Morris, var. obtusifolia, prevailing form. Abundant.
Thinnfeldia odontopteroides, var. media, common.
Sphenopteris elongata, Carr., not uncommon.
Trichomanides Ettingshauseni, Johnston, not uncommon.
Tæniopteris Tasmanica, Johnston, common.
Rhacopteris Feistmantelii, Johnston, common.

The absence of *Zeugophyllites elongatus*, Morris, *Alethopteris Australis*, Morris, and of the various species of *Sphenopteris* and *Phyllotheca* is here worthy of special notice, so far as the beds containing the above species are concerned. This is specially remarkable as Strezelecki positively states (p. 128 "Physical Description of N.S.W. and V.D.L.") that in a section of a well sunk at the locality of London Inn, near to the beds referred to, he discovered *Alethopteris Australis* and *Zeugophyllites* overlying a seam of coal.

York Plains Coal Beds.

Zeugophyllites, elongatus, Morris, abundant.
Phyllotheca, Australis, Brong., common.
Phyllotheca, ramosa, M'Coy, common.
Phyllotheca, Hookeri, M'Coy, abundant.
Thinnfeldia obtusifolia, abundant.
Alethopteris Australis Morris, very abundant.
Pecopteris caudata (?), Johnston, common.
Sphenopteris sp , common.

Longford Coal Beds (Mason's Seam).

Zeugophyllites elongatus, Morris, abundant.
Phyllotheca Hookeri, M'Coy, common.
Alethopteris Australis, Morris, common.
Pecopteris caudata, Johnston, common.
Tæniopteris Morrisiana, Johnston, rare.

PLANTAE.

Class Acrogens. *(Al Lycopodales.)*

Ord. Marsileaceae (?).

Vertebraria (Royle).

Gen. Char.—Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuration.

Vertebraria Australis (M'Coy).

Sp. char.—Leaves constantly eight in each whorl.

Localities.—Tasmania (?). N.S. Wales—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 147, t. 9, f. 1 ; ibid, Proc. Roy. Soc., V.D. Land, 1851, I., p. 304, t. 9, f. 1 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 101.

Equisetum.

Fructificationes in spicam ovato-oblongam digestæ. Singula orbiculata basi dehiscens pluribus valvulis, apice plano peltato connexis.

The definition of Schimper (Paleontologie vegetale, vol i., p. 259), remedies this:—It is *Fructus spicaeformis cylindraceus oblongus, seu ovatus, sporangiorum receptaculis peltoidis. Folia in vaginam connata.* (Tenison-Woods).

Phyllotheca.

Gen. Char.—Stem slender, jointed, simple, or branched ; branches springing from above the joints, not arranged in

the same plane; surface smooth or longitudinally sulcated; articulations surrounded by sheaths, the free edge of which terminates in long narrow leaves, having a more or less distinct midrib. Inflorescence arranged in whorls near the extremity of certain branches.

Phyllotheca Australis (Br.)

Stem simple, smooth, or slightly striated; sheaths tight, shorter than the internodes, terminated by narrow leaves, double the length of the sheaths, without distinct midrib.

Localities.— Tasmania— Upper Coal Measures (Mesozoic). Jerusalem, Constitution Hill, Spring Bay, Gravelly Beach, Tamar (?) York Plains. N.S. Wales—Anvil Creek, Newcastle, Clarke's Hill, Wianamatta. Victoria—Cape Paterson.

References.— Brongniart Prodrome, 1828, p. 152; Morris, Strezelecki's Phys. Descrip. N.S.W. and V.D. Land, 1845; Lindley and Hutton, Foss. Flora, 1833—35 II. p. 89; M'Coy, Annals, Nat. Hist., 1847, XX., p. 196; Ibid, Proc., Roy. Soc. V. D. Land, p. 312; Schimper, Traité Pal. Veg., 1869, I., p. 289; Tenison Woods. Proc. Lin. Soc. N. S. Wales, 1883, vol. VIII., pt. I., p. 69-73; R. Etheridge, Jun., Cat. Aust. Fossils, 1878, p. 98.

Phyllotheca ramosa (M'Coy).

Stem branched, smooth, or slightly striated; sheaths half the length of the internodes; leaves thin, linear, flat, twice to three times the length of the sheath, with a very fine indistinct midrib.

Localities.—Tasmania--Upper Coal Measures (Mesozoic), Richmond, Spring Bay, York Plains, Jerusalem. N.S. Wales—Mulimbimba.

References.—M'Coy Annals Nat. Hist, 1847., XX., p. 156, t. 11, figs 2 and 3; ibid Proc. R. Soc. V.D. Land, 1851, I., p. 312, t. 11, figs 2 and 3; Schimper Traite de Pal. Veg., 1869, I., p. 289; Tenison-Woods Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., pt. 1, p. 72-73; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

Phyllotheca Hookeri (M'Coy).

Sp. Char.—Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose, subinfundibuliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong prominent midrib.

Localities.—Tasmania—Upper Coal Measures (Mesozoic), New Town, Richmond, Jerusalem, Longford, York Plains, Constitution Hill, Impression Bay, Hamilton. N. S. Wales—Mulimbimba, Clark's Hill, Arowa.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 157, t. 11 figs. 4-7; ibid, Proc. R. Soc., V.D. Land, 1851, p. 313; Schimper, Traite Pal. Veg., 1, 1869, 1, p. 289; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883. Vol. VIII., pt. 1, p. 72-74; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

Sphenopterideæ.

Including *Sphenopteris*, *Hymenophyllum*, *Eremopteris*, *Coniopteris*, *Steffensia*, *Trichomanides*.

Fronds petiolate, simple or divided, pinnate, bi-tri-pinnatifid. Pinnules connate or lobate. Lobes dentate or subdivided. Costa fine and delicate, often bifid or free at the top; veins diverging above, or produced to the sinus of the lobes or teeth. Venules either indistinct or only proceeding from the lower part of the secondary nerves.

Sphenopteris lobifolia (Morris).

Frond bipinnate; pinnæ, somewhat linear, elongate, alternate; pinnulæ membranous, those of the lower pinnæ equal, ovate oblong, contracted at the base, approximate, with three nearly equal rounded lobes on each side, and a terminal obtuse one; the veins proceeding into each lobe, divide near the mid rib, the upper one being furcate; the pinnulæ towards the apex of the frond are rather sharply three-lobed and decurrent, the veins becoming furcate in each lobe.

Localities.—Tasmania—New Town, York Plains, Longford (?). N.S. Wales—Newcastle, Mulimbimba.

References.—Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 246, t. 7, f. 3; M'Coy, Annals, Nat. Hist., 1847, xx., p. 149; ibid, Proc. Soc. V.D. Land, 1851, i., p. 306; Tenison-Woods, Proc. Lin. Soc. N.S. Wales, 1883, vol. viii., pt. 1, p. 88; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

Sphenopteris alata (Brong.).

Frond tripinnate, rachis winged, pinnæ pinnate, above pinnatifid, with decurrent sessile pinnules, lower pinnatifid, with three to six bluntly toothed segments, upper ones inciso-dentate, veins either simple or forked, diverging slightly into each lobe from the costa at an acute angle.

Localities.—Tasmania—New Town, Longford (?). N.S. Wales, —Mulimbimba.

References.—Brongniart *(Pecopteris)*, Hist. Vég. Foss., 1828, i., p. 361, t. 127; *(Sphenopteris* var. *exilis)* Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 246, t. 7, f. 4; M'Coy, Annals Nat. Hist., 1847, xx., p. 149; ibid, Proc. R. Soc., V.D. Land, 1851, i., p. 306; Schimper Traité de Pal. Vég., 1869, i., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. viii., pt. 1, p. 90; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

Sphenopteris elongata (Carr).

Frond dichotomously divided, each division irregularly pinnate; pinnæ simple, bi-furcate or irregularly pinnate; segments narrow, linear, slightly tapering upwards to the somewhat blunt apex, the costa sending out simple veins which run along the middle of each segment.

It is doubtful whether the Tasmanian variable form, the rhachis of which, sometimes scarcely a millimetre in width,

is not specifically distinct from *S. elongata.* The former is very distantly and sparingly branched.

Localities.—TASMANIA — New Town, Richmond, Spring Hill, Jerusalem, York Plains, Spring Bay, Mt. Nicholas (?). QUEENSLAND —Tivoli mines.

References.—Carruthers, Quart. Jour. Geol. Soc., 1872, XXVIII., p. 355, t. 27, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 92; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

SPHENOPTERIS HASTATA (M'Coy).

Sp. Char.—Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulato-dentate, having obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

Localities.—TASMANIA—Upper Coal Measures (Mesozoic), New Town (?). N.S. WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 149, t. 10, f. 1; ibid, Proc. Roy. Soc., V.D Land, 1851, I pp. 306-307, t. 10 f. 1; Schimper, Traité de Pal. Vég., 1869, I. p. 410; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, Vol. VIII., pt. I., p. 90; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS GERMANUS (M'Coy).

Bipinnate; pinnæ oblique, alternate elongate, ovate, with a narrow membranous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three lobed; nerves bipinnate, three branches reaching the margin of each lobe.

Localities.—TASMANIA (?). N.S. WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 10, f. 2; ibid, Proc. R. Soc., V.D. Land, 1851, I, p. 307; Schimper, Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS PLUMOSA (M'Coy).

Sp. Char. — Bipinnate; pinnæ curved, elongate, narrow, plumose, with a scarcely alate margin to the rachis; pinnules close, oblique, ovate, pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; nerves strong, much branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin.

Localities. — TASMANIA — New Town (?). N. S. WALES — Mulimbimba. VICTORIA—Wild Dog Creek, Apollo Bay.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 1, f. 3; ibid, Proc. R. Soc., V.D. Land, 1851, I., p. 307, t. 10, f. 3; Schimper, Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1., p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

SPHENOPTERIS FLEXUOSA (M'Coy).

Sp. Char.—Bipinnate; pinnæ very long, with a strongly flexuous naked rhachis; pinnules large, moderately oblique, unequal, ovate, sides cut into two very large obtusely rounded lobes on each side; apex trilobed; nerves strong, much branched, seven branches reaching the margin of each lateral lobe, and three going into each of the three lobes of the apex.

Localities.—TASMANIA—New Town (?). NEW SOUTH WALES—Mulimbimba.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 150, t. 9, f. 4; ibid Proc. R. Soc., V.D. Land, 1851, I., p. 307 t. 9., f. 4; Schimper Traité de Pal. Vég., 1869, I., p. 411; Tenison-Woods, Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., pt. 1, p. 91; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 99.

TRICHOMANIDES. (Tenison-Woods, Proc. Lin. Soc., New South Wales, p. 94.)

Frond simple or divided, bi, or tri-pinnate, primary rachis narrow, or terete, sori unknown.

TRICHOMANIDES, ETTINSHAUSENI. Nov. Sp.

Frond pinnate; (or bi-pinnate ?) pinnæ delicate, membranous narrow, with closely adpressed, simple distant alternate pinnules, similar in character to winged rhachis; pinnules simple, linear, sub-decurrent towards winged base, slightly diverging towards bluntly pointed apices. A simple nerve traverses branches and simple pinnule as in the existing *Hymenophyllum rarum* Br. Length of pinna, 3 inches; length of pinnules from junction of median nerve to apex, 15 millimetres; breadth of pinnule, $1\frac{1}{2}$ millimetres.

This form is very distinct from *Sphenopteris elongata*, Carr., which also occurs in the Spring Hill beds, and with which it has some points of resemblance.

RHACOPTERIS, SCHIMPER.

Frond pinnate, rachis rigid, grooved in the middle. Pinnæ elongate, broadly linear. Pinnules sub-horizontal, somewhat remote, contiguous or sub-imbricate, spreading, oblong rhomboidal, more or less deeply incised and flabellate; lobes narrow, straight or slightly removed.—*Obs.*—The incisions are in the direction of the veins, and each ligule comprises one or two branches. The name refers to the incision of the pinnules. The genus hitherto was supposed to be confined to the Devonian or Lower Carboniferous.

RHACOPTERIS (?) FEISTMANTELII. Nov. Sp.

Frond coriaceous imparipinnate, handsome; rhachis strong; pinnæ sub-opposite, variable, distant, symmetrical or unsymmetrical, lingulate or obovate lanceolate, curved or spreading, greatly contracted at attachment to rhachis; terminal pinnule erect, inequilateral, with a rounded lobe on one side

at base, somewhat falciform; apex generally more rounded than the terminations of lateral pinnæ; neuration parallel and crowded at contracted or petiolate attachment, thence gently spreading and forking, the lateral nerves, terminating in dentate or curiously recurved and variable laciniate segments, which are more strikingly developed at base of lateral pinnæ; the central nerves reach the extreme termination of pinnæ; nerves form a somewhat coarse linear grooving on surface of pinnæ, but do not anastamose. Not uncommon in shaly beds at Spring Hill, Tasmania.

I have placed this singularly handsome form under the genus Rhacopteris, although the form of its neuration is very suggestive of alliance with certain forms of Otozamites. See *O. imbricatus*, Feistm. The rhachis, though strong and rigid, with a broad shallow groove on one side, lacks the prominent mesial angle which characterises *R. intermedia*, Feistm, and the more closely related *R. septentrionalis*, Feistm. It almost invariably happens also that, unlike the latter, the most pronounced recurved segment is the lower one of any marginal group; the segments are smaller and finer as a rule towards the apex of each pinna where they usually are simply dentate. It is here again noteworthy that the European members of this singular genus is confined to the Devonian and Lower Carboniferous rocks, a fact which should not be overlooked in attempts made to correlate the widely separate groups of Upper Pal. and Mesozoic rocks of Australasia.

R. INÆQUILATERA (Goeppert).

Frond upper side broadly rounded, truncate at the base at a right angle. Petiole, short, straight, decurrent. Veins united at the base, spreading widely and dichotomously divided.

Localities.—TASMANIA — (Not known. See *R. Feistmantelii*). N. S. WALES—Arowa, Smith's Creek.

References.—Goeppert (Cyclopteris), Flora, A. Silur-Devon., p. 72, Vol. XXXVII., pp. 6, 7, and 8; Tenison-Woods, Proc. Lin. Soc., N. S. Wales, 1883, Vol. VIII., pt. 1., p. 98; Feistmantel, Foss. Flora. of E. Austral. and Tasmania, Geol. Mag., Nov., 1879, p. 489.

R. INTERMEDIA (Feistmantel).

Rhachis thick, with a prominent mesial angle, pinnules alternate, pedunculate, oblong, rhomboid, incised into cuneate segments, the centre longest, incisions scarcely marked above. Margins of the segments denticulate, veins numerous, forking, radiating in the segments. In the form of the rhachis this resembles very much *R. transitionis* and *R. machanechi*, Stur.

Localities.—TASMANIA—(Not known. See *R. Feistmantelii*). N.S. WALES—Port Stephens (Stroud).

References.—Feistmantel, Pal. Berträge Cassel., 1878, pt. III., p. 75, t. 11; Tenison-Woods, Proc. Lin. Soc., N. S. Wales, 1883, Vol. VIII., p. 98; Feistmantel, Foss. Flora. of E. Austral. and Tasmania, Geol. Mag., Nov., 1879, p. 490.

R. Septentrionalis (Feistmantel).

Rhachis as in the last species, pinnulæ sub-alternate, with short petioles, sub-erect, oblong near the rhachis, deeply lobed, and thence sub-flabelliform, lobes sub-rhomboid, deeply incised, segments rounded above. Veins indistinct.

Localities.—Tasmania—(Not known. See *R. Feistmantelii).* N.S. Wales—Smith's Creek (Stroud).

References.—Feistmantel, Pal. Berträge Cassel, 1878, pt. III., p. 147; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 98.

Cyclopteris (Brongniart).

Frond simple, pedicellate, flabelliform or reniform, symmetrical, membranaceous; margin sub-entire, crenulate or fringed; veins arising from the base, forking frequently, radiating, slender, all reaching the margin. (Tenison-Woods).

Cyclopteris cuneata (Carruthers).

Form of the entire frond unknown; pinnæ entire, large cuneate, narrowed at the base, with the distal margins rounded; veins delicate, once or twice dichotomously divided, sometimes anastomosing once in their length in the middle of the pinnæ.

Localities.—Tasmania–Porter's Hill, Hobart (?).* Queensland—Tivoli Coal Mines.

References.—Carruthers, Quart. Journ. Geol. Soc., 1872, XXVIII. p. 355, t. 27, f. 5; Feistmantel Records Geol. Survey, India, 1876, IX., pt. 4, p. 123.

Thinnfeldia (Ettingshausen).

Fronds pinnate, segments or pinnæ oblong, ovate lanceolate, decurrent, and confluent at the base, coriaceous; costa divided into many veins, venules and veinlets, before reaching the apex; veins emerging at a slight angle, diverging in ascending, and often forking, venules or veinlets reaching the margin. Stomata in both sides of the lobes. Obs.—The frond is generally dichotomous, and is with the leaves of a thick and fleshy habit. It belongs in Europe to the lower Lias and Rhaetic formations.

Thinnfeldia (Pecopteris), Odontopteroides (Morris).

Frond pinnatifidly bipinnate, or flabellate (?); pinnæ, linear, elongate, acuminate; pinnulæ opposite, approximate, adnate, ovate obtuse, entire; veins nearly obliterated.

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* May only be a curiously cut fragment of a species of *Gangamopteris.*

Localities..— TASMANIA — Jerusalem, Whale's Head. NEW SOUTH WALES—Clark's Hill, Hawkesbury Sandstones. QUEENSLAND—Ipswich, Tivoli Mines.

References.—Morris. Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 2, 49, t. 6, f. 2-4. M'Coy (Gleichenites) Annals Nat. Hist., 1847, XX., p. 147 ; Schimper, Traité dé Pal. Vég., 1869, I., p. 488 ; Feistmantel, Records Geol. Survey, India, 1876, IX., pt. 4. pp. 123-124 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, vol. VIII., pt. 1, pp. 106-107 ; R. Etheridge, junr., Cat. Aust. Fossils, 1878, p. 98.

THINNFELDIA ODONTOPTEROIDES (Morris).
Var. *obtusifolia* (Johnston).

Frond bipinnate ; pinnæ simple or dichotomous ; rhachis strong and grooved, not winged; pinnules sub-opposite scarcely oblique, connate at the base, obtuse, broader than long, lower ones frequently emarginate ; upper margin emerging obliquely or at right angles to rhachis and roundly tapering downward towards lower margin, adhering base broadest ; lower pinnules free and relatively more square, emarginate, and shorter than the somewhat continuous or pinnatifid segments at the extremities of pinnæ ; the two inner pinnules at base of furcate pinnæ are slightly imbricate ; pinnæ usually from three to five inches long, and from six to thirteen millimetres broad; veins extremely fine, all arising from the rhachis, dichotomous, diverging as they ascend.

This fern is especially the characteristic form in certain shales at the foot of Spring Hill. From the extreme divergence of this form from the types figured originally by Professor Morris in Strezelecki's work (Physical Descrip., N.S.W., and Tas.), and from the frequency which the very fine venules ascend from the rhachis independently, I was at first inclined to regard it as a distinct species allied to *Odontopteris*, but the further study of Dr. Feistmantel's able investigations and of the fuller and more correct characters of the various forms given by him led me to abandon my original view, and refer the whole of the various forms at Spring Hill to *Thinnfeldia odontopteroides.* There is one beautifully preserved specimen, however, in my possession which from the delicacy and independence of the branching venules would almost justify its inclusion under the genus *Odontopteris.* This specimen particularly is almost identical in form with *O. Schlotheimii*, far more so, I believe, than the *O. microphylla*, M'Coy. The latter is found common in the fine sandstones of Clarke's Hill, N.S. Wales (Wianamatta beds). The shales at Spring Hill appear to be older than the eruptive greenstone forming the high ridge at that place. It is possible that the shales at Spring Hill, may belong to a formation distinct from the Jerusalem basin.

It is significant to find that all the associated plants at this place are new to Tasmania, viz., *Tæniopteris Tasmanica* mihi; *Rhacopteris Feistmantelii*, mihi; *Thinnfeldia media*, Woods closely resembling *T. indica*, *Sphenopteris elongata*, Carr. and a form having the characters of the genus *Trichomanides* (*T. Ettingshauseni*, mihi). The prevailing forms of the Tasmanian Coal Measures as represented at Jerusalem, New Town, Oatlands, Longford, Fingal, Ben Lomond, and Seymour, could not be traced among those mentioned.

The prevailing forms throughout the Upper Coal Measures are *Pecopteris Australis* (Mor); *Sphenopteris lobifolia* (Mor); *S. alata*, Br.; *S. plumosa*, Br.; *Zeugophyllites elongatus* (Mor); *Phyllotheca Australis*, Br.; *P. ramosa* (M'Coy); *P. Hookeri* (M'Coy).

THINNFELDIA ODONTOPTEROIDES (Morris).

Variety *superba* (Johnston).

Frond bipinnate, large and graceful; pinna forking, dichotomous, contained angle of fork 48 degrees; segments of pinnules invariably cleft close to rhachis leaving a continuous wing along the latter, against which the broad bases of the pinnules are attached; the pinnules below the fork are broader than long, squarish, and become increasingly obtusely lobed on the upper marginal shoulder, the lower margin becoming gently rounded, thence parallel, and close to upper margin of the subjacent pinnules, all of which usually run into rhachis wing at a right angle. Pinnules at and above fork gradually lose the squarish appearance, are variably curved, broadly lanceolate and spreading, length greater than breadth at base, frequently becoming simply lanceolate towards apex; inner pinnules of fork generally smaller. Neuration fine, and forking repeatedly as in *T. falcata* from which it only differs in having a winged rhachis and in being a very much larger form. Rhachis strong, grooved; extreme length of pinnules below fork, 11 millimetres; above fork, 39 millimetres; average breadth of pinnules below fork, 18 millimetres; above fork, 12 millimetres.

This magnificent form occurs in shales associated with the coal seam at Spring Bay where it is associated with *Sphenopteris elongata*. (Carr.) *P. caudatus*, mihi, and *P. trilobita*, mihi.

THINNFELDIA TRILOBITA. (Nov. Sp.).

Frond bipinnate (?), pinnæ, linear elongate, dichotomously divided; pinnules pinnatfid, coriaceous, oblique, opposite trincately narrowly strap-shaped, invariably terminating in three variably shaped digits or lobes, the central one of which is usually the most prominent; veins obscure, not well defined. Adjacent margins of pinnules run closely parallel

to each other, joining in a rounded sinus near to rhachis, giving to the latter the appearance of a broad marginal wing; rhachis strong and grooved; average breadth of of pinna, 15 millimetres; average length of pinnules, 9 millimetres; breadth, $4\frac{1}{2}$ millimetres.

Associated with *T. superba* mihi, in shales beneath coal seam at Spring Bay.

THINNFELDIA MEDIA (Tenison-Woods).

Frond pinnatifid or bipinnate (?) pinnæ nearly opposite, lanceolate, acuminate, on the margin sinuate, the lower ones shorter, the upper more or less nearly auricled, the lower ones more or less decurrent, the costa dividing into many veins; these veins are forked. Stalk thick, striated.

Localities.—TASMANIA—Spring Hill, Spring Bay. QUEENSLAND —Dubbo.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., plate 6, fig. 1.

PECOPTERIDEÆ.

Frond undivided, simple, or pinnate many times in a beautiful manner. Pinnules often entire, but here and there sub-divided, and with a dentate margin, base wholly adnate, rarely constricted, sometimes confluent. Costa persistent to the apex, pinnately ramose; veins dichotomous, diverging to the margin at a more or less open angle. Venules simple, forking twice or thrice, rarely anastomosing When sori are present they are marginal or disposed towards the middle of the pinnule, punctiform, oval or linear.

PECOPTERIS (Brogniart).

Veins emerging from the costa in a more or less open angle, diverging arcuately, simple or dichotomous, venules often forked.

PECOPTERIS (?) TENUIFOLIA (M'Coy).

Sp. Char.—Bipinnatifid (?), pinnules and rhachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rhachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

Localities.—TASMANIA (?). N.S. WALES—Clark's Hill.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 152, t. 9, f. 6; ibid, Proc. R. Soc., V.D. Land, 1851, 1 p. 308, t. 9, f. 6; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 110; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 98.

PECOPTERIS CAUDATA. Nov. Sp.

Frond bipinnate (?); pinnæ linear-lanceolate, pinnules connected, lobate or slightly pinnatifid from base to within an inch of apex, where the pinnæ terminate in a simple or

confluent linear terminal pinnule; all lobes oblique, rounded, with margins rough or finely venulate; primary vein of each lobe emerging acutely from rhachis, from which radiate dichotomously numerous small venules which reach the margin; an occasional independent venule arises from rhachis towards sinus of each lobe.

Pinnæ or frond (?), imperfect $2\frac{3}{4}$ inches long. Breadth across middle of terminal pinnule, 5 millimetres. Breadth across base, 14 millimetres.

From greyish shale below 4 feet coal seam at Longford

This is probably a very variable species, as it corresponds in some respects with a protean form occurring in the shales associated with a similar coal seam at Spring Bay and at York Plains. There are certain characters which link this form with the genus *Odontopteris*, but until more perfect specimens are obtained, it is referred by me provisionally to the genus *Pecopteris*. The veins are invariably strong and prominent, very unlike the fine neuration of *Thinnfeldia Odontopteroides* (Morris).

ALETHOPTERIS (PECOPTERIS), AUSTRALIS. Morris.

Frond bipinnate; pinnæ oblique, alternate, rather distant; pinnulæ thin falcate and rather obtuse, oblique and somewhat incurved, more or less adnate to the rhachis, and sometimes decurrent, dilate at the base, or auriculate; midrib slightly flexuous, evanescing towards the apex; veins oblique, bifurcate, or dichotomous.

Localities. — TASMANIA — New Town, Hamilton, Richmond, Jerusalem, Spring Bay, Impression Bay, York Plains, Longford, Ben Lomond, Seymour. VICTORIA—Bellarine.—N.S. WALES—Clarence River. QUEENSLAND—Ipswich, Darling Downs.

References.—Morris, Strezelecki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 248, t. 7, f. 1 and 2; M'Coy, Annals. Nat Hist., 1862, IX., p. 143; ibid, Geol. Survey, Vic., Dec. 1, 1874, p. 34; Schimper, Traité de Pal. Veg., 1869, I. p. 569; Feistmantel, Records, Geol. Survey India, IX., pt. 4, p. 123; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pp. 111-112; R. Etheridge jun., Cat. Aust. Fossils, 1878, p. 97.

TÆNIOPTERIDÆ.

Fronds stipitate, simple, oblong, lanceolate, and broadly elongate, entire or pinnate; pinnæ linear, lingulate, more or less acuminate, shortly pedicellate or sessile. Rhachis and costa conspicuous; veins emerging at an acute angle, but immediately becoming horizontal or oblique, simple and dichotomous. Sori transversely oblong, sub-marginal or rounded, and scattered over all the lower part of the surface, or in series along the venules.

TÆNIOPTERIS (Brongniart).

Frond simple, and in habit like *Scolopendron*. Costa con-

spicuous above, sub-terete underneath; veins generally conspicuous, slender, numerous, and close, dichotomous a little above the base; venules simple or dichotomous, parallel, with an occasional intermixture of simple nerves.

TÆNIOPTERIS TASMANICA. Nov. Sp.

Frond simple, broadly strap-shaped, not obovate; midrib moderately strong; veins well defined, exceedingly close and numerous, parallel, emerging from midrib at an acute angle, and immediately bending and reaching margin at a slight angle upwards. About one nerve in ten simply furcate near middle of wing; about 24 nerves in the space of half-an-inch. Length unknown. Breadth, about 46 millimetres, Common in the shales at foot of Spring Hill. This form approaches *Macrotæniopteris Wianamatta* (Feistm.) of the Hawkesbury sandstone, but seems to differ from the latter by its closer neuration and its broadly strap-shaped form. It also approaches *T. densinervis* (Feistm.), from Kukurbit, India, but it would appear that the latter differs in having the nerves more delicate if not more dense, and in being more frequently furcate.

TÆNIOPTERIS MORRISIANA. Nov. Sp.

Frond simple, narrowly strap-shaped; costa fine; veins numerous, parallel, one in six simply furcate, emerging and radiating outwards at a moderately acute angle to margin. Length, unknown; breadth about 16 millimetres; nerves fully 1 millimetre apart.

Occurs in a greyish white shale below 4 feet coal seam belonging to Mr. Mason near Longford. Associated with *Zeugophyllites elongatus* (Mor.), and *Alethopteris Australis* (Mor.).

T. Morrisiana is a very distinct form from *T. Daintreei* (M'Coy). It approaches *Oleandridium vittatum* (Brgt.) far more closely. It differs from the latter in the less frequent furcation of the nerves and in the delicacy of its midrib, *O. vittatum* being very strong comparatively. It is more closely allied to the example figured as *T. Daintreei*, by Mr. Carruthers (Quart. Jour. Geol. Soc. London, 1872, Pl. XXVII. fig. 1), but, which I consider, with Prof. M'Coy (p. 16, Decade. Prod. of Pal. of Victoria, Pl. XIV., fig. 1), to be a very distinct species. See *T. Carruthersii*, Tenison-Woods, Proc. Lin. Soc., 1883, Vol. VIII, p. 117.

TÆNIOPTERIS DAINTREEI (M'Coy).

Frond very long, linear, parallel sided; substance thick, edges straight, costa very strong; veins extending at right angles from the midrib to the lateral margins, a few straight and simple, the greater number once forked at a variable distance between the midrib and

lateral margin; total width of frond four lines, about ten or eleven lateral veins in the space of two lines at the margin, both of ordinary specimens, four lines wide, and one specimen nearly two inches long, but only one and a half lines wide throughout.

Localities.—TASMANIA. Referred to by M'Coy (Dec. 2, Pal. Vic., p. 15), as occurring "in the same mass of stone with *Glossopteris Browniana*, in one of the Tasmanian specimens," therefore locality probably Mersey Coal Basin (?). N.S. WALES—M'Coy. VICTORIA.—Bellarine, Barabool Hills, Cape Paterson, Strezelecki Range, Murundal. QUEENSLAND.—Tivoli Mines (?).

References.—M'Coy, Trans. Roy. Soc. Vic., 1860, V., pp. 196 and 215; ibid, Dec. II., Pal. of Vic., p. 15, pl. 14, f. 1-2; Carruthers, Quart. Journ., Geol. Soc., 1872, XXVIII., p. 355, t. 27, f. 6 (?); Feistmantel, Geol. Survey, India, IX., pl. 4, pp. 123-124; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII. (T. Carruthersii, Woods), p. 117; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 100.

Sub-Order.—DICTYOPTERIDEÆ †

Nerves *reticulate*, fronds many times pinnate or pinnatifid †

A. With a midrib.

a. Costa conspicuous, frond simple. *Glossopteris.*

b. Costa inconspicuous, except in the middle, frond quadrilobate. *Sagenopteris.*

B. Without a costa. *Gangamopteris.*

GLOSSOPTERIS (Brongniart).

Frond simple, elongately elliptical, acuminate, entire, coriaceous, petiolate, rhachis broad, gradually tapering up to the apex. Veins emerging from the rhachis at an acute angle, from which, to the middle of the leaf, they form a hexagonally rhomboid net, thence to the edge somewhat more free, dichotomous, not so often anastomising, and forming very large rhomboidal areolæ. Sori rounded.

GLOSSOPTERIS BROWNIANA (Brongniart).

Frond simple, spathulate, or oblong, lanceolate, entire, attenuate at the base; costa thick, canaliculate, gradually contracting towards the apex; veins oblique, anastomosing, hexagonal near the rhachis and elongate near the edge.

Localities.—TASMANIA—Lower Coal Measures (Up. Pal.), Mersey, Southport (Wintle), Lower Tamar (Wintle). N.S. WALES—Newcastle, Jerry's Plain, Mulimbimba, Illawara.

References.—Brongniart, Prodrome, 1828, p. 54; Morris, Strezelecki's Phys. Descrip., N.S. Wales and V.D. Land, 1845, p 247, t. 1, f. 1; Schimper, Traité de Pal. Vég, 1869, p. 645; Carruther's Quart. Journ. Geol. Soc., 1872, XXVIII., p. 354; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pp. 122-123; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

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† In Schimper and Zittel's Paleontologie this is only a sub-order of Tæniopterideæ.

GLOSSOPTERIS BROWNIANA, Var. PRÆCURSOR (Feistmantel).

Leaves small, long, spathulate; costa distinct, fading away towards the apex; veins emerging at an acute angle, curved, forked, anastomosing, forming a sub-equal elongate, polygonal network.

Localities.—N.S. WALES—Stony Creek.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 126.

GLOSSOPTERIS LINEARIS (M'Coy).

Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50deg. with the midrib, anastomising occasionally from the midrib to the margin.

Localities.— TASMANIA — Mount Nicholas (Killymoon Coal Seam ?). N.S. WALES—Woollongong, Arowa.

References.—M'Coy, Annals Nat. Hist., 1847, XX., p. 151, t. 9, f. 5; ibid, Proc. R. Soc. V.D. Land, 1851, I., p. 308, t. 9, f. 5; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 97; Tenison-Woods Proc. Lin. Soc. N.S. Wales, 1883, vol. VIII., p. 123.

GLOSSOPTERIS AMPLA (Dana).

Frond very large, widely ovate, entire, undulating, obtusely acuminate; costa thick, extending to the apex; veins extremely fine and close, leaving long, narrow reticulations, which are longest towards the margin.

Localities.—TASMANIA—Porter's Hill, Hobart (?). Mersey (?). N.S. WALES—Newcastle, Illawara.

References.—Dana, Geol. U.S. Expl. Expd., 717, Atlas, t. 13, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII. pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 976.

GLOSSOPTERIS RETICULATA (Dana).

Frond large, oblong-elliptical, the width not exceeding a third part of the length, gradually attenuate towards the apex; veins broadly reticulate to the margin. Considered to be a variety of *G. ampla* by Feistmantel.

Localities.—N.S. WALES— Newcastle, Illawara (Rare).

References.—Dana, Geol. U.S., Expl. Expd., p. 717, Atlas, t. 13, f. 1; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII, pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 976.

GLOSSOPTERIS ELONGATA (Dana).

Frond narrowly elongate, lanceolate, attenuate at the base; costa somewhat thick, distinct; veins neatly reticulate. Considered to be a variety of *G. ampla* by Feistmantel.

Localities.—N.S. WALES—Newcastle.

References.—Dana, Geol. U.S. Expl. Expd., p. 718, Atlas, t. 13, f. 5; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 124; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

Glossopteris cordata (Dana).

Frond distinctly cordate towards the base ; lobes rounded; costa thick; veins reversed at the base, diverging from the costa, neatly reticulate, with narrow, oblong interspaces. Considered to be a variety of *G. ampla*, by Feistmantel.

Localities.—N.S. Wales—Illawara.

References.—Dana, Geol. U.S., Expl. Expd., p. 718, Atlas, t. 13, f. 5 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 124 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

Glossopteris tæniopteroides (Feistmantel).

Frond simple, elegant in form, oblong, ovato-spathulate, attenuate at the base ; costa valid, striate or grooved. Veins emerging at nearly a right angle, giving at first sight the appearance of a *Tæniopteris*. Under the lens the venation is seen to form an oblong, narrow, obliquely acute parallel network which is sometimes indistinctly polygonal. The costa is stiff and straight. Only one specimen was known to Dr. Feistmantel, which came from Blackman's Swamp Coal Beds.

Localities.—N.S. Wales—Blackman's Swamp Coal Beds.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, vol. VIII., p. 125.

Glossopteris Wilkinsoni (Feistmantel).

Frond extremely narrow, sub-parallel, strap-shaped, costa distinct, produced at the apex; veins sub-horizontal, dichotomous, anastomosing usually once near the apex, forming an oblong network, with a few smaller meshes towards the margin of the rhachis.

Localities.—N.S. Wales—Blackman's Swamp.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 125.

Glossopteris parallela (Feistmantel).

Frond very long, simple, elongately ovate, apex unknown; costa distinct, grooved in the middle. Veins emerging at an angle of 30 deg., in the lower portion, and at an angle of 20 deg. in the upper portion of the frond, dichotomous parallel, but anastomosing, forming a distinct oblong polygonal net, which is narrower towards the margin.

Localities.—N.S. Wales————(?)

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., p. 125.

Glossopteris elegans (Feistmantel).

Frond of medium size, oblong spathulate, with a costa which becomes merged in the tissue above ; below it is formed of pairs of areola spaces, which are oblong; above these are similar spaces, but shorter and somewhat polygonal. Veins

arising at an acute angle from the medium areolar spaces, dichotomous, anastomosing, and forming an oblong network.

Localities.—N.S. Wales—Greta.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 125-126.

Glossopteris primœva (Feistmantel).

Frond spathulate, costa thick, grooved veins, emerging at an angle of from 20 to 30 deg., parallel, dichotomous, anastomosing, forming a polygonal network, which is wider and shorter near the rhachis, narrower and longer near the margin.

Localities.—N.S. Wales—Greta. India—Damuda.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883. vol. VIII., pt. 1, p. 126.

Glossopteris Clarkei (Feistmantel).

Leaves oblong ovate, obtusely acuminate; costa distinct, grooved in the middle. Veins parallel, dichotomous, free for the greater part of the leaf, like a *Tœniopteris*, anastomosing only at the margin, twice or thrice forming a rhombo-polygonal network.

Localities.—N.S. Wales. ————————(?)

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 126.

Gangamopteris (M'Coy).

Frond simple or impari-pinnate; middle pinnæ spathulate, symmetrical, semi-elliptically pointed above, gradually tapering towards the base; lateral pinnæ variable, very acute, tapering from base or obliquely ovate, to trigonal or flabelliform, broad above, gradually narrowed towards the oblique adherent base, which is never auriculate, but moderately wide and embracing no costa; veins coarsely reticulate, many arising from the base, branching as they diverge towards the margin and frequently anastomosing to form an irregular polygonal network.

Gangamopteris spathulata (M'Coy).

Spathulate, symmetrical, equal sided, semi-elliptically pointed above, tapering towards the base to a slender petiole; length $4\frac{1}{2}$ inches, width about $1\frac{1}{2}$ to 2 inches. (This is the rarest of the three forms in the Bacchus Marsh sandstones, M'Coy.)

Localities.—Tasanmia—Mersey. Victoria—Bacchus Marsh.

References.—M'Coy, Geol. Survey, Vic., Dec., II., 1875, p. 12, t. 13, f. 1; Feistmantel, Records, Geol. Survey, India, 1876, IX., pt. 4, p. 123; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 127.

Gangamopteris obliqua (M'Coy).

Frond wide, inequilateral, oblique, sub-trigonal, widest near the broadly rounded distal end, gradually tapering towards the base, which is not petiolate, but obliquely truncated, with a

moderately wide sessile base of attachment. Length, commonly about four or five inches ; width near apex, about three and a half inches ; width near base, commonly about nine lines.

Localities.—TASMANIA—Mersey. VICTORIA—Bacchus Marsh.

References—M'Coy, Geol. Survey, Vic., Dec. II., 1875, p. 13, t. 12, f. 2-4 ; Feistmantel Records, Geol. Survey, India, 1876, IX., pt. 4, p. 123 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 127 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 96.

GANGAMOPTERIS ANGUSTIFOLIA (McCoy).

Leaf linear, lanceolate, eight or nine times longer than wide ; side straight, nearly parellel, pointed above, contracted to a lengthened petiole below ; nerves equal, those of the middle third of the frond nearly parallel, straight rather closer than those of the sides, which gradually divaricate towards the margin at a very acute angle ; all the nerves dichotomise at irregular intervals, and those of the sides occasionally anastomose and are connected by a few transverse bars.

Localities.—TASMANIA—Upper Marine Beds, Mersey. N. S. WALES—Guntawang, Newcastle. VICTORIA—Bacchus Marsh.

References.—McCoy *(Cyclopteris)*, Annals Nat. Hist., 1847, XX., p. 148, t. 9. f. 3 ; ibid, Proc. Roy. Soc., V.D. Land, 1851, I., p. 306, t. 9. f. 3 ; Feistmantel, Rec. Geol. Survey, India, 1876, IX., pt. 4., p. 123 ; Tenison-Woods, Proc. Lin. Soc., 1883, Vol. VIII., pt. 1., p. 127 ; R. Etheridge, junr., Cat. Aust. Fossils, 1878, p. 95.

GANGAMOPTERIS CLARKEANA (Feistmantel).

Frond spathulately rounded, of medium size, coriaceous, entire, symmetrical, rounded above but greatly attenuated towards the base, whence the somewhat thick and distant veins radiate, forking and forming an oblong network. Resembles *G. spathulata.*

Localities.—N.S. WALES—Bowenfels.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 127-128.

SAGENOPTERIS (Presl.).

Frond quadri-lobate arising from a terete stipe, lobes free to the base, articulate, deciduous, extremely variable even in the same frond, being hastate cultriform, rhomboidal, oblong, lanceolate, and unsymmetrical, coriaceous, thickened at the articulation. Costa immersed in the tissue at the base, but distinct towards the middle ; veins arising at an acute angle, but diverging in ascending, anastomosing, forming a hexagonal rhomboidal network. Epidermis unequally rectangular above, polygonally areolate below, and pierced with stomata.

SAGENOPTERIS RHOIFOLIA (Presl.).

Frond very variable both as to the shape and size. Pinnæ narrow at the base, articulate, spathulate, obovate, or oblong

acuminate, rarely oblong lanceolate or sub-rotundate, inequilateral, very rarely sub-symmetrical, the middle leaves larger than the lateral ones, and quite entire. Ordinary length about 32 millimetres, with a diameter of 16 millimetres. The internal margins of the lateral fronds somewhat expanded, furnished here and there with a broad indistinct dental lobe.

Localities.—QUEENSLAND—Ipswich, Darling Downs.

References.—Presl. in Sternberg, Vol. I., p. 640, tab. XLIV., fig. 2-8 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 128.

SAGENOPTERIS TASMANICA (Feistmantel).

Frond compound digitate (?), with linear lobes, attenuate at the apex; costa distinct and rounded, veins emerging at an acute angle, forked, and once (so it seems in the fragments) anastomosing. A doubtful species resembling *S. Phillipsi*, Lindley and Hutton of the English Oolite.

Localities.—TASMANIA—Jerusalem Basin.

References.—Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 129.

JEANPAULIA (Unger).

Fronds coriaceous, arising from a cylindrical stem, flabelliform ; segments, which are linear, forking repeatedly, entire, more or less elongate. Veins numerous, rather prominent, equal, parallel, dichotomous with the divisions of the frond. Superior epidermis formed of elongate rectangular or oblique cells ; lower side of hexagonal cells with an undulating margin, and numerous stomata. Fruit, ovate-pisiform.

JEANPAULIA BIDENS (Tenison-Woods).

Frond broadly flabellate ; segments somewhat short, often becoming broader towards the apex, and ending in a short wide bifurcation, or in a curved falcate, acute or acuminate point. Veins not conspicuous, numerous (6 to 10), parallel, not branching. The longest of the segments in the specimen figured is 55 millimetre, and the width is from 3 to 6 millimetre.

Localities.—QUEENSLAND—Burnett River Coal Seams.

References.—Tenison-Woods, Proc. Lin Soc., N.S. Wales, 1883, vol. VIII., pt. 1, p. 132.

Order. LYCOPODIACEÆ.

Stem or rhizome bearing true leaves, either linear, or small and one-nerved, or reduced to minute scales. Spore-cases solitary or few together, sessile in the axils of the leaves or of the bracts of a terminal spike, either all similar or of two kinds, larger ones *macro-sporangia*, containing a few larger spores or *macrospores*, and smaller *micro-sporangia*, containing numerous smaller often microscopic *microspores*, the differences now generally admitted to be sexual.

LYCOPODIUM.

Stems leafy, hard, branching, creeping, prostrate, or erect. Leaves small, entire or minutely serrate, inserted all round the stem, usually in 4 rows. Spore cases all of one kind, flattened, one-celled, two-valved, sessile in the axils of the upper leaves, or of bracts usually smaller or broader than the stem leaves, and forming terminal or lateral spikes. Spores all minute and powdery.

TASMANITES PUNCTATUS (Newton).

Bituminous discs (Sporangia) minute, rounded, usually flattened. Surface under microscope ornamented with minute crateriform rings, in the centre of each of which occurs a fine pore or tube communicating between the internal and external surface. These tubes are generally filled with blackish matter, and appear through the transparent coating of sporangium wall as hairs. The peculiar nature of this organism and its ornamentation was first described by the author in "Memoranda to Tasmanian Botanists" (p. 53), published in August, 1874, where it is described as "the spore-cases of some ancient tree allied to the existing club moss family." Forms the bituminous matter of the shale of the Lower Coal Measures of the Mersey, known as *Tasmanite*, *Yellow Coal*, or *Dysodile*.

References.—Johnston Mem. Tas. Botanists, 1874, p. 53; *Newton* Geol. Mag, 1875, Dec., 5, II., pp. 337-342, t. 10, f. 1-9; *Johnston* pamphlet on Tasmanite, or Mersey Yellow Coal, Hobart, 1877, p. 6, *T. Australis*; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 199.

LEPIDODENDRON (Sternberg).

Large trees with dichotomous branches, surface closely covered with alternately arranged rhombic scars, having a vascular cicatrix near the middle or upper angle. Leaves linear, or peltate, fruit a strobilus or cone at the extremity of certain branches.

Sub-Genus. BERGERIA (Presl.).

Scars nearly flat, obovate, rhomboic or quadrate, with a very small oval vascular cicatrix near the upper angle.

This genus belongs to the Paleozoic rocks, and various portions of the same plant have been formed into *Stigmaria* (roots), *Lepidostrobus* (cones or fruit spikes), *Sigillaria* (fluted trunks of some species), *Cyperites* (foliage), *Knorria* (casts of stems), *Sternbergia* (pith) and other genera.

LEPIDOSTROBUS.

Cylindrical cones composed of winged scales, their axis traversed by a longitudinal cavity or receptacle, and terminating in rhomboidal disks, imbricated from above downwards.

Lepidostrobus Muelleri (Johnston).

Strobilus or cone imperfect, oblong, narrow, clyindrical, $4\frac{1}{4}$ inches long, and $\frac{7}{8}$ inches in diameter; the longitudinal, striated cylindrical core of specimen about half an inch in diameter, indicates that the central longitudinal cavity or core occupied fully one third of the total diameter; bractæ emerging from central axis at a slight descending angle, about 20 in number, from 4 to 6 millimetres thick at base, and tapering downwards to margin, where they are from 2 to 3 milimetres thick, and from which they suddenly bend upwards, and form long, thin, leaf-like imbricating bracts enclosing sporangia cavities or cells, of similar appearance and size to the enclosing bracteæ

This unique and interesting specimen was discovered by the author in the so-called auriferous sandstones of Campania, which belong to the Mesozoic Coal measures of Jerusalem.

The sandstones are intimately related with shaly beds replete with impressions of Phyllotheca Australis, P. Hookeri and Zeugophyllites elongatus.

Unfortunately the specimen soon after its discovery disappeared mysteriously from the Royal Society's Museum, Hobart, where it was temporarily deposited. Fortunately a careful drawing was taken by the author at the time when it was discovered. In the Royal Society's Museum, Hobart, there is a fragment of what appears to be a trunk of a species of *Knorria*. The locality cannot now be ascertained, but from the character of associated shales, it is probable that it came from the Jerusalem Basin. If so, there is a likelihood that it may be related to the strobilus *L. muelleri*.

Locality.—Tasmania—Campania sandstones.

Reference.—Johnston, Proc. Roy. Soc., Tasmania, 1884, p. 225, fig. 1.

Lepidodendron (Bergeria) Australis (M'Coy).

Stem about two inches in diameter, having rhombic scars, with straight thick boundaries, about four inches long, and three and a half inches wide, with a very small oval, rounded, vascular, cicatrix, rarely near the middle or more usually eccentric towards the upper angle, and often connected with the appearance of a vertical shallow rounded sulcus; branches one inch in diameter having similar scars three lines long, and two and a half lines wide, upper and lower angles of the scars usually slightly more acute that the lateral ones, very rarely the lateral ones more acute.

Locality.—Victoria—Avon River Sandstones, Gippsland.

References.— M'Coy Annals Nat. Hist., 1862, IX., p. 141; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 134; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31.

LEPIDODENDRON NOTHUM (Unger).

Scars of the leaf contiguous, rhombic, with a single and generally central vascular scar; leaves small, peltate and imbricate, on long slender petioles, fruit produced on the apices of the thick branches, a single sporangium, almost sessile, borne on the middle of the petiole of the leaf, roots stigmarioid.

Localities.—N.S. WALES—Cowra, Canowindra, Goonoo-Goonoo Creek. QUEENSLAND—Mount Wyatt, Drummond Range, Ryedale, Mount Lambie.

References.—Unger, Deuksch K. Akad, Wien, 1856, XI., p. 175, t. 10, f. 4-8; Carruthers, Quart. Jour. Geol. Soc., 1872, XXVIII, pp. 350, 353, t. 26, f. 1-5, f. 7-14; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 135; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31.

LEPIDODENDRON VELTHEIMIANUM (Sternberg).

Localities.—EUROPE—Silesia, Hartz Mountains, Upper Vosges. AUSTRALIA— ——— (?).

References.—R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 31; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII., pt. 1, p. 136. See also *L. rimosum* (Sternberg), ibid.

Order.—CYCADEÆ.

Flowers unisexual, without any perianth. Male flowers forming catkins or cones, consisting of numerous spirally arranged imbricated scales (or stamens), more or less cuneate, bearing on the concealed portion of their under surface, numerous sessile or rarely stipitate anther-cells, each opening in two valves, the upper imbricated exposed part of the scales hardened, and often much thickened, the apex truncate or more or less produced into an incurved or recurved point or lanceolate appendix. Female cones consisting of numerous scales, imbricate at least when young, either with one pendulous ovule (or carpel) on each side of the thickened and hardened apex, or with three or more erect ovules (or carpels) in marginal notches below the flattened acuminate, and usually dentate or pinnatifid apex. Fruiting-cone enlarged, and either remaining imbricate with two pendulous seeds to each scale, or the scales with marginal seeds spreading as the central shoot is developed within the cone. Seeds naked (or nuts) with a thick or hard outer coating or integument, and a fleshy albumen in a central cavity of which the straight embryo is suspended by a long folded cord. Cotyledons two, undivided. Palm-like plants, with a thick globose, and underground or erect and cylindrical woody stem, simple or rarely slightly branched, marked with the scars or bases of the old leaves. Leaves forming a crown at the apex of the stem, once or twice pinnate. Cones sessile or very shortly pedunculate, within the crown of leaves.

Zamites (Brongniart).

(As amended by Schimper including *Zamia* and *Zamites* of Brongniart in part and *Crossozamia* of Powell.)

Leaves very variable in size and shape, either ovate oblong acuminate, or oblong or linear and oblong acuminate; all regularly pinnate. Pinnæ more or less horizontal and inserted perpendicularly into the rhachis, lanceolate, linear lanceolate, oblong, acuminate or obtuse, base contracting suddenly and fixed to the anterior side of the rhachis by a more or less distinct callosity; solidly coriaceous. Nerves distinct, straight, parallel, ending abruptly at the apical margin of the leaflet.

Podozamites (Fr. Braun.).

Leaves of medium size. Leaflets distinct, spreading, oblong, ovate, and linear oblong, apex obtusely acuminate or rounded, gradually narrowed towards the base, sub-pedicellate, pedicel articulate, deciduous. Nerves dichotomous at the very base, then simple, erect, parallel, then converging towards the apex.

P. Barkleyi, M'Coy, *Victoria* — Queenscliff (Ten.-Woods, l.c., p. 144).

P. ellipticus, M'Coy (Ten.-Woods, l.c., p. 144).

P. longifolius, M'Coy, *Victoria*—Bellarine (Ten.-Woods, l.c., p. 145).

P. lanceolatus, Lindley and Hutton, *Queensland*—Ipswich (Ten.-Woods, l.c., p. 146).

Otozamites (Fr. Braun).

(*Odontopteris*, Sternb. Goeppert, Unger, in part. *Otopteris*, Lindley and Hutton, Schenk.)

Leaves moderately large, rarely very large, regularly pinnate, elongately linear, narrowed at each end, leaflets, densely close or more or less remote, alternate or linear lanceolate, obovate rhomboid or sub-circular, base suddenly narrowed, obliquely inserted on the upper side of the sub-terete rhachis, unequally auriculate, upper auricle smaller than the lower one, and adpressed to the rhachis. Nerves radiating from the insertion of the leaflet, basilar arcuate, the others sub-arcuate, once or more dichotomous. Epidermis with elongate deeply sinuous cellules.

O. Mandeslohi.— Kurr. Talgai Diggings, Queensland (Tenison-Woods, l.c., p. 151).

Zeugophyllites (Brongniart).

Fronds (?) petiolate, pinnate, opposite (?) oblong, nerves valid few, equal, becoming confluent at the base and apex.

Z. elongatus (Morris).

Stem (?) leaves petiolate, oblong elongate, entire truncate, and slightly thickened at the base; veins distinct, equal, parallel.

Localities.— TASMANIA — New Town, Richmond, Jerusalem, Impression Bay, Seymour, Ben Lomond, York Plains, Longford, Hamilton. N.S. WALES—Mulimbimba (?).

References.—Morris, Strezelicki's Phys. Descrip. N.S. Wales and V.D. Land, 1845, p. 250, t. 6, f. 5, 5a; M'Coy Annals. Nat. Hist., 1847, XX., p. 152; ibid Proc. R. Soc., V.D. Land, 1851, 1, p. 309; Tenison-Woods, Proc. Lin., N.S. Wales, 1883, Vol. VIII., pt. 1, pp. 151-152; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 101.

NŒGGERATHIOPSIS (Feistmantel).

Leaves unknown, leaflets (pinnules) wedge-shaped from the base, or elongate-spathulate, sub-rhomboid or obovate, margins straight or incurved; nerves close and numerous, somewhat thick at the base, and from thence forking twice or oftener, becoming slender and diverging into the leaf.

NŒGGERATHIOPSIS SPATHULATA (Dana).

Leaves short, spathulate, apex triangular and sub-acute, narrowed at the base, and thence gradually dilating; nerves very delicate, and only partially distinct, four or five veins in the breadth of a line.

Localities.—N.S. WALES———— (?). TASMANIA (?).

References.—Tenison-Woods, l.c., p. 153.

NŒGGERATHIOPSIS MEDIA (Dana).

Elongate, lanceolate, tapering towards the base, and broadest within an inch of the apex. Extremity sub-triangular, and apex rounded. Veins a little divergent, about fifteen to half an inch. One leaf five inches long, about an inch wide within an inch of the apex, and a fourth of an inch at base; another shorter.

Localities.—TASMANIA — Mersey Coal Basin. N.S. WALES—Newcastle.

References—Tenison-Woods, l.c., p. 154.

NŒGGERATHIOPSIS ELONGATA.

This is a doubtful species, which Dana identified with *Zeugophyllites elongatus* Morris, but says that it was found at Newcastle, which is clearly an error. He says that it may be identical with Goeppert's *N. distans*, but that plant grew in clusters, and, moreover, had veins bi-furcating in the middle, which does not occur in Morris's fossil. (Tenison-Woods).

Locality.—N.S. WALES—Newcastle.

References.—Tenison-Woods, l.c., p. 154.

NŒGGERATHIOPSIS PRISCA (Feistmantel).

Leaves unkown, leaflets (pinnules) medium-sized, sub-rhomboid, obovate, slightly inequilateral, nerves close and fine, emerging radiately from a narrow base, and forking twice or thrice.

Greta Creek, N.S.W., under the marine Paleozoic fossiliferous strata. (Tenison-Woods, l.c., p. 154).

Cordaites (Unger).

Stem, a simple woody cylinder without medullary rays, but composed of radiating scalariform vessels, encircling a large pith with transverse lamellar partitions. Bark marked with leaf-scars. Leaves simple, sessile, very long, flat, parallel-sided, with broad clasping base, easily disarticulated from the stem, no midrib, but fine parallel neuration.

Cordaites Australis (M'Coy).

Leaves several inches long, thick, flattened, parallel-sided, with unequal, longitudinal, simple parallel striæ; clasping base, slightly widened and bent a little downwards. Leaves at one inch from the base, about four or five lines wide; base about two to three lines wider.

Localities.—Tasmania—Mersey Basin (?). Victoria—Upper Devonian Flags, Iguana Creek. Queensland—Gympie, Drummond Range. N.S. Wales—Mulimbimba.

References.—M'Coy, Geol. Survey, Vic., Dec., IV., 1876, p. 22, t. 36, f. 6-7 ; Tenison-Woods, Proc. Lin. Soc., N.S. Wales, 1883, Vol. VIII, pt. 1, p. 155 ; R. Etheridge, jun., Cat. Aust. Fossils, 1878, p. 30.

Class.—Coniferæ.

Trees or shrubs, mostly with resinous secretions, the leaves are stiff, sometimes linear or needle-like, sometimes short and scale-like, or more rarely broad-lobed, or divided. The flowers are unisexual, either in cylindrical or short catkins, with closely packed scales, or the females are solitary. There is no perianth. The stamens in the males are either inserted on the axis of the catkin under the scales or the anther-cells are sessile, on the inside of the scales themselves, which then form part of the stamens. The ovules and seeds are naked, that is without ovary style or pericarp, although sometimes more or less enclosed in two bracts, or in a fleshy or hardened disk. The seeds are albuminous with one, or sometimes several embryos in the centres, each embryo having sometimes more than two cotyledons. (Tenison-Woods).

Localities.—Tasmania—Upper Coal Measures and Lower Coal Measures, silicified trunks abundant. See also :—

Taxites medius, Tenison-Woods (ibid, l.c., p. 160, Queensland).
Sequoites (?) Australis, Tenison-Woods (ibid, l.c., p. 162, Queensland).
Walchia Milneana, Tenison-Woods (ibid, l.c., p. 163, Queensland).
Cunninghamites Australis, Tenison-Woods (ibid, l.c., p. 165, Queensland).
Aracaurites polycarpa, Tenison-Woods (ibid, l.c., p. 165, Queensland).

REMARKS ON TIN ORE DEPOSITS AT MOUNT BISCHOFF, TASMANIA.

By Baron Von Groddeck, Chief Mining Councillor of the Hartz Mining Districts and Director of the Royal Prussian Academy of Mines at Clausthal, Germany.

Translated by G. Thureau, F.G.S., *from the Special Imprint of the Journal of the German Geological Society of* 1884.

Read September 7th, 1885.

The Royal Academy of Mines at Clausthal was some time ago placed in possession of a very fine collection of Australian ores. That collection was presented to our Academy by M. Wagenknecht, of Aachen (a Fellow of the Royal Society of Tasmania).

Amongst the samples were found a number of specimens of Tin Ore, together with the rocks and the minerals said to be associated with same, from Mt. Bischoff, Tasmania. The series interested me, particularly on account of a piece of supposed Quartz-Porphyry, which rock, it was represented, is associated (according to the description of S. H. Wintle* and Geo. H. F. Ulrich†) with those Tin Ores, and also because of some peculiar, dense, greyish-blue coloured masses of mineral‡ which most frequently are found to enclose those Tin Ores.

The chemical and microscopical tests gave the unexpected and interesting result, proving this Quartz-Porphyry to be a kind of *Topaz* rock of porphyritic structure, the white or light-coloured portions of same consisting of dense Topaz, whilst the greyish-blue were principally formed of dense Tourmalines.

As this appears to be—so far as I am aware—a totally unknown occurrence of Topazes with Tourmalines carrying Tin Ores, a description of same may be, under the circumstances, justified. As to the value of this discovery, from a geological point of view, I am not able to form an opinion, and such can be only ascertained properly after a careful

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* S. H. Wintle; Stanniferous Deposits of Tasmania. Trans. Royal Society of New South Wales, 1875, vol. ix., page 87.

† Geo. H. F. Ulrich. Written communication; New York Book for Mineralogy, etc., 1877, page 494.

‡ These dense masses of minerals at first led to the belief, from the peculiar structure of same, that they were the results of transmuted Quartz-Porphyries. An analogy certainly exists in the well-known transmutation of Granites, carrying Tin Ores, into "Greisen" or a felspar—less rock. These possibilities gave rise to the now detailed researches; and this paper was read by me at a meeting of the German Geological Society at Hanover in September, 1884. At that time I was not aware of the real character of the supposed Quartz-Porphyry. The special examinations of same were initiated in October of the same year.—V.G.

examination of the several features observable in the respective localities. To initiate and induce such examinations the following may deserve attention:—

1. Porphyritic Topaz Rock from Mount Bischoff.

This resembles, to a considerable degree, the Quartz-Porphyries, whether such is examined by the naked or unarmed eye or by means of powerful lenses. It consists of a light grey-coloured, dense, hornstone-like base, in which numerous transparent Quartz-crystals can be observed up to 3 mm. in size. One imagines, likewise, of being able to distinguish, in the white coloured cross fractures of this rock, crystals of felspar. It carries also Iron Pyrites in both large and small crystal or in crystalline aggregations.

A preliminary chemical examination showed that, after the removal of the metalliferous ores, the pulverised rock would completely fuse with soda, but that hydro-chloric acid had no effect except the deposition of a white precipitate, composed of Silicious Acid and Alumina. Distinct Fluor reactions were observed with traces of Lime and Magnesia, but alkalis were not present.

The special chemical analysis of this sample of rock, freed from iron pyrites through nitric acid, as carried out by Dr. Sommerlad in the Royal Academy's Laboratories, gave the following results:—

Silicious Acid	76·68
Lime	1·19
Fluor	6·48
Alumina	19·99
Magnesia	Traces
Phosphoric Acid	Traces
Total	104·34
Specific Gravity	3·014

Two separate tests were made, according to Rose's method, for ascertaining the percentage of Fluor. The high percentage of Fluor, and the total absence of alkalis, are therefore convincing proofs of this rock not belonging to the Quartz-Porphyries, and that it can now be stated that it consists of, in round numbers, 35 per cent. of Topaz and 65 per cent. of Quartz. To what form the 1·19 per cent. of Lime in this rock can be assigned is not quite clear; but it is quite possible that some very minute crystals of "Titanite"—to be described lower down—contain this Lime. In the same manner, it is doubtful also how the Phosphoric Acid occurs, except with "Apatite." The solution which was obtained by treating the ores with Nitric Acid in order to secure their extraction was found to contain a considerable percentage of

Lime, owing to some Calcites which the microscope had previously discovered.

On placing the pulverised rock into a "Thoulet's" solution of 3·202 specific gravity, the ore was gradually precipitated, and on analysis of that precipitate, the presence of Iron Pyrites was detected with slight traces of Antimony, Copper, and Zinc. The chemical and microscopical examinations which followed established the composition of the rock as follows:—Quartz, Topaz, Iron Pyrites, Calcite, Titanites, and Apatite (?) of which the first two form the leading, and the remainder the less important constituents. The base of the Topaz, as ascertained by analysis, appears, in the microscopic slides under their proper magnifier, as an aggregation of colourless and irregularly formed crystalline grains not above 0·02 min. measurement. Every now and then—especially in the vicinity of the crystals of iron pyrites, the basic Topaz partakes of a more fibrous texture, gaining thereby an appearance which very closely assimilates with the denser whitish Topaz referred to below. The very small crystals, already alluded to, as having been observed in the fractures of the rock itself, sometimes enclose such fibrous Topaz, and they are frequently coated by a whitish mineral, which on account of its granular composition renders the inner or enclosed crystals necessarily less clear, but opaque. It has been impossible for me, at present, to classify these small crystals under any distinct system. It is likewise not possible to declare same as "*pseudo-morphic*" as there are no grounds for such an assumption. On the other hand, they may be accepted as imperfectly formed, minimised crystals of Topaz —*microscopic Pycnite* (*?*)—as composed of very minute fibrous crystals, and that their want of clearness is due to those incrustations. It remains now only to be observed, that within those minute crystals, grains or specks occur, which exhibit vividly coloured polarising colours (also of Topaz) as well as irregularly formed particles of iron pyrites.

The Quartz occurs in the basic mass of the rock in the form of crystalline grains or aggregations from 0·06 to several mins. in measurement. To judge from the very regularly developed form—six sided—of some of these crystals, and their behaviour, when crossing each other's positions, the well-known Dihexadron would most likely be their form under that system, if accompanied by the narrow column sides which are so frequently observed when embedded in Quartz-Porphyries. On magnifying these transparent and polarising crystalline aggregations 400 times their original size, they exhibit frequently those well-known vesicular openings filled with fluids. Fluids, because, they do not appear to consist of carbonic acid, as is sometimes the case,

on account of their immobility and I have not, so far, been able to observe any really distinct changes in their position. Various granular and crystalline-foliated minerals could not likewise be defined to satisfaction. Very fine, needle-like crystals occasionally occur, and they may, in all probability, hereafter be recognised as *Apatite*, which would explain the presence of phosphoric acid as shown by the analysis, which acid has not been found in any other form in the rock. The aggregations of iron-pyrites exhibit in the thicker slides under the microscope some very interesting features, as one is enabled to recognise cubes from 0·05 to 0.15 min. in length, edgewise. These crystals are sometimes enclosed for over half their length in quartz crystals, the remaining half being embedded in the basic Topaz. Other very peculiar features are also observable with some very long fibrous forms, measuring from to 0·1 mm. in width by 0.3 to 0.7 m.m. in length, also partly or wholly encrusted by a very thin coating of Calcite. These are very probably lengthened cubes, which have, by some occult means or another, developed in one direction more than in another. These cubes are irregularly formed crystals of iron pyrites, Besides these, there also occur rectangular, nearly cubical, but otherwise irregular crystals of iron pyrites, measuring from 0·35 to 2 mm. in size; impregnated as they are sometimes by crystals of quartz and Calcites; these latter predominate sometimes to such a degree over those sulphurets, which however retain their crystalline form, as to make same quite subordinate so far as proportions or percentage are concerned.

The Calcites occupy various forms and positions within these iron pyrites, and they are confined sometimes by peculiar minute botryoidal and oblong crystals, brownish red in colour, which, from their general appearance, their distinct pleochroism, and the absence of the former fibrous forms, and being accompanied by a very vivid rainbow-like polarism, cannot be mistaken for any other but "*Titanite.*"

The Calcites of this rock, so easily distinguished by their vivid iridescent properties, occur most frequently in the form of impregnations of the iron sulphides, also in distinct, but smaller particles. These crystals of quartz and iron pyrites are evidently of a remoter origin than the basic mass of Topaz. Could it be assumed, for instance, that the latter consisted, whilst in the course of formation, or partook of the gelatinous compound?

2. Dense White Topaz of Mt. Bischoff.

This rock exhibits in its peculiar uneven and splintery fractures a trace crystalline.

When heated, in a solution of Cobalt, it turns blue, and gives distinct reactions with Fluor. After roasting, the fact of Hydrofluoric, or Muriatic acids, having no effect is a distinguishing feature.

Dr. Sommerlad's analysis gave the following results :—

Silicious Acid	33·34
Aluminous Acid	37·02
Lime	0·83
Fluor	17·64
Total	108·73
Specific Gravity...	3·456

The alterations from the normal composition of Topaz (5 Al Si O5 + Al Si Fl10) are very insignificant, indeed, and they may be attributed to these impurities, the existence of which have been demonstrated when under the microscope, but the percentage of Lime is very remarkable as such cannot belong to the Topaz proper, but is due to other minerals interspersed through the rock. The "slides" of this dense white Topaz exhibit an aggregate of irregularly deposited streaky or oblong groups of needle-like prisms from 0·01 to 0·05 min. in width, to 0·04 to 0·3 min. in length, showing also, across their diameter vivid rainbow-like colours, which, however, disappear entirely with their longer axis. Only very rarely—as quite natural—are the rhombic cross-sections observable in the directions just alluded to. The terminal apices of these prisms resemble those, with crystallized Topaz, customary pyramidal and domatic points.*

To judge from the specimens now before me, dense Topaz, intermixed with dense greyish blue Tourmaline, can easily be discerned with the naked eye, though the latter occurs in forms unlike its usual character, maintaining, however, the ordinary fibrous forms.

Tourmaline is seen distinctly in the "slides," in the form of botryoidal nests and as filling cavities of the Topaz rock.

3. Tourmaline from Mt. Bischoff.

This occurs also in the Carbonates of Iron as needles measuring 0·25 mm. thick, to 1 m. in length, from dark green to blackish colours. "Slides" exhibit the same likewise, as a dirty violet nucleus, which is enveloped by a greenish coating. Their pleochroism is very strongly marked, and the colouring partakes of lighter and stronger tints, according to the manner and position in which the crystals

* G. vom Rath has already described Topaz crystals from the Waratah Mine, Mount Bischoff, as from ¼ to ½ min. in size. These crystals formed fine crystalline aggregations in which crystals of Cassiterite were embedded. Also the occurrence of nests of radiating crystals of *Pycnite*. Bonn, 1879.

are being held by the observer. These proportionally larger crystals of Tourmaline are gradually developed from a granular and indistinctly radiated mass which appears under the microscope as finely radiated or irregularly fibrous. The mineral in question fuses, under the blow-pipe, with but little effect at the edges and it gives distinct reactions of Boron, and very little of Fluorine.*

Dr. Sommerlad has undoubtedly proved, from decimal analysis, that these light greyish blue masses of minerals are Tourmalines.

Silicious Acid	36·86
Aluminous Acid	36·72
Boracic Acid	10·56
Peroxyde of Iron	5·66
Peroxyde of Manganese	0·66
Lime	0·34
Magnesia	3·92
Kali (Potassium)	1·11
Natrium	3·57
Water	1·16
Fluor	0·61
Total	101·17
Specific Gravity ...	3·042.

Closing Remarks.

According to the descriptions given by Messrs. Wintle and Geo. H. F. Ulrich of Mt. Bischoff, it would appear that, on the top of that mountain, there occurs a bold stockwerk-like mass of porphyry which has penetrated a non-fossiliferous, and very probably, very old formation of slate, sandstone and quartzite. These latter exhibit, in the immediate neighbourhood, or, within the contact planes of the porphyries, great irregularities and considerable contortions in the bedding of the strata.

Wintle speaks of tinlodes in this porphyry; according to Ulrich, however, the tin ores occur as impregnations of the porphyry only, and principally so within the planes of contact with the schists. Ulrich reports also that the Waratah Company at the south-eastern flanks of the mountain is engaged in the exploitation of a lode (?) of Quartz-Porphyry carrying tin ore, which intersects independently the adjacent schistose (blue) formation.

It is quite evident, from these descriptions, that the

* These coarse needle-like aggregations of Tourmaline from Mt. Bischoff have that peculiar appearance, and remind strongly of those of *Zeuxite.*

Quartz-Porphyries at Mt. Bischoff must be considered the "carriers" of tin ores.

The specimen, I have been presented with, and which I have described as closely resembling Quartz-Porphyry, had therefore to be recognised as representing the occurrence of tin ore at that mountain, and therefore as occupying a very important position.

If, however, it has now been unmistakably proved that that specimen is actually not Quartz-Porphyry, but, a *porphyritic Topaz Rock*, then the question arises, whether any such Quartz-Porphyry occurs at Mt. Bischoff *at all*, and whether the whole formation, assumed to be such rock, is very probably a Topaz Rock, and in what manner, and under what conditions the latter occurs contiguously to the real Quartz-Porphyry.

The Topaz Rock, as described, is certainly a very remarkable formation in its character, and it is to my knowledge exceptional in its kind. I have named it Topaz Rock, because of its composition—like the well-known *so-called* Topaz Rock, near Auerbach, in Saxony—of Quartz and Topaz, though there it exhibits not the slightest resemblance in its mode of occurrence to that of Mt. Bischoff.

A probably not unimportant fact, which tends to connect both of these occurrences, otherwise so widely apart, should not, at this stage, be omitted to be mentioned. M. Breithaujet,* it should be borne in mind, has already proved that the Topaz Rock of Auerbach forms, at the surface, a huge well-like mass, which in itself contains or forms an immense lode of Tin Ore.

Topaz, it is well known, is a very frequently and widely disseminated mineral in close conjunction with Tin Ore deposits; but, to our knowledge, such an extraordinarily developed formation as that at Mt. Bischoff in Tasmania is not known to exist elsewhere. The occurrence of Tourmaline there is also very different from any other known in connection with Tin Ore deposits. These two minerals—viz., Topaz and Tourmaline (which are, however, not even mentioned in Messrs. Wintle and Ulrich's descriptions)—in their *dense* forms appear to play a very important and prominent part in the celebrated Tasmanian Tin Ore deposit. It might prove, in all probability, very interesting and valuable to ascertain whether or not such dense—and therefore easily passed over—masses of Tourmaline occur also with other Tin Ore deposits.

A. Von Groddeck.

* New Year Book for Mineralogy, 1885, page 788.

MOSSES OF TASMANIA *(continued)*, TRIBE 2, WEISSIÆ.

By R. A. Bastow.

[*Read October 12th*, 1885.]

It will be understood from the previous papers that the Andreæaceæ and the Sphagnaceæ are so far removed from other mosses as to each form separate sub-orders, the remaining sub-order Bryaceæ containing two Sections, which are again divided into Tribes. Tribe 1, of this sub-order, containing Phascæ and Bruchia, has already been described, and we now notice Tribe 2.

The Weissiæ are a low and tufty growing tribe, with narrow leaves, and are difficult subjects for the tyro to identify. The tribe includes the genera Gymnostomum, Weissia, and Symblepharis; the first of these is distinguished by the total absence of a peristome around the mouth of the capsule; the second, Weissia, bears a peristome of sixteen teeth; and the last, Symblepharis, has eight pairs of bifid teeth at the summit of the capsule. The three genera are similar in their mode of growth, generally not more than half-an-inch in height, and, when dry, the foliage curls and twists around the fruit-stalks, or anything they come in contact with; under an ordinary botanising lens they resemble a multitude of miniature rams' horns. The capsule, with its fruit-stalk, is generally yellowish-green, the rim around the mouth of the capsule being of a decided reddish colour.

The fact that these three genera of mosses are placed in one tribe (Mitten places them in the Tribe Tortulæ), and yet that one of them is gymnostomous, is in conflict with the ordinary view that split-mosses and naked-mouthed mosses are the earliest forms. The affinity of the vegetative systems of the three genera appears too close to strongly support such a view, notwithstanding the entire absence of the peristome in the genus Gymnostomum. Indeed, M. Philibert, in the *Bryological Review*, 1884,* states his belief that the earlier structure is the perfect peristome from which the others have varied by degeneration, and he would have us regard the Encalypta †(extinguisher moss) as the central point whence all the other forms of moss-plants have diverged, all those which have a

* Journal, Royal Mic. Soc., Feb. 1885, p. 100.

† Since reading the above paper, I have received from Alfred J. Taylor Esq., some magnificent fruited specimens of the genus Encalypta found by him at the summit of Mount Rumney.

peristome nearly identical in structure being probably of a common origin; also, that it is difficult on any other theory to account for the almost complete identity of the peristome in *Dicranum, Fissèdens, Campylopus, Dicranella, Cynodontium, Trematodon, Dichodontium, and Leucobryum.*

That gymnostomous mosses as well as peristome-bearing mosses existed in the upper Miocene age we have abundant proof. In reply to a request for information on this subject from Baron Von Müller, whose life-long investigations in botanical science constitute him the highest authority in the Southern Hemisphere, he, with his usual courtesy, informs me "that Gæppart found one Phascum in amber; also, in amber, several species of Dicranum, as D. fuscescens, D. flaggillare, D. scoparium, and D. pellucidum; a Hymenostomum, which Schimper finds very similar to H. microstomum; two species of Polytrichum allied to P. urnigerum and P. septentrionale; and a Catherinea allied to C. undulata. Schimper has described a Fontinalis from the upper Miocene formation, and Bragniart another from that geological age. Of Hypnum, several species have been found by Herrs Ettingshauren, Unger, and Saporta in Schists; and Ludwig and Schimper discovered some Hypnums in lignite, in which also some species of Sphagnum occur." After alluding to the special works of the above-mentioned authors, I am particularly referred to Schimper's "Paleontologie Vegetate," a work we unfortunately do not possess in the Library.

It is therefore evident that gymnostomous Sphagnum and Phascum, single-peristomed Dicranum, and the perfectly-developed double-peristomed Hypnum flourished side by side comparatively in the upper Miocene age. Had no Phascum or Sphagnum been in this formation we should have been in a better mood to embrace M. Philibert's view; on the other hand, had no perfectly-developed Hypnum been there found we might have felt a little closer drawn to the old views of development from gymnostomous forms.

Had moss-plants been as large as Sigillaria pachyderma we might have known more of their history, the little we have received creates the want for more. If the perfect double-peristome is the earliest structure, from what allied form can it have varied? Does it not appear more probable that the double-peristome has been developed by slight variations, one small step at a time, through climatic influences, from the single-peristome? May not the single-peristome, in like manner, be developed from the gymnostomous plant; the gymnostomous from the splitting capsule—the latter through leafy, then frondose jungermannia, lichens, fungi, or algæ; and all from the unicellular organism; the primary organism originating from beyond the limit of present discovery?

If, for instance, in a plant of any of the species of three genera comprising the Tribe Weissiæ, after fertilisation of the archegonium, the slightest deviation in the division of the cell by septa should take place, we should most probably have a variation of greater or less significance in the fructification:* it is, therefore, astonishing to note the almost complete immutability of the Natural Law which maintains, for trillions of generations, not only the generic but also the much more minute specific characters of so small a part as is the tooth of a deristome. And if such diverse forms have really been developed from a unicellular organism how vast the intervening period must have been.

Genus 5.—Gymnostomum.

Beardless Moss.

The Greek words of which the name of this genus is composed are γυμνος (naked) and στομα (mouth), referring to the naked orifice of the capsule. According to Bridel, this plant is frequently found intermixed with Phascum and Weissia, and has an erect simply-branched stem about half-an-inch high. The capsule is seated on a high and seldom arcuate fruit-stalk; it is small, and loves to be near the habitations of mankind, growing in both barren and cultivated fields amongst grass. It is generally found in tufts, seldom growing solitary. In its fresh state it is a graceful little plant, but cannot be well observed without the aid of a lens. The essential generic characters are the naked mouth and the linear lancet-shaped leaves.

Genus 6.—Weissia.

This genus was instituted by Hedwig in memory of Weissius, Professor of Botany, Göttingen. The plants are small, tender, and slightly branched; the capsule bears a peristome of sixteen teeth. They must be looked for on moist banks or damp sandy places; they may frequently be found in crevices along with Fissedens, and sometimes on wall tops. The species of this genus present much variation in form, and will sometimes be found very similar to Gymnostomums. The light green tufts have a beautiful cushion-like appearance, hence the English name for W. contraversa — *green-cushioned Weissia.*

Genus 7.—Symblepharis.

Wilson.

This genus is so named by Mr. Wilson because the teeth of the peristome shut close in a cone when dry, the name literally meaning *adhesion of the eyelids.* Bridel names the only species of this genus collected in Tasmania Olomitrium

* Hofmeister on the higher Cryptogamia.

perichætiale; Hooker names it Trichostomum perichætiale in Musc. Exot.; and Griffiths figures it as Didymodon perichætiale. The name Symblepharis is, however, expressive of the appearance of the capsule, and, as we find it in Flor. Tasm. arranged as above, it will be advisable so to accept it here. The perichætal leaves are very long, and, when dry, twist around the fruit-stalk sometimes as high as the capsule.

TRIBE 3.—FISSEDENTIÆ.

Genus 8.—Fissedens.

The character of the foliage of this genus at once distinguishes it from any other genus of mosses. It is the little beauty of the whole Natural Order. To make its acquaintances we must explore the very little caves and grottoes to be found n every shaded clayey bank, for the small plume-shaped fronds appear to avoid exposure to the strong light of day, as well as to seek shelter from the passing storm. At this time of the year the minute capsules cast off their lids and expand the bright red peristomes in order to permit the contained spores to mature and escape; in this state they present a charming appearance under a low power of the microscope. The foliage is distichous; this character gives the charm to the plant; indeed observed with a common pocket lens a tuft of Fissedens presents the appearance of a Lilliputian fernery with the addition of richly coloured masses of peristome crowning the gracefully curved fruitstalks.

The African traveller, Mungo Park, has made famous a variety of the first species of this genus, Fissedens bryoides; after being exposed in the sultry parts of that continent to many privations, towards the close of one day the traveller, sad, faint, and weary, sat him down to rest and consider his position; his eye rested upon one small tuft of this moss in the wilderness around him, he gathered it, and as he did so, after a little reflection, he took encouragement therefrom, and banished the fear of a scorching grave in the unknown waste from his mind, the promise of moisture was before him, and in a short time he escaped the danger that had just before appeared so threatening.

One species, F. adiantioides, fruits laterally, and, as its name implies, resembles, on a small scale, a species of Adiantum. The genus at one time belonged to the Dicrani, and if the form of the peristome, which is undoubtedly the Linnæan rule for drawing the generic distinction, be adhered to, it should abide amongst them; but when so great an authority as Mr. Wilson, the author of the Musc. Britt., thinks it wise to employ the characters founded on the difference of foliage, and when other eminent authorities concur therein, we must abide by that arrangement. The

peristome is similar in both genera, but the leaves of Fissedens are distichous, whilst those of Dicranum are inserted on all sides of the stem. The teeth of the peristome are bifid, and the divided limbs are usually bent back in the form of a flesh-hook: hence the original name of the genus Dicranum.

TRIBE 4.—LEUCOBRYACEÆ.

Genus 9.—Leucobryum.

White Fork-Moss.

Hedwig placed this moss amongst the Dicrani as the teeth of the peristome were similar, but the pale and sometimes bluish grey colour and cellular structure of the foliage sufficiently distinguish it from the Dicrani. Müller has consequently placed it in the Leucobryacæ, and he states that in viewing the leaves at an acute angle the prismatic colours are seen. It grows in moist ground, on heaths, in bogs, at the roots of trees, and on decaying wood.

TRIBE 5.—DICRANACEÆ.

Genus 10.—Dicranum, *Hedwig.*

Fork-Moss.

The peristome of Dicranum is similar to that of the two preceding genera, and at that point the similarity ceases. The stems of the plants of this genus are erect and branched, they grow vigorously in company with Bryum and Polytrichum, the leaves are generally bent to one side (secund), they are narrow and numerous, and usually have a fine narrow nerve to the apex of the leaf. The capsules are seated on high fruit-stalks, are frequently plentiful, they are cernuous, and sometimes erect. The lid of the capsule is furnished with a long beak, bent somewhat to the shape of a shoemaker's awl. They may be found on mountains and in valleys, in woods, fields, and almost everywhere, except in water. They usually grow in large tufts, and are frequent on old logs in the bush around Hobart. The fruiterers of the city generally have a good supply of Dicranum in their windows; it may be easily distinguished from other mosses by its long bristly bundles of leaves, which have somewhat the appearance of miniature horse-tails.

The accompanying photograph will convey a correct idea of the usual form of Dicranum capsule, also of the bifid apices of the teeth of the peristome. These photographs have been taken by the microscope with a $1\frac{1}{2}$in. objective, a small camera without the lens, and an ordinary microscopic lamp.

EARTHQUAKE PHENOMENA IN TASMANIA.

By Capt. Shortt, R.N. (Meteorological Observer.)

[*Read November* 16, 1885.]

Since last November when I read a former paper on earthquake shocks and tremors, and up to the present time there has been a considerable decrease both in the number and intensity of the shocks, excepting that of May 13th.

From the table annexed with this paper, giving the time of occurrence, it will be observed, that at Gabo the shock is felt earlier than in Tasmania, also shocks have been felt farther inland on the continent of Australia, showing that the centre of disturbance during the past year, is to the north of the centre, marked in the Coloured Map, produced in my previous paper. The disturbance has been felt very severely at the Kent Group Lighthouse about a dozen panes of glass have been broken from the commencement.

To strengthen the position I have taken in fixing the probable centre of disturbance. I will introduce the views of Professor Milne, of Japan, who recently visited Victoria and Tasmania, and published an article in the Melbourne *Argus* on the earth movements in Australia. He is undoubtedly a great authority on Seismology, on account of Japan being always more or less in a state of disquietude from shocks and tremors, and his having had charge of the Seismological Department for some ten years, making a study of the Volcanic Phenomena, and his investigations have not been confined to actual disturbances, but also by experiments with dynamite discharges in the earth at various depths, by which he has gained much knowledge as to the rate of progression of shocks through different strata.

The following are his conclusions on the disturbance affecting us:—"From the various investigations which have been made, it appears that there is a line of weakness in the earth's crust running parallel to the eastern coast of Tasmania. From time to time, whilst sinking to a state of equilibrium, this line gives way, first at one point and then at another. Each of these movements is announced as a series of tremors which now and then may be accompanied by one or more violent lurches. If this is a correct view to take, then, in a few years, it is possible that actual stability may be reached, and the earthquakes of Tasmania and Victoria become tradition of the past.

"A second view is that the disturbances are directly connected with the capillary intrusion of sea-water to volcanic foci, consequent on which there are explosions and ruptures

along the above-mentioned line of weakness. Be it as it may, it is certainly remarkable that the greater number of earthquakes in the world occur in volcanic countries, but not actually at volcanoes. They usually originate on or near the foot of a slope beneath deep water. Eighty per cent. of the earthquakes in Japan have such an origin. The great earthquakes of South America, which are sometimes propagated to the shores of this colony as a series of sea waves, originate beneath the deep water off the western coast of that continent. Many of the earthquakes of New Zealand have originated beneath the ocean at the entrance to Cook's Straits.

"Lastly, we have the earthquakes which have so recently been felt in Melbourne, probably originating, as pointed out by Captain Shortt, near to the edge of the 2,000 fathom line off the north east shore of Tasmania."

Reports on the Earthquake Shocks, 1885.

January 1.—Barque Free Trader at sea, when 80 miles to the Eastward of Flinders Island, experienced a severe shock at 2 p.m., duration about 10 seconds.

January 31.—The Superintendent of Swan Island Light House reports that a shock was felt at 12h. 36m. a.m. The Light House appeared to rock, and everything seemed to be on the move for several seconds.

February 27.—9h. 35m. p.m. at Swan Island, severe shock, was reported as remarkable, as during several seconds, the iron roof on Superintendent's dwelling house sounded as if it was tearing in all directions, but no damage was sustained.

March 21. and 30.—Medium strong.

May 13.—This shock was the heaviest experienced since September 19, 1884, and the great distance the shock was felt from the centre of disturbance shows it to be as strong as the very severe one of July 13th last year. Extending to Corrina to the Westward, Melbourne N. W.; and to the North to Candello, which is 258 miles South of Sydney. It was felt severely at Hobart and Launceston. Vessels lying alongside the wharves at Hobart were surging backwards and forwards, as if there was a ground swell moving the ships.

Also at Sandridge the effect on the shipping was most noticeable.

Mr. J. R. Hurst, of Moorina, in describing the shock, states that he saw cats and dogs flying about the yard, in great alarm, and a mob of cattle grazing in a paddock in the same state; dead standing trees in the clearing were moving about in nearly a North and South direction, and small branches falling from them, wave-like motions were observed upon the earth under foot.

July 17.—Strong shock, loud and long rumblings at Moorina.

August 7.—At 8 p.m. barque Kassa experienced sharp shock of earthquake when 30 miles East of Cape Barren Island.

September 11.—The strongest since the 13th of May.

Before concluding I beg to thank Mr. R. M. Johnston, and Mr. J. Clunies Ross, for the assistance I have received from them in acquiring knowledge of earthquake phenomena, as it comes more under the province of Geologists, than Meteorologists. The Secretary of the Meteorological Society, London, in acknowledging receiving my previous paper on shocks and tremors, remarked that the Phenomena has not been recognised to have any connection with the Weather and Meteorology.

I also wish to make acknowledgments, and return my thanks to those observers who have rendered me assistance in furnishing records of shocks that have come under their notice.

TABLE OF THE SEVEREST SHOCKS, NOVEMBER, 1884 TO NOVEMBER, 1885.

TIME OF SHOCKS ON THE CONTINENT CORRECTED TO HOBART TIME. A.=A.M., P.=P.M.

Month.	Date.	Hobart.	Launceston.	Moorina.	Falmouth.	Corinna.	Gabo Isl'd.	Wilson's Promontory	218 miles S of Sydney, Candello.
1884. Dec.	20	—	—	7·8 P	—	—	7·5 P	—	—
1885. January	31	12·55 A	12·53 A	12·57 A	—	—	12·50 A	—	—
February	27	9·50 P	9·49 P	—	—	—	9·45 P	—	—
March	21	9·13 A	9.11 A	9·7 A	9·20 A	—	9·10 A	9·20 A	—
March	30	—	—	9·13 P	9·15 P	—	9·10 P	—	—
May	13	9·38 A	9·37 A	9·39 A	9·40 A	9·45 A	9·35 A	9·37 A	9·45 A
July	17	8·38 A	8·35 A	8·32 A	8·35 A	—	—	—	—
Sept.	11	7·19 P	7·20 P	7·17 P	7·25 P	—	—	—	—

NOTES ON BORING OPERATIONS IN SEARCH OF COAL IN TASMANIA, 1884. (*Continued.*)

By T. Stephens, M.A., F.G.S.

[*Read November* 16, 1885.]

In continuation of the short paper read last year on the works then in operation at Cascades, Hobart, and at Tarleton, I now lay before the Society the records of boring with the diamond drills, together with a few remarks on the results. I have, on several occasions, pointed out the extreme improbability of the discovery of coal in either locality, but there were many who held a different opinion, and it was well that the question should be set at rest

The work at the Cascades was much impeded by the "jointy" character of the rock, which from the surface downwards showed unmistakeable signs of disturbance, such as might be expected from the presence of great faults crossing the valley on both sides and from the proximity of eruptive rocks. Circumstances prevented me from visiting the place from the beginning of March until after the works had been stopped, but I was informed from time to time of what was being done. In the month of August I was informed that the drill had struck "granite," and a glance at a core, sent to me by order of the Minister of Lands, enabled me to report that the trap rock had been reached, and that further exploration was useless. After the stoppage of the work I ascertained, by inquiry and by examination of the cores which had been preserved, that the igneous rock, which is the common diabase or "greenstone" of the neighbourhood, had been first struck by the drill between 509 and 519ft. from the surface, and had therefore been penetrated to a depth of about 100ft. before its true character was recognised. That it is here an intrusive rock, and therefore newer than the Upper Palæozoic beds, which are in contact with and partly overlie it, I have no doubt at all; the superficial evidence of local disturbance, the joints and fissures filled in with calcite and pyrites, the alteration noticeable in various bands, which differs according to their lithological character, and is in exact conformity with that which is always associated with the presence of intrusive rocks, point unmistakeably to this conclusion. I regret to find that on this point I am compelled to disagree entirely with my friend, Mr. Johnston, who, in a paper recently read before the Society, cites this as an instance of the priority of the igneous rock to the sedimentary beds with which it is associated.

The records of the boring at Tarleton call for little remark. The coal measures proper were found to continue to a depth of a little over 200ft. below the seam of coal, being succeeded by Upper Palæozoic marine beds apparently conformable to them and reaching to a further depth of 105ft., where, at 370ft. 6in. from the surface, the Silurian limestone easily recognisable by anyone acquainted with the district was struck, and the question of the existence of another seam of coal definitely settled there at least. It may be well to note the circumstance of the absence from the records of any mention of the marine beds usually found overlying the Mersey coal seam. These beds, as was first pointed out by Mr. Hainsworth, are never found nearer the coal than 50ft., and, therefore, would not be met with in a section which begins only 41ft. 9in. above the seam.

In my former notes on this subject I gave a brief sketch of the possible relations of the coal measures of Tasmania to those of New South Wales, in which I ought, perhaps, to have pointed out that the presence of *Gangamopteris* in the Mersey beds suggests a comparison with the Bacchus Marsh sandstone, and that the *Thinnfeldia* and *Equisetaceæ* of the upper coal measures of Tasmania indicate some relationship between them and the Wianamatta beds of New South Wales, or even the upper coal measures of Victoria and Queensland. Until, however, the order of succession and the continuity of our own rock system has been more thoroughly investigated and determined, and the fossil *fauna* and *flora* of its various formations more fully identified and described, there will be no sufficient basis for any satisfactory geological comparison; and this defect will not be adequately remedied until the Geological Survey of Tasmania is again taken in hand.

ABSTRACT OF RECORDS OF BORING IN UPPER PALÆOZOIC BEDS AT CASCADES, HOBART, 1884.

DESCRIPTION OF ROCK.	DEPTH IN FEET.
Surface soil, about 2ft., and limestone, full of joints, with conglomerate band 3ft. thick at 13ft. 6in....	32·11
Limestone and mudstone, changing from hard and brittle to soft, latterly very hard	125
Limestone and mudstone, at 151ft. very changeable from hard to soft for 5ft.; very hard bar of limestone 22in. thick at 161ft. 6in.	180·7
Very changeable, soft soapy band 1ft. thick at 200ft.	202
A few fossils, very changeable; last 10ft. full of veins of pyrites	255·3
Full of pyrites; struck water at 265ft.; country latterly more regular	298·10
Country changeable, much pyrites, fossils rare; water, 300gals. per hour, and getting stronger...	336·6
Changeable; much jointy rock, bad to bore; hard limestone at 356ft.	358
Hard and brittle; fossils at about 370ft.; finished in soft limestone	384
Hard and regular, changing to brittle, and then soft band full of pyrites...	428
Hard and brittle; 3ft. of fossils at 448ft.	458·9
Very hard and brittle; no fossils last 15ft.	488
Very hard; at 496ft. went through 5ft. 6in. of marble; left off in dark grey stone without fossils showing; water about 700gals. per hour ...	519
* * * * * * * *	
Total depth	612·1

* [NOTE.—The remaining portion of the records, which were evidently written under a misconception as to the nature of the rock passed through, is omitted. The "dark grey stone without fossils," which is subsequently described as "limestone," is a fine grained crystalline diabase passing in the ordinary way into a coarser variety noted as "very coarse rock like granite." This rock must have been struck between 509 and 519 feet from the surface.]

ABSTRACT OF RECORDS OF BORING IN COAL MEASURES AT TARLETON, MERSEY, 1884

Strata.	Ft.	In.	Depth in Ft.	In.
Clay...	15	0		
			15	0
Sandstone	33	9		
			48	9
Conglomerate and Pyrites ...	3	0		
Shale	5	0		
Coal...	1	6	58	3
Sandstone	36	6		
			94	9
Conglomerate	2	0		
Dark Sandstone	6	6		
Shale	2	0		
Sandstone	2	6		
Shale	5	0	112	9
Marl	32	3		
			145	0
Sandstone	2	0		
Pebbly Marl	8	6		
			155	6
Pebbly Marl, with thin veins of Carbonaceous Matter at 175 and 182 feet	32	6		
			188	0
Pebbly Marl, with Sandstone, showing Carbonaceous Matter at 265 feet	77	3		
			265	3
Pebbly Sandstone, with Marine Shells	20	9	286	0
Conglomerate with Shells ...	36	0		
			322	0
Conglomerate Sandstone, with Shells changeable	30	9		
			352	9
Conglomerate	17	9		
			370	6
Silurian Limestone	30	6		
Total Depth	...	...	401	0

AUSTRALIAN TOPOGRAPHY: EDEL'S LAND, DE WITT'S LAND, AND CARPENTARIA.

By James R. McClymont, M.A., Edin.

[*Read November* 16, 1885.]

In the Letter of Instructions issued to Tasman in 1644, as edited by Mr. Swart in the *Verhandelingen en Berigten betrekkelijk het Zeewezen*, Jaargang 1844, bl. 65, occurs the following reference to an early Dutch expedition for the fuller discovery of New Guinea and the unknown south land:—

"De tweede voyagie met seecker jacht, in den jare 1617, onder 't berleyt van den fiscael D'Edel, met weynich vrucht gedaen, van welck bejegeningh en ondervindingh tegenwoordich (mits't verlies van de journaele aenteyckeningen) geen seeckere contschap te vinden is."

"The second voyage in a certain yacht in 1617, under command of the Fiscal D'Edel, was attended with meagre results, concerning which undertaking and discovery no certain account can now be found, in consequence of the loss of the journals and observations."

A comparison of this passage with others in the same Letter and with the maps of Tasman and Visscher and the Stadhuys map, leads to the opinion that the Edel's Land of western Australia was approximately the goal of this voyage, and that the date 1619, generally ascribed to its discovery, should be regarded as that of a subsequent visit. *Harris' voyages ed. Campbell. i, p* 325.

In support of this opinion, it will be remembered that a discovery of land far south of the turning-point of the *Duyffken* was reported in Java towards the end of 1616 on the arrival of the outward-bound ship *Eendracht*, and that a lively interest was awakened in the minds of the Dutch authorities by the news of this and subsequent glimpses of the western coast of the new south land. This is evident from the fact that in September 1622, the then Governor-General, Jan Pietersz Coen, authorised an expedition for the express purpose of reporting upon this and other chance discoveries, and equipped thereto the yachts *Haeringh* and *Hasewindt*. It may be presumed that this expedition, six years after the discovery of the *Eendracht*, was not the first attempt made to authenticate the same by an official survey, for the discovery was important to the Dutch East India Company from a commercial point of view, since the crews of their outward-bound ships frequently fell a prey to sickness and scurvy about the time of their reaching these latitudes, for whose relief Gerrit Pool was enjoined in 1636 to find a con-

venient place for obtaining water and other refreshments in about lat. 26° to lat. 28° S. *Instructie voor den E. Command. Gerrit Thomasz Pool.* (*Swart's Journaal van Tasman's Reis.* bl. 36.) This was probably a stereotyped order to the leaders of these expeditions; it occurs again in the Instructions of Tasman, 1644.

To prevent misapprehension, let me state that the maps to which reference is made in association with the names Tasman and Visscher are (1) that map which was draughted by order of Van Diemen in 1644 for the purpose of illustrating, in a connected sketch, the discoveries of the Dutch in New Holland, and the adjacent islands; (Vide *Proceedings R. S. Tas.* 1884. p. 262.) (2) a map said to be the work of Francois Jacobsz Visscher, Tasman's chief pilot, a copy of which, taken as is supposed, by Captain Thomas Bowrey about the year 1687, is reproduced in Major's *Early Voyages to Terra Australis*, p. xcvii. The (3) map referred to is that which was inlaid in the floor of the Groote Zaal of the Amsterdam Stadhuys, and which is reproduced in Thévenot's *Relation de divers voyages*, 1re partie, 1663, and elsewhere.

There are considerable discrepancies in these maps regarding the geographical position of Edel's Land and the date of its discovery. Tasman's map has a stippled outline, extending from about lat. 30° S to lat. 32° S, opposite to which on the landward side is placed the legend '*i.d. Edels lant bijseijlt Ano* 1619.' In the Stadhuys map there is a blank in place of the stippling, and the legend appears at a definite part of the coast-line several degrees further north, so that in this map Edel's Land extends from about lat. 27° S to lat. 29° S.[1]. The draughtsman of Tasman's map is very inaccurate in his lettering, and is evidently at fault when he places a legend at a part of the coast which the Stadhuys map shows to have been unknown. On the authority of that map we assign the more northerly position to the visit of 1619. Turning now to the map of Visscher, it is observable that a vangue connecting line replaces the stippling of the one and the blank space of the other map, and that the legend, which runs '*I dedels Land discovered Anno* 1628,' appears south of the doubtful place, not, as in the Stadhuys map, north of it. In the latitude of the Land of Edel this map agrees with Tasman's. Had the D'Edel who is mentioned in Tasman's Letter of Instructions been personally associated with these discoveries in 1619 and 1628, it is probable that further reference would there have

[1] The latitudes are those of the maps referred to. It is not easy to distinguish the portion allotted to the *Eendracht* in Thévenot's map from that allotted to D'Edel'. Houtman's Abrolhos are here regarded as dividing the two discoveries.

been made to him. In default of any such reference, we may suppose that his name had become associated with the coast between the Lands of the *Eendracht* and of the *Leeuwin* in consequence of an earlier voyage to those parts, and that the designation, 'D'Edel's Land,' was extended to fresh discoveries in the same region out of compliment to him as its first visitor.

De Witt's Land.—Reverting to the text of the Instructions, we find the following account of the discovery of De Witt's Land.

"In't volgende jaer 1628, 't selve lant aen de noortcant by 't schip Diana (varende uyt *Indiae* na Nederland) op de zuyderbreete van 21 graden onverwacht ontdect, en omtrent 50 mylen custs beseylt is."

"In the following year, 1628, the same land was unexpectedly discovered on the north side in lat. 21° S. by the ship *Diana* (bound from the Indies to Holland), which vessel sailed along the coast for about 200 miles."

The name *G.F. de Witte-lant* is borne by this coast, and the discovery seems to have comprized about one hundred miles on either side of the present N. W. Cape of Australia. Strangely enough, the Instructions as edited by Dalrymple (*Collection of Memoirs concerning the Land of Papua*) give the name of the discovery-ship as the *Vianen*. In default of a reference to the original MSS, we can only set the one authority against the other. The probability however is in favour of the goddess, whose name is naturalised in Dutch, while the word "Vianen" belongs neither to that, nor, so far as I know, to any other language.

Carpentaria.—The publication of Tasman's map confirms the opinion that the Gulf of Carpentaria was first coasted in its entirety by Tasman in his second voyage. His track, anchorages, and soundings are marked with great minuteness. The name "Carpentaria," however, does not appear, and we may conclude that it was one of those latinised names introduced for the first time in the original of the map published by Thévenot, where it appears on the land east of the gulf. *Vide Major's Early Voyages to Terra Australis.* pp. xcix.-ciii. It is interesting to note that Carpenter's name is appropriated to a river on the east side of the gulf in about lat. 13° S. by the draughtsman of Tasman's map,—probably a survival from one of the early expeditions for the exploration of what was then regarded by the Dutch as the west coast of New Guinea.

I cannot conclude these fragmentary notes without acknowledging my indebtedness to Mr. Justin Browne and Mr. J. B. Walker for their kind loan of books during their preparation. But I would insist on the fact that private collections

can never supply the place of a public collection of works relating to Australian discovery. If Australians are to become familiar with the beginnings of Australian history, the means of studying the sources whence that history is derived must be placed within their reach—an end to be attained, first of all, by a gradual and persistent acquisition in each colony of books, maps, and documents bearing chiefly on its own history; and next, by the establishment of an Australian library enriched with all procurable rarities of colonial history and discovery.

FIGURES OF FOSSIL LEAVES, ILLUSTRATING PAPERS READ BY R. M. JOHNSTON, F.L.S.

(See pp. 322-325 & 335-337.)

Plate I.

Fig. 1—Eucalyptus Kayseri, *Johnston* (Fig. 4, p. 323)

2, 3.—Quercus Bischoffensis, „ („ 5, 6, p. 324)

4.—Ulmus Tasmanicus „ („ 7, p. 325)

5, 6 7. —Leaf Impressions associated with 1, 2, 3, and 4, not determined ... ... („ 2, 3, 9, p. 325)

8.--Cycadites microphylla, *Johnston* („ 8, p. 324)

Plate II.

1.—Laurus Sprentii, *Johnston* („ 1, p. 324)

2, 3.—Leaf Impressions from beneath basalt at Mt. Bischoff, undetermined ... ... („ 10, 11, p. 325)

4.—Eucalyptus Milligani, *Johnston* (p. 336)

Plate III.

General outline of Section of Coast-line, illustrating R. M. Johnston's paper. (See p. 310.)

PLATE I.

PLATE I.

1

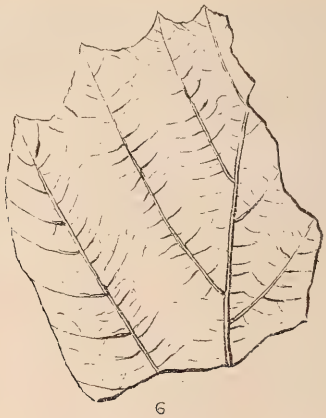
2

3

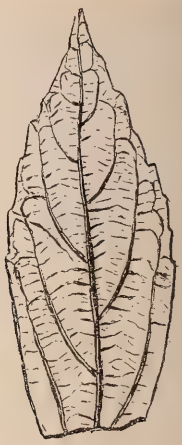
4

8

5



6



7

PLATE II.

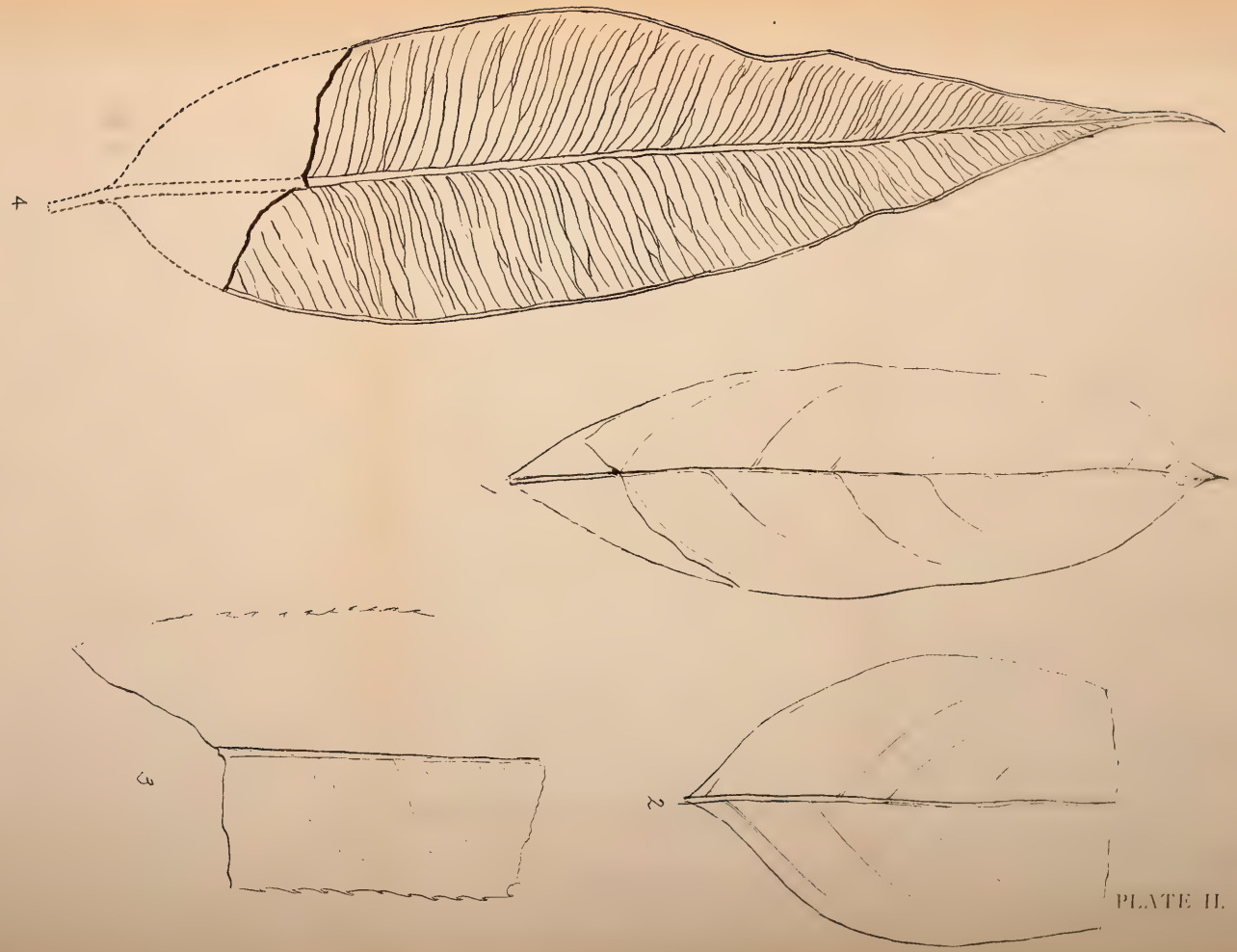


PLATE II.

a. = Older Greenstone.

b. = Marine Beds. (up. Pal.)

C. = Newer intrusive diabase.

R. M JOHNSTON.

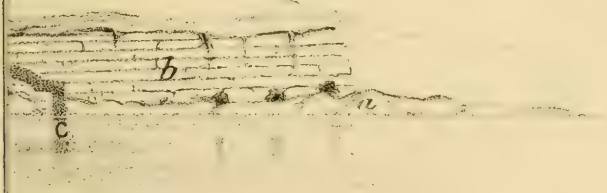


PLATE III.

General outline of section of Coast-line between Blackmans Bay and Passage Point.

PLATE III.

	Farrot .			
n	Stonelumpy .	Kaikoura		Millstone Grit
n	Mt. Lambie Range;	formation	Talchir . -	
	Olympic and		Karbari Beds	Limestone Series
	Rockhampton beds			
	Cracow Creek "			
	Bowen River "			
	Don River .			
Creek		Kaikanui		Devonian
ns		Waihao		Upper
ns.		Waitaka		Middle
River		formation		Lower
Ulta				
Murian		Upper Silurian		Silurian
				Upper
e and				Ludlow group
Graptolite			Silurian	Wenlock .
			Obolus Beds	Upper Llandovery .
River,			Bhabch series	
Ponds				
Murian		Lower Silurian		Lower
				Lower Llandovery group .
rue		Mt. Arthur series		Caradoc & Bala
o				Llandeilo
aine				Arenig
			Infra Silurian	Cambrian
				Upper { Tremadoc slates, Lingula flags
				Lower { Menevian group, Harlech group
ean	Archaean	Archaean	Archaean	Archaean or Pre . Cambrian

rtment Hobart

GEOLOGICAL TABLE

SHOWING THE PROPOSED PROVISIONAL CLASSIFICATION OF STRATIFIED [illegible]

TASMANIA

ALSO SHOWING CORRESPONDING DIVISIONS [illegible]

[illegible]

		TASMANIA		AUSTRALIA			NEW ZEALAND	INDIA	ENGLAND
	Rock Divisions		[illegible]	N. S. WALES	VICTORIA	QUEENSLAND			
QUATERNARY	RECENT	Native shell mounds Alluvium	Native plants [illegible] and shells	Recent	Recent	Recent	Recent	Recent	Recent
	PLEISTOCENE	[illegible] beaches [illegible]	Ostrea edulis [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible] Fluviatile sandstone [illegible]	[illegible]	Wellington Valley caves	Mt. [illegible]	[illegible] Drift deposits	. [illegible] Deposits		
TERTIARY OR CAINOZOIC	NEOGENE	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]
		[illegible]	[illegible]	Auriferous leads containing plant remains [illegible] Gulgong	[illegible]	[illegible] Downs	[illegible]	[illegible]	[illegible]
	PALAEOCENE	[illegible] Richmond. [illegible] Glenora	Laurus . Magnolia . Fraxinus . [illegible] Cinnamomum [illegible]		[illegible]				
		Marine Beds [illegible] Flinders Island	[illegible] [illegible] . Lima . Pecten . [illegible] Cucullaea . [illegible] . Limopsis . [illegible] . Spondylus &c		[illegible] Beds Cape [illegible] [illegible]			[illegible] Beds [illegible] [illegible]	[illegible]
SECONDARY OR MESOZOIC	MESOZOIC ROCKS	[illegible] Rocks [illegible] Sandstones Shales & coal seams of the Upper Coal Measures at [illegible], [illegible], [illegible], [illegible], [illegible], Fingal, [illegible] Hill, Mt. [illegible], [illegible], Spring Bay, [illegible], Hamilton, Richmond, Spring Hill, [illegible], [illegible], [illegible], [illegible], York Plains, Coal Hill &c	Plants — [illegible] Sphenopteris, [illegible] Thinnfeldia, Cyclopteris, Pecopteris, Alethopteris, Taeniopteris, [illegible] [illegible], Zeugophyllites, coniferous trunks &c	[illegible] Beds Wianamatta & Hawkesbury Beds Clarkes Hill. Cockatoo Id . Mt Victoria [illegible] Beds Upper Coal Meas. [illegible], [illegible] Stockmans swamp. Gulgong. . Mudgee Illawarra [illegible] . Newcastle Wollongong	Upper Mesozoic [illegible] Beds [illegible] Cape [illegible] [illegible] Lower Mesozoic	Cretaceous Beds . Maryborough [illegible] Beds [illegible]	[illegible] formations [illegible] formations [illegible] formation	[illegible] . Marine Cretaceous . Marine Jurassic [illegible] Group Gondwana System	Cretaceous [illegible] Jurassic [illegible] Upper Lias Middle Lias Lower Lias Triassic [illegible] Keuper . Muschelkalk Bunter
PRIMARY OR PALAEOZOIC	CARBONIFEROUS ROCKS	Upper Marine Beds . Mersey, Porters Hill Tasmanite Beds. . Mersey Lower Coal . Measures . Mersey	Spirifera, [illegible], [illegible], [illegible], [illegible] &c :— Plants .. Glossopteris, [illegible] &c	Lower Coal Measures Anvil Creek, [illegible]. Harpers Hill, [illegible] Creek, [illegible]	[illegible]			Damuda system	Permian or Dyas
		Lower . Marine Beds . . Mudstones ; Limestones, Conglomerates &c [illegible]	[illegible] : Spirifera Productus. Strophalosia, [illegible] [illegible]	[illegible] Stony Creek Wollongong Harpers Hill [illegible] Illawarra [illegible] [illegible] [illegible] Yass	[illegible]	[illegible] Coal . [illegible] . [illegible] . . Mt [illegible] [illegible] and [illegible] [illegible] . [illegible]	[illegible] formation	Talchir Boulder Beds	Coal measures . Millstone Grit Limestone [illegible]
	DEVONIAN	Fingal [illegible] (Fresh water)	[illegible]	[illegible] Beds	[illegible]		[illegible]		Devonian Upper . Middle Lower
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]


SKETCH MAP
GENERAL GEOLOGICAL FEATURES
OF
TASMANIA
Scale 15 miles to an inch
BASS STRAIT
BANK'S STRAIT
FLINDERS ISLAND
CAPE BARREN I.
THREE HUMMOCK I.
BARREN I.
ISLANDS
WELLINGTON
RUSSELL
DEVON
LAUNCESTON
CORNWALL
WESTMORLAND
LINCOLN
MONTAGU
GLAMORGAN
SOMERSET
CUMBERLAND
FRANKLIN
MONMOUTH
MONTGOMERY
PEMBROKE
BUCKINGHAM
ARTHUR
KENT
TREYCINETS PENINSULA
SCHOUTEN I.
REFERENCE
I. Igneous Rocks
Basalt
Greenstone (Diabase)
Granite, Syenite and Felsite Porphyry
Crystalline and metamorphic schists, clayslates, quartzites and sandstones of Archæan.
II. Sedimentary Rocks
TERTIARY AND POST TERTIARY

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1885.

Tasmania:
WILLIAM THOMAS STRUTT, GOVERNMENT PRINTER, HOBART.

1886.

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Obituary.

John Swan, aged 53, an old and much valued Fellow of the Society, and a Member of the Council. Born in Tasmania, Mr. Swan proceeded at an early age to England in order to complete his education. On his return to the Colony he engaged in pastoral pursuits. Was for many years a Member of the House of Assembly, and for some time Chairman of Committees. Resigned his seat on acceptance of the office of Inspector of Police, which he held till the period of his death, December 22nd, 1885.

Other Members who had died during the year were—the Hon. Henry Butler, F.R.C.S., Speaker of the House of Assembly; and Dr. G. F. Story, of Swansea.

MINUTES of the Annual General Meeting of the ROYAL SOCIETY OF TASMANIA, *held at the Museum on Friday, February 5th,* 1886,—THOS. STEPHENS, *Esq., M.A., F.G.S., Vice-President, in the Chair.*

THE under-mentioned gentlemen were elected Corresponding Members; viz.—William A. Haswell, Esq., M.A., B.Sc. Edin., Sydney University, N.S.W.; J. V. R. Swan, Esq., U.S. Consul, St. Petersburg, Russia. James Rule, Esq., Senior Inspector of Schools, Tasmania; and Edw. A. Counsel, Esq., Hobart, were elected Fellows.

In the absence of the Hon. J. W. Agnew, M.D., M.E.C., Hon. Secretary, the Chairman called upon Mr. A. Morton, Assistant Secretary and Librarian, to read the Annual Report.

Mr. Belstead, in moving the adoption of the Report, referred to the handsome legacies bequeathed to the Society by the late Dr. Milligan, and trusted it would stimulate other wealthy men in our midst to follow his example. He also made reference to the loss the Society had sustained in the death of the late Mr. John Swan.

Rev. J. W. Simmons, in seconding the motion, expressed his pleasure at the numerously attended meetings of the past session, but deplored the want of necessary space for the use of the microscope in illustrating various papers.

Mr. R. A. Bastow, F.L.S., remarked, with the permission of the Chairman, he intended early in the session to read a paper "On the Science of Sanitation," illustrated by diagrams. He went on to remark that in this colony we have a Public Health Act, as good an Act as could possibly be framed for the conservation of the health of the community, and now that the Parliament had done their part so well it remains for the community to carry out the Act in all its requirements. As yet it appears as though the science of sanitation were totally unknown in the colony except by some few gentlemen who have made the science a study, and unless the eyes of the public are opened, the dangers existing in their very homes, in the air they breathe, in the food they eat, in the rooms they sleep in, and everywhere outside their homes, in the drains and accumulations of filth visible at all times in many of our streets, the annual death rate will still continue over 24 per 1000, instead of 12 per 1000, for the registration district of Hobart,—

that is 3 per 1000 more than the deaths in that thickly populated registration district, the city of Manchester. He concluded by expressing the hope that he might be allowed a fitting opportunity to place before the Members of the Royal Society the results of his many years experience as sanitary surveyor under the Medical Health Officer of Manchester.

The Chairman stated the Society were indebted to Mr. Bastow for the promise of so interesting and valuable a paper.

VOTE OF THANKS TO THE HON. J. W. AGNEW, M.D.

Mr. C. T. Belstead, in rising, said the motion he had to propose was one in which all connected with the Society would acquiesce. It was,—"That a vote of thanks be recorded to the Hon. J. W. Agnew, M.D., the worthy Hon. Secretary of the Society." Dr. Agnew, for many years past, had taken the deepest interest in the welfare of the Society, and he trusted that the Society might long enjoy the kindly attention shown by Dr. Agnew.

Rev. J. W. Simmons seconded the motion.

The Chairman, in putting the motion, which was carried by acclamation, spoke in high terms of the Honorary Secretary.

Mr. A. Morton intimated that before closing he would wish to propose a special vote of thanks to the Press for the prompt and ready manner in which they had, during the session, reported the proceedings of the Society, and the large amount of space that had been given to these reports.

Mr. F. Abbott seconded.

The Chairman, in putting the motion, remarked that the publicity afforded by the Press was of infinite value to the Society, as otherwise its operations would be confined to a very small circle.

Mr. C. J. Atkins moved, and Rev. J. W. Simmons seconded, that a vote of thanks be recorded to the Chairman.

The meeting then adjourned.

REPORT.

It must be a subject for congratulation to the Fellows that the papers read during the session of 1885 were not only of great variety, but of special interest and importance. The monthly meetings were all numerously attended, and on several occasions many ladies were present.

The papers, 26 in number, were as follows:—

Zoology of Australia: by the Hon. W. Macleay, F.L.S.

"Fresh contributions to our knowledge of the character and relationship of the Upper Palæozoic and Mesozoic Formations of Tasmania with the associated Diabasic Rocks."—"Notes regarding the Silurian Fossils of the Gordon Limestones, with generic descriptions and a specific list of the organisms already named and classified."—"Notes on the discovery of new species of leaf impressions from the Tertiary sandstones at Mount Bischoff, belonging to the Genera Eucalyptus, Laurus, Quercus, Zamia, etc."—"General observations regarding the classification of the Upper Palæozoic and Mesozoic Rocks of Tasmania, together with a full description of all the known Tasmanian coal plants, including a considerable number of new species."—"Description of two new species of Tertiary fossil plants belonging to the genera Eucalyptus and Taxites."—"Tasmanian fossil plants of the upper and lower coal measures of Tasmania."—"Local distribution of the fossil plants of the upper and lower coal measures of Tasmania."—"Geological table showing the proposed provisional classification of stratified rocks for Tasmania, also showing corresponding divisions elsewhere:" by R. M. Johnston, F.L.S.

"The Lunar Eclipse of 30-31st March, 1885."—"The Tasmanian earth tremors, 1883-4-5:" by Mr. A. B. Biggs.

"*Jungemannia reticulata.*"—"On the identification of Tasmanian mosses, etc."—"Mosses of Tasmania" (continued): by R. A. Bastow, F.L.S.

"New species of Tasmanian Marine Shells."—"Description of two apparently new species of *Ancillaria*, Lam.:" by W. F. Petterd, C.M.Z.S.

"Notes on Jean Julien Houten De-Labillardiere:" by Baron F. Von Mueller, K.C.M.G., M.D.

"Remarks on Tin Ore Deposits at Mount Bischoff:" by Baron F. Von Groddeck.

"Earthquake Phenomena in Tasmania, with table:" by Captain Shortt, R.N.

"Notes on boring operations in search of Coal in Tasmania, 1884, *(continued)*, with the abstracts of Records of boring in Upper Palæozoic Beds at Cascades, Hobart, 1884, and in the Coal Measures at Tarleton, Mersey, 1884:" by T. Stephens, M.A., F.G.S.

"Water and Typhoid:" by W. F. Ward, A.R.S.M.

"Iceland and the Icelander:" by the Rev. J. B. Woollnough.

"Shells of the Group *Polcystina*:" by C. J. Atkins.

"The Scientific treatment of Waste Material:" by W. H. Charpentier.

"Australian Topography; Edel's Land, De Witt's Land, and Carpentaria:" by J. R. M'Clymont, M.A. Edin.

"Sketch Map General Geological Features of Tasmania:" by C. P. Sprent and R. M. Johnston.

Discussion took place, as usual, on the various papers, to some of which additional interest was lent by means of microscopic illustrations by Mr. Bastow and Mr. C. J. Atkins. In reference to the paper by the former, it may be mentioned that Mr. Bastow is at present engaged on a monograph of Tasmanian mosses, which will, no doubt, be of the greatest value to the future workers in that interesting branch of natural history.

Library.

The usual additions of periodic literature have been made to the Library, but special mention must be made of a valuable donation accruing from the interest on the "Morton Allport Fund," *i.e.*, seven volumes Bleeker's

Atlas Ichthyologique, two vols. Day's Fishes of India, Gunther's Fishes of Zanzibar, and 13 parts Journal Museum de Goddefroy. Of still greater importance, however, for the general interests of the Society was the receipt of the very large legacy of £350, in accordance with the will of the late Dr. Milligan. Of this valuable bequest due notice was taken at the monthly meeting held in May.

It will be noticed with much satisfaction that, for the second time at so early a period, the Transactions of the year are already bound and ready for distribution.

Fellows.

Twenty-two new Fellows have been elected, and 12 have been lost through death or resignation. The total number is now 176.

Meteorology.

Meteorological observations have been carried on as in last year.

Council.

The Council have to deplore the loss of one of its oldest members, Mr. John Swan. From Mr. Swan's practical knowledge of much of the natural history of the colony, his death creates a void in the ranks of the Society not readily to be filled. Mr. R. M. Johnston, F.L.S., has been appointed to the vacant seat in the Council.

Election of Officers.

Messrs. R. M. Johnston, F.L.S., Justin M'C. Browne, A. G. Webster, and H. A. Perkins, M.D., the retiring Members of the Council, were re-elected, as also Messrs. John Macfarlane and Francis Butler, hon. annual Auditors.

Finance.

The income has been:—Government grant in aid to Museum, £300; grant to Gardens, £800; annual subscriptions to Royal Society, £22 10*s.*; sale of plants, £169 7*s.*; legacy by the late Dr. J. Milligan, £350; making, with balance from 1885, £1871 4*s.* The expenditure

amounted to £1452 18*s.* 1*d.*; leaving a balance to credit with fixed deposit, £419 3*s.* 7*d.*

Museum.

The Museum has undergone a change of government, in accordance with an Act passed during the recent session of Parliament. Having by that Act been incorporated, it is now a national institution, with an annual endowment of £500. The management of its affairs is vested in a Board of Trustees, consisting of five officials, a Crown Trustee named by the Governor, and six others elected from the Council of the Society.

The fact that the Museum has thus for the first time been placed on a secure and permanent basis will unquestionably exert a happy influence over its future development. The number of visitors has been very large, including temporary residents from other colonies and passengers by the various steam routes who make a short stay on their way to and from New Zealand.

The collection is still being steadily increased, chiefly, it is pleasant to remark, by specimens illustrative of the colony. In the geological collection special to Tasmania, printed tablets, compiled by the Curator, and explanatory of the various Orders and Families, have been placed. In an educational point of view these will be found to be of the greatest value.

For a collection of New Guinea birds, in which visitors take a great interest, we are indebted to our excellent friends the Trustees of the Sydney Museum. The Trustees of the Brisbane Museum have also kindly contributed to our ornithological collection. Owing to the rapidly increasing number of specimens our space is becoming very limited, and it is therefore with great satisfaction that we have to acknowledge our obligation to Government and Parliament for a vote of £3000 for the purpose of giving largely increased accommodation.

The approximate number of visitors, including Sundays, was 27,069.

Gardens.

Consequent on the annual grant being increased to £800, more labour has been employed, and a marked improvement in the appearance of the Gardens has already taken place, and many urgently needed repairs and additions have been effected.

By the Act of Parliament already referred to, the Gardens have also been incorporated and placed under the same management as the Museum.

A large bush or lath house has been constructed for the combined purposes of growing the more hardy varieties of florists' flowers and general nursery stock. For both purposes the house promises to be of great utility, the plants in it having done remarkably well.

About 450 new plants have been received, and a large number of seedlings of many plants suitable for planting parks or public reserves have been raised.

The beautiful *Picea amabilis*, the Japan silver fir *(Picea)*, and the Crimean fir *(Abies Nordmannania)* are producing cones for the first time. As these three plants are much sought after for ornamental purposes, their fresh seeds will be highly valuable.

The heavy rains which fell in November cut up the beds and walks, but were very beneficial to the plants generally. From the same cause the grass lawns have also remained green without artificial watering longer than in ordinary seasons.

The estimated number of visitors was 67,000.

Domain.

The improvement of the Queen's Domain has been continued so far as the funds provided for the purpose would permit. The drive leading past the new cricket ground is now complete, and promises to become very popular.

On the sides of the road for a distance of some 200 yds. Large numbers of *Cedrus deodara*, the Indian cedar, and *Abies Douglassi*, the Douglas fir, have been planted, and are looking well.

Planting and levelling have also been carried out on the ground in the vicinity of the powder jetty.

The triangular piece near the new cottage has been trenched, fenced, and planted as a mixed shrubbery. The drain creek opposite the powder jetty has been partly levelled, and planted with Norfolk Island Pines.

The palms and *Pinus insignis* trees planted on the side of the main road to Government House have generally done well, the only exceptions being where they are in the vicinity of the indigenous gums, which will therefore require removal.

J. W. AGNEW, *Hon. Secretary.*

STATEMENT of the Funds of the ROYAL SOCIETY OF TASMANIA *for the Year* 1885.

Receipts.	£	s	d.	£	s.	d.
Balance as per statement for 1884....		..		30	9	9
Royal Society.						
Annual Subscriptions and arrears for 1885	221	10	0			
Legacy, Dr. Milligan	350	0	0			
				571	10	0
Museum.						
Grant in aid from Treasury.....		..		300	0	0
Botanic Gardens.						
Grant in aid from Treasury.....	800	0	0			
Proceeds of sale of Plants, Flowers, &c.	169	0	7			
				969	0	7

Expenditure.	£	s.	d.	£	s.	d.
Royal Society.						
Printing and Advertising.....	57	7	6			
Collector's Commission	10	18	6			
Messenger, Cartage, &c.	2	15	1			
Furniture, Fittings, &c.	17	8	0			
Library—Books, Stationery, &c.....	65	2	0			
Sundries, Cheque Book.....	10	10	6			
Water-rate, Gas, &c.....	8	10	5			
Insurance	4	18	6			
Fuel, &c.....	11	1	0			
Interest on overdrawn account	0	3	7			
				188	15	1
Museum.						
Salary of Curator	200	0	0			
Wages of Attendant.....	79	0	0			
Ditto (Sundays)	13	0	0			
Purchase of Specimens.....	0	18	9			
Sundries	3	14	7			
Ironmongery, Brushware, &c.....	5	5	7			
Freight and carriage of Specimens..	1	5	9			
Repairs to Building, &c.....	2	13	6			
Chemicals, &c.	14	4	4			
Petty Cash.....	6	14	3			
				326	16	9
Botanic Gardens.						
Salary of Superintendent.....	200	0	0			
Wages of Labourers.....	470	2	0			
Tools and Repairs..... ...	2	2	6			
Freight and carriage of Plants	15	15	10			
Stationery and stamps	2	19	0			

Forage	16	0	10			
Horse hire	6	4	0			
Ironmongery and fittings	93	4	6			
Plants and Seeds	3	18	3			
Sundries	27	10	7			
Water rate	3	3	4			
Flower-pots	23	0	0			
Sand, earth, &c.	10	13	0			
Timber and repair of buildings	62	12	5			
				937	6	3
				£1452	18	1
Balance as per statement for 1885	30	9	9			
Receipts	1490	10	7			
Legacy, Dr. Milligan	350	0	0			
Expenditure		..		1452	18	1
Fixed Deposit Commercial Bank, due 5th November, 1886		..		300	0	0
Balance to Credit, as per Bank Pass Book		..		118	2	3
	£1871	0	4	1871	0	4
Balance, as per Bank Book	119	3	7			
Less unpresented cheque, Weaver £1 1 0 / Less error petty cash 0 0 4	1	1	4			
				£118	2	3

£1871	0	4	

Hobart, 31*st December*, 1885.

Examined and found correct.

JOHN MACFARLANE.

12*th February*, 1886.

STATEMENT of the MORTON ALLPORT *Memorial Fund*, 1885.

1886.	Dr.	£	s.	d.
Jan. 1.	To Balance as per Statement for 1884	58	16	3
1885.				
Aug. 31.	Interest, Savings Bank	2	12	6
Nov. 28.	Cheque	10	0	0
		£71	8	9

1885.	Cr.	£	s.	d.
Nov. 30.	By Cash, Trubner & Co.'s Account	57	1	1
	Balance at Savings Bank to credit of Fund.	14	7	8
		£71	8	9

Examined with Savings Bank Book, and found to be correct,

JOHN MACFARLANE.

12*th February*, 1886.

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Acta Horti Petropolitani, Tomus VIII., IX., Fasciculus I.-II. From the Society.
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Agricultural Gazette, December, 1884; January, February, 1885.
American Agriculturist.
Annals de la Société Malacologique de Belgique, Tome XIV., XV., XVI., From the Society.
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Annual Report of the Surgeon-General U.S. Army, 1884.
Annual Report of the Curator of the Museum of Comparative Zoology at Harvard College, 1883-4. From L. Agassiz.
Annual Report of the Chief Signal Officer to the Secretary of War. Parts I. and II. Washington. From the War Department.
Archives du Musée Teyler, série II., Deuxième partie, Troisième partie, From the Society.
Astronomical and Meteorological Observations, year 1878-79, Washington, From the U.S. Naval Observatory.
Athenæum, The, December, 1884.
Adelaide University Calendar for the year 1885. From the University.
Agricultural Gazette, March 9, 16, 23.
American Agriculturist, March, 1885.
Annals and Magazines of Natural History, March, 1885.
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Australian Scientific Magazine, The. Vol. I., No. 1; August, 1885, Victoria. From the Editor.
Abhandlungen der Mathematisch. Physikalischen Classe der Koniglich Bayerischen Akademie der Wissenchaften. Munchen, 1883. From the Society.
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Ditto ditto, for 1883.
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Annals and Magazine of Natural History, London, September, 1885.
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Bericht des Verines für Naturkunde, XXIX., XXX. From the Society.
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Bulletin of the Essex Institute, January, February, March, 1882. From the Society.

Bulletin of the Buffalo Society of Nat. Sciences. Vol. IV., No. 2. Buffalo. From the Society.

Bombay Magnetical and Meteorological Observations for 1883.

Bulletin du Musée Royale d'Histoire Naturelle de Belgique. Tome III., 1884. No. 1.

Bulletin de la Société Royale de Botanique de Belgique, Tome Vingt. From the Society.

Bulletin du Musée Royal d'Histoire Naturelle de Belgique. Tome III., IV., Nos. 3, 4. 1885. From the Trustees.

Birds and Mammals of Australia. By Gracius J. Boinowski. From the Hon. W. J. Trickett, M.P., N.S.W.

Bulletin de la Société Imperiale des Naturalistes de Moscow. Tome LX., No. 3. Moscow, 1885. From the Society.

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Bibliotheca hassica, by Dr. Karl Ackermann. From the Society.

Bestimmung der erdmagnetischen Inklination von Kassel, Von Dr. Karl Ackermann.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass. No. 2. The Felsites and their associated Rocks north of Boston, by J. S. Diller. No. 3. On an occurrence of Gold in Maine. No. 4. A microscopical study of Iron Ore or Peridotite of Iron, Mine Hill, Cumberland, Rhode Island, by M. E. Wadsworth. No. 5. Observations upon the Physical Geography and Geology of Mount Ktaadn and the adjacent district, by C. E. Hamlin. No. 6. Report on the recent additions of Fossil Plants to the Museum collection, by Léo Lesquereux. No. 7. The great Dike at Hough's Neck, Quincy, Mass., by J. Elliott Wolff. No. 8. On some specimens of Permian Fossil Plants from Colorado, by Léo Lesquereux. Vol. II., part 1. The Azoic system and its proposed sub-divisions, by J. D. Whitney and M. E. Wadsworth. From Alexander Agassiz.

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Bulletin of International Meteorology for 1882-3, Washington. From the Department.

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Catalogue of superior Second-hand Books, J. Sotheran & Co.

Catalogue of the Australian Hydroid Zoophytes. By W. Bale, Esq. From the Trustees Sydney Museum.

Catalogue of the choicest portion of the Lyston Park Library. From B. Quaritch, Esq.

Chronologie géologique, La. From E. Dupont, Esq.

Charts of relative Storm frequency for a portion of the Northern Hemisphere: Charts and Tables showing geographical distribution of rainfall in the U.S. From the War Department, Washington.

Colonies and India, The, January 16th, 1885. Comparative Vocabularies of the Indian Tribes of British Columbia, with map. From A. R. C. Selwyn, Esq.

Compte-rendu de l'Excursion, &c. D. Ræymaekers.

Catalogue of Zoological works, comprising Icthyology, &c. Catalogue of Ornithology, Mammalia, &c. Catalogue of Entomology. From J. Wheldon & Co.

Catalogue of the Passeriformes, or Perching Birds, in the collection of the British Museum, "Fringilliforms," Part. I., containing the Families Dicæidæ, Hirundinidæ, Ampelidæ, Mniotiltidæ, and Motacillidæ. Vol. X. By R. Bowlder Sharpe. From the Trustees of British Museum.

Catalogue of the Fossil Mammalia in the British Museum, Part I., containing the Orders Primates, Cheiroptera, Insectivora, Carnivora, and Rodentia. By Richard Lydekker, B.A.K.

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Catalogue of the Echinodermata in the Australian Museum, Part I., "Echini;" Desmosticha and Petalosticha. By E. P. Ramsay, F.R S.E. From the author.

Catalogue des Livres de Fonds et en Nombre, Historie, Archeologie, Ethnographie, et Liguistique de l'Europe, de l'Asie, de l'Afrique, de l'Amerique, et de l'Oceanie. From the Society.

China and the Roman Orient, researches into their ancient and mediæval relations as represented in old Chinese records. By F. Hirth, Ph. D. From the author.

Chart of Java, by S. H. Lerne. From Mr. J. Wemyss Syme.

Catalogue de las Zonas, Zone Catalogue, mean positions for 1875 of the Stars observed in the zones at the Argentine National Observatory. By B. A. Gould. Parts I. and II. From the Society.

Catalogue of the Library of the Statistical Society, with Preface and Regulations, 1884. From the Society.

Daily Bulletin of Meteorological Observations. From the Meteorological Observatory, Washington.

Descriptive Sketch of the Physical Geographical Geology of the Dominion of Canada. From A. R. C. Selwyn, Esq.

Descriptive Notes on Papuan Plants. From Baron F. von Müeller, K.C.M.G.

Den Norske Nordhavs Expedition, 1876-78. XII. Zoologi, "Pennatulida," by D. C. Danielssen and J. Koren. XIII. Zoologi, "Spongidæ," by Dr. G. A. Hansen. Christiania, 1884-85. From Prof. H. Mohn.

Descriptions of the Stations. From the Meteor. Office, India.

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Epinal Glossary, Latin and Old English, of the Eighth century, photolithographed from the original MS. by W. Griggs, and edited, with transliteration, introduction, and notes, by Henry Sweet, M.A. From the Chief Secretary of Tasmania.

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Forest Culture and Eucalyptus Trees. By Edward Cooper.
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Government Statist's Report on the Vital Statistics of Melbourne and Suburbs, 1884. From the Government Statist.
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Results of Rain and River Observations made in New South Wales during 1884. From the Government Astronomer.

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Reports of the Mining Registrars for the quarter ended 31st March, 1885. The Gold Fields of Victoria. From the Mines Department, Melbourne.

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Signal Service Tables of Rainfall and Temperature compared with the Crop Production, No. 10. From War Department, Washington.

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Studies on the Elasmobranch Skeleton. By W. A. Haswell, Esq., B. Sc. From the Author.

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Transactions of the Royal Historical Society. New series, Vol. II., Part IV., 1885. From the Society.

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Verein für Naturkunde gu Kassel. From the Society.

Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westfalens. By Dr. C. J. Andra. Zweite Hälfte, 1882. Erste Hälfte, 1883. Zweite Hälfte, 1883. From the Society.

Victorian Year Book for 1883-4. By Mr. H. H. Hayter. From the Author.

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Victorian Naturalist, March and April. From the Society.

Vital and Meteorological Statistics for April. From R. M. Johnston, Government Statistician.

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Wood Pavement Board Report: Minutes of Proceedings and Appendix, Sydney, New South Wales, 1884. From Professor A. Liversidge.

Wattle Bark: Report of the Board of Enquiry.

Washington Astronomical and Meteorological Observations made during the year 1880. From the Department.

LIST of Donors to the Museum during 1885.

(For particulars of Donations see Lists in Monthly Proceedings.)

Agnew, C. S.
Atkinson, T. R.
Archer, —
Alomes, R.
Blyth, C.
Brent, A.
Buckland, W. H.
Bethune, R. D.
Bush, —
Boyes, W. L.
Burgess, Miss
Bradshaw, J.
Bessitt, —
Coverdale, Dr.
Crouch, Dr. E. J.
Cearns, Mrs.
Crosby, Hon. W.
Chapman, A. K.
Cole, W. H.
Dunbabin, —
Davies, J.
Douglas, Hon. A.
Echlin, J.
Edwards, G.
Easton, —
Flexmore, —
Facy, —
French Brs.
Featherston, Miss
Gellibrand, Hon. W.
Gawne, E. B.
Hull, A. F. B.
Headlam, —
Holden, Dr.
Hinsby, H.
Hedberg, O.
Hull, E.
Hadley, Mrs. J. C.
Johnston, R. M.
Lester, W.
Lardson, L. D.
Lindley, C. H.
Lovett, —
Lord, Mrs. John
Legge, Col. W. V.
Meredith, C.
M'Cluskey, J.
M'Clymont, J.
Moore, —
M'Cance, J.
Mace, F.
Massey, L.
Morrisby, H.
Nairn, C. C.
Oakley, T.
Propsting, —
Propsting, Miss
Perkins, —
Peacock, W.
Read, R.
Richardson, Geo.
Seager, P.
Shoobridge, W. E.
Selfe, F.
Stannard, H.
Salmon Commissioners of Tasmania
Stanfield, T.
Short, J. N.
Swan, Miss G.
Swan, Master A.
Swan, E. D.
Swan, John
Street, —
Schott, Herr
Syme, J. Wemyss
Tabart, T.
Turvey, W.
Triffett, T. J.
Trustees Brisbane Museum
Wilson, —
Wright, E. C.
Wallack, E. T.
Whitehead, J. N.
Wilson, L.
Wilkins, —

PLANTS INTRODUCED INTO THE ROYAL SOCIETY'S GARDENS DURING 1885.

Abies brachyphylla
„ dumosa
Acacia coccinea
„ linifolia
„ lentis
„ speciosa
Aciphylla Munroi
Acrostichum quercifolium
„ sorbifolium
Adiantum caudatum
Albertus simplicifolius
Alsophilla Rebeccæ
„ Leichardtiana
Anogeissus latifolia
Aotus gracillima
Aphelexis macrantha purpurea
„ rupestris grandiflora
Aristea Ecklonii
Aspidium arguta proliferum
„ confluens
„ varium
Asplenium lessertifolium
Asparagus virgata
Astetia grandis
„ nervosa
Atragene Alpina
Atreplex halameoides
„ verrucosum
Bauhinia tomentosa
Bossiæa linophylla
Buckinghamia populnea
Callistemon speciosus
Callixema parviflora
Camellia reticulata
Campanula barbata alba
„ Siberica eximea
„ turbinata
Campsidium filicifolium
Carmichælia Erysii
Caryota Rumphii
Celmisia coriacea
„ holosericea
„ petiolata
„ spectabilis
Coprosma fætidissima
Corum alba
„ alternifolia
„ brachypoda
Cyathea Gardnerii
Danthonia flavescens
Dicksonia lanata
Dictymia lanceolata
Doronicum Caucasicum
Dracocephalum nutans
Eucalyptus gomocephala
„ diversicolor
Eremurus altaicus
Erigeron aurantiacus
„ Caucasicus
„ elongatus
Euchalæna luxuriens
Eulalia zebrina
Fagus Solandri
Gemostoma ligustrifolia
Gentiana Walugerii
Grisilinia littoralis
Hamanthus Catherina
Hedera Madariensis variegata
Hedysarum neglectum elatum
Heleborus albus
„ albus Otto
„ atropurpureus
„ lividus
„ niger major
„ roseus pallidus
Hymenanthera Chatamica
Ilex Cassina
Iris prismatocarpus
Kennedia glabrata
Larix leptolepis
Lastrea glabellum
Lippia repens
Littonia modesta
Lonicera ruprecptiana
Lophospermum coccineum
Lunaria biennis
Lycopodium Billardieri
„ plegmaria
Macroglossa albescens
Maurandya alba
Medicago articularis
Melicytus ramiflorus
Metrosideros lucida
Myrsine Australis
„ divaricata
Myrtus obcordata
Nesodaphne Tawa
Nicotiana longiflora
Olearea angustifolia
„ Colensoi
„ nitida
„ operima
„ Traillii
Ourisea macrophylla
Oxybaphus himalensis
Oxytropis ochroleuca

Panax simplex
Pancrateum amænum
„ Caribbeum
Panicum variegatum
Petalostemon Canadensis
Pentstemon diffusus
Phænix farinifera
Phaseolus Caracalla
Phegopteris refracta
Phytuma orbiculare
„ Schencherii
Pitcairnia flavescens
„ integrifolia
Pittosporum erioloma
Plagianthus Lyallii
Polypodium Richardii
„ sorbifolium
Prunus Pisardi
Pteris lepidophylla
„ umbrosa
Pyrus prunifolia cerasiformis
Ranunculus Lyalli
Rhus aromatica
Ribes saxatilis
Sanguisorba alpina
Saracenia variolaris
Saxifraga intermedia
„ nivalis
Scrophularia laterifolia
„ vernalis
Sempervivum Laggeri
Senecio compacta
„ elæagnifolia
„ Hectori
„ Muelleri
„ saxifragioides
„ sciadophyllum
Sesamum prostratum
Solandra grandiflora
Spiræa amurensis
„ lævigata
„ Media
Statice leptostachya
Stilvocarpus polaris
Tarratula coronata
Tecoma rosea
Teletia speciosa
Thyrsacanthus multiflorus
Weinmannia racemosa
Xylomelum reticulata

Camellia.

Adela Pelegi Medici
Belle de Fonteari
Bonimiana
Comte de Gomer
Comtesse Callina
Cup of Beauty
C. H. Hovey
Don Pedro
Flag of Truce
Harriet Beecher Sheather
Lady St. Clair
Madame A. Verschaffelt
Madame Abbe Mea
Prince Frederick William
Tabbs
Verschaffeltii

Azalea.

Bijou de Paris
Charles de Buck
Dame Melanie
Princess Charlotte
Helene Theleman
Imperatrice Charlotte
Madlle. Marie Van Houtte
Orange Brilliant
President Raphail de Smet
Triomph de Dbl. Blanc

Roses.

Amelia Hoste
Beauty of Greenmount
Comtesse Janconet
Dr. Berthet
Etoile de Lyon
Gloire de Bourg la Reine
Homer
Imperatrice Charlotte
Jules Finger
La Boule d'Or
Madame Justure
Madame Place
Marie Leonida
Marie Louise Pernet
Masterpiece
Merveille de Lyon
Mons. Cordier
Mons. Furtado
Paul Jamin
Prince Humbert
Queen of Queens
Souvenir d'Amiens
Souvenir Mdm. Rosseaux
Ulrich Brunner Fils
Vivelina
William Allan Richardson

Fuchsias.

Aurora Superba
Avalanche (Henderson's)
Baroness
Boliviana
Canary Bird
Crimson Bedder
Glory
Harlequin
John Gibson
Lady Brideport
Mdm. J. Chretien
Marvellous
Minerva
Mrs. Marshall
Mrs. Rundle
Phenomenon
Progress
Startler
Sylvanus
Tower of London
Triton
Try me O
Warrior Queen
White Giant

Pelargoniums.

Alfonso
Ameythyst
Arisba
Dolphin
Gidour
Grison
Hector
Instance
Lauretta
Leonard
Lessce
Marsus
Nabob
Nelly Hayes
Ondine
Pension
Rustic
Sportsman
Telemon
The Baron
Treasure

Pelargoniums (Fancy).

Animation
Jewel

Pelargoniums (Regal).

Duke of Bedford
Elegantissima
Mdm. Ch. Konig
Princess Beatrice
Regalia
Sultan

Pelargoniums (Ivy-leaved).

Isador Feral
Jeanne d'Arc

Dahlias.

40 named varieties.

Chrysanthemums.

80 named varieties.

FRUITS.

Apples.

Ben Davis
Fallwater
Golden Spire
Grange's Pearmain
Reinette Rouge Hiver
Willis's Red

Apricot.

Pine Apple.

Peaches.

Belle Bauce
Biggs's late May
Desse Tardive
Early Silver
Grey's late Cling
Monstreuse de Douay
Red Nectarine Peach
Seedling China

Cherry.

Bohemian Black

Currant.

Black Grape

Pears.

Beurre Bachelier
Beurre de l'Assumption
Colmar de Jonghe

Grape Vines.

Baxter's Sherry
Bell's Seedling.
Chaptal
Chasselas Musque
Golden Chasselas
La Mamelon
Royal Ascot
Shipland's Reisling
Waltham Cross
White Allicant
White Morillon
White Sherry

EXCHANGES PLANTS, SEEDS, &c. DURING THE YEAR 1885.

February:

From C. F. Creswell—Collection imported bulbs, about 300 varieties.
From Miss Brumby, Old Beach—8 packets seeds, Australian.
From Messrs. Heyne & Co., Adelaide—3 varieties boronia seed.
From Baron Ferd. Von Mueller, Victoria—14 packets seeds.
From Miss Woodin—Seeds Japan coniferæ and lily bulbs.

March:

From Messrs. Van Gert, Belgium—5 varieties seeds, coniferæ.
From Mr Wm. Bull, London—32 packets seeds; 2 bulbs.
From Miss Woodin, Hobart—25 packages seeds, Japan.

April:

From the Botanic Gardens, Madras—16 packets seeds.
From Botanic Gardens, Saharunpur, India—Seeds, abies dumosa.

May:

From the Botanic Gardens, Queensland—Case plants.
From Baron Ferd. Von Mueller, Victoria—135 packets seeds.
From Dr. R. Schomburgk, Botanic Gardens, Adelaide—25 packets seeds.
From Mr. G. Brunning, Nurseryman, St. Kilda—Case containing 45 plants.

June:

From Agri-Horti Society, Madras—Seeds podocarpus.

July:

From Mr. S. Purvis, Swanport—Plants, encryplica; seeds, telopea.
From Royal Botanic Gardens, Kew, London—Seeds, Buckinghamia populnea.
From Mr. Ch. Traill, Stewart Island, N.Z.—Case containing 38 plants.
From Botanic Garden, Cape Town—Seeds, Pentzia virgata.
From Messrs. Shepherd & Co., Sydney—Case containing 60 plants.
From Botanic Gardens, Bombay—Packet seeds.
From Mr. S. Purchase, Parramatta—36 dahlia roots.

August:

From Mr. J. Smith, sen., Riddell's Creek, Victoria—Case plants.
From Botanic Gardens, Jamaica—Package seeds.
From Mr. Elliott, Hobart—14 packages seeds.
From Mr. Emmet, Hobart—Seeds waratah.

September:

From Mr. J. Latham—24 plants.
From Mr. S. Purchase, Parramatta—Case plants.
From Messrs. Shepherd & Co., Sydney—14 plants.
From Mrs. Archer, Hobart—Seeds.
From Mr. C. Sprent—Imported seeds.

October:

From Mr. Wm. Bull, New Plant Merchant, London—Case chrysanthemums, 103 sorts.
From the Botanic Gardens, Christchurch, New Zealand—Case plants.
From Baron Ferd. Von Mueller, Victoria—1 packet seeds; 1 bulb.
From Agri-Horti Society, Madras—Seeds Phœnix paludosa.

November:

From Botanic Gardens, Calcutta—7 packets seeds.
From Mr. H. T. Manning, Hobart—7 packets seeds, New Caledonia.
From the Royal Gardens, Kew, London—Seeds Phœnix paludosa.

December:

From Messrs. Vilmorin & Andrieux, Paris—26 packets seeds.
From Agri-Horti Society, Madras—Packet seeds.
From Messrs. Law, Somner, & Co., Melbourne—Case containing 66 plants.
From Baron Ferd. Von Mueller, Victoria—3 packets seeds.
From Miss Woodin, Hobart—Seeds Rhodoleia championi.
From Mr. S. Probin, Hobart—Fuchsia and Pelargonium plants.

February:

To Messrs. Law, Somner & Co., Melbourne: 2 mats sphagnum.

March:

To Mr. Wm. Bull, London: 10 small tree ferns.
To Dr. R. Schomburgk, Adelaide: 2 mats sphagnum.

May:

To Mr. J. Smith & Sons, Riddell's Creek, Victoria: 2 mats sphagnum.
To Messrs. Law, Somner & Co., Melbourne: 2 mats sphagnum.

June:

To Mr. G. Brunning, St. Kilda: box plants and cuttings.

July:

To Messrs. Shepherd & Co., Sydney: 2 mats sphagnum.
To Baron Ferd. Von Mueller, Victoria: 286 packets seeds.
To Messrs. Shepherd & Co., Sydney: 150 packets seeds.
To Mr. G. Brunning, St. Kilda: 40 packets seeds.

August:

To Messrs. Vilmorin & Andreaux, Paris: 30 packets seeds.
To August Van Gert, Belgium: 18 packets seeds.
To Mr. Wm. Bull, London: 16 packets seeds.
To the Royal Gardens, Kew, London: 18 packets seeds.
To the Botanic Gardens, Calcutta: 24 packets seeds.
To the Botanic Gardens, Saharanpur, India: 20 packets seeds.
To the Forest Board, Madras, India: 26 packets seeds.
To Mr. J. Smith & Sons, Riddell's Creek, Victoria: case plants.
To Mr. C. Traill, Stewart Island, N.Z.: case, 43 plants.
To the Botanic Gardens, Christchurch, N.Z.: case, 40 plants.
To Mr. S. Purchase, Parramatta: package seeds.
To the Botanic Gardens, Melbourne: 2 mats sphagnum moss.

September:

To the Botanic Gardens, Cape Town, South Africa: collection seeds.
To the Chamber Agriculture, U. S. America: collection seeds.
To Messrs. Smith & Adamson, Melbourne: 4 packets seeds.
To Mr. L. Boehmer, Japan: collection seeds.
To Miss Owen, Ireland: collection seeds.
To Conservator Forests, Punjaub: seeds eucalypti.
To Mrs. Oliver, New Plymouth, N.Z.: collection seeds.
To C. Moore, Botanic Gardens, Sydney: 2 mats sphagnum.
To Messrs. Shepherd & Co., Sydney: case plants.
To B. F. Wellington, San Francisco: Seeds eucalypti.

October:

To Mr. C. F. Creswell: plants, chrysanthemums, &c.

December:

To Messrs. Law, Somner & Co.: case chrysanthemums.
To Messrs. E. B. Heyne, Adelaide: 90 packets seeds.
To Mr. Wm. Bull, London: case araucaria excelsa.

F. ABBOTT.

T FOR 1885.

d to 32° Fahrenheit, and reduced to Sea Level.

YE	RAIN.		PREVAILING WINDS.		CLOUDS.
18	*Total Fall.*	*No. of days Rain fell.*	*Direction.*	*Force.*	*Amount.*
	Inches.			(0—12)	(0—10.)
January .	2·40	14	S. & N.N.W.	2·3	6·7
February	1·97	18	S.S.E. & N.N.W.	2·0	7.6
March .	3·51	17	S.S.W. & N.W.	2·3	7·0
A					
M					
J					
J					
A					
S					
O					
N					

	nches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.
	2·75	19	5·81	6	1·32	14	5·72	5	1·56	147	42·86
	3·24	17	5·72	12	0·90	21	9·14	12	1·16	197	40·75
	0·81	15	3·74	5	2·22	11	7·40	9	2·11	122	29·42
	0·62	15	3·09	8	1·41	10	6·82	8	1·74	112	24·50
	1·34	17	4·12	10	1·43	15	7·39	11	1·77	176	28·29
	0·88	15	4·25	6	0·96	13	8·81	8	1·56	123	25·81
	1·77	16	3·54	6	0·96	16	5·53	5	1·44	125	25·54
	0·77	19	2·76	8	1·06	11	5·60	9	1·88	132	23·40
	1·63	19	2·79	10	1·56	13	7·63	11	1·99	172	44·15
	0·71	9	2·20	4	2·20	8	8·42	3	2·55	55	24·76
la	1·26	16	3·57	9	1·46	12	4·27	8	1·88	116	22·81
	1·53	16	4·38	7	1·10	10	3·52	7	1·98	115	25·39
ow	0·95	9	2·26	5	1·45	11	5·12	6	1·94	72	27·31
	2·21	8	1·47	7	0·69	13	3·46	6	3·01	101	23·47
, Fi	1·99	9	1·99	5	0·84	9	4·30	4	1·62	79	22·25
	1·56	13	1·45	7	0·83	10	4·26	5	2·86	103	23·46
ount	0·97	8	1·28	4	1·08	7	3·24	5	1·90	70	19·01
a	6·04	13	4·25	8	2·35	9	3·51	9	3·17	128	47·21
d	2·45	12	3·27	6	2·10	5	0·75	4	1·73	88	25·31
on	2·66	16	1·89	7	1·62	8	1·70	4	2·32	128	25·66
ie	4·31	13	1·98	9	1·97	11	3·18	4	3·77	117	31·96
	5·28	17	2·35	9	2·06	13	2·44	9	3·69	161	37·71
ay	6·66	9	2·70	7	2·72	8	2·13	4	4·05	103	41·74
field,	5·38	16	3·12	9	2·80	—	—	—	—	—	—
Bay											
t Bischo	8·63	18	4·47	6	2·71	12	2·79	4	3·58	151	55·05
ar Head	3·08	25	9·62	24	4·23	24	5·08	16	3·73	282	86·81
na	3·45	20	2·85	12	1·31	19	1·24	7	3·03	191	29·24
	1·95	19	9·53	21	4·12	21	3·98	6	3·36	215	80·11

J. SHORTT, *R.N.*, *Meteorological Observer.*

SUMMARY OF METEOROLOGICAL OBSERVATIONS TAKEN AT HOBART FOR 1885.

Latitude, 42° 53′ 25″ S.: Longitude, 147° 20′ 6″ E. Height of Observatory above Sea Level, 190 feet. Barometer corrected to 32° Fahrenheit, and reduced to Sea Level.

YEAR.	BAROMETER.	THERMOMETER IN SHADE.						RADIATION.		HUMIDITY.			RAIN.		PREVAILING WINDS.		CLOUDS.
1885.	Mean.	Maximum.	Mean Maximum.	Minimum.	Mean Minimum.	Mean Diurnal Range.	Mean Temperature of Month.	Solar Max.	Terrestrial Min.	Dew Point.	Elastic Force of Vapour.	Humidity.	Total Fall.	No. of days Rain fell.	Direction.	Force.	Amount.
	Inches.	°	°	°	°	°	°	°	°	°			Inches.			(0–12)	(0–10)
January	29·852	85·0	70·5	41·7	52·1	18·4	63·8	143·0	34·0	53·0	·403	0·68	2·40	14	S. & N.N.W.	2·3	6·7
February	29·838	86·5	69·1	42·8	53·2	15·9	61·6	139·0	36·9	55·2	·435	0·80	1·97	18	S.S.E. & N.N.W.	2·0	7·8
March	29·835	85·0	65·3	41·2	48·3	17·0	58·5	136·0	33·7	51·3	·378	0·77	3·51	17	S.S.W. & N.W.	2·3	7·0
April	30·181	74·0	61·2	34·7	46·9	14·3	54·9	128·0	28·0	49·5	·355	0·82	0·78	7	S. & N.W.	1·6	7·0
May	29·956	70·8	57·2	35·7	42·9	14·2	52·2	118·0	26·0	45·2	·302	0·77	0·89	14	S.S.W. & N.W.	2·0	7·0
June	29·957	69·0	52·0	29·8	38·5	13·5	45·7	110·0	25·0	42·1	·268	0·87	1·76	17	S.S.W. & N.N.W.	2·0	6·0
July	30·140	58·4	51·5	29·5	37·2	14·3	44·2	108·0	22·5	40·7	·254	0·88	0·93	17	S.W. & N.N.W.	2·0	5·4
August	29·774	71·0	56·5	32·0	41·6	14·9	49·5	122·0	24·7	43·5	·282	0·79	1·34	19	S.W. & N.W.	2·5	6·6
September	29·891	69·3	57·5	36·8	42·8	14·7	51·2	127·0	27·0	45·5	·305	0·81	4·12	17	S.S.W. & N.W.	2·6	7·0
October	30·008	63·0	63·1	33·7	43·7	18·4	53·4	146·0	25·0	48·2	·335	0·76	1·43	10	S.S.E. & N.N.W.	2·6	6·8
November	29·908	86·2	64·4	37·0	47·4	17·0	56·6	146·0	28·5	48·5	·342	0·75	7·39	15	S.S.E. & N.W.	3·0	7·6
December	30·001	91·0	69·1	44·3	52·8	16·3	61·6	153·0	35·3	55·1	·434	0·79	1·77	11	S.S.E. & N.N.W.	2·0	6·8
Mean	29·945	..	61·44	..	45·7	15·7	54·6	..	..	48·15	·341	0·79	2·36	14.5	S. & N.W.	2·2	6·8
Extremes	..	Dec. 8 91°	..	July 1 29·5°	..	..	..	Dec. 8 153°	July 22 22·5°	..	..	..	Total, 28·29	Total, 176			

EPITOME OF RESULTS OF METEOROLOGICAL OBSERVATIONS AT THE DIFFERENT STATIONS FOR THE YEAR 1885.

STATIONS.	BAROMETER. Mean.	THERMOMETER, IN THE SHADE. Maximum.	Mean Maximum.	Minimum.	Mean Minimum.	Mean Diurnal Range.	Mean Temperature of Year.	RADIATION. Solar Max.	Terrestrial Min.	HUMIDITY, MEAN. Dew Point.	Elastic Force of Vapour.	Humidity.	RAIN. Total Fall.	No. of days Rain fell.	PREVAILING WINDS. Direction.	Force.	CLOUDS. Amount.
	Inches.	°	°	°	°	°	°	°	°	°			Inches.			(0-12)	(0-10)
Southport	29·969	84·0	60·3	27·0	42·7	17·6	55·9	...	...	52·0	·378	0·84	42·80	147	S., N.W., & N.E.	2·8	6·2
Hobart	29·945	91·0	61·4	29·5	45·7	15·7	54·6	153	22·5	48·15	·341	0·79	28·29	176	S. & N.W.	2·2	6·8
Oatlands	29·941	87·0	60·9	20·0	39·3	21·6	52·25	...	...	42·9	·281	0·70	27·31	72	S.W. & N.N.W.	2·4	6·2
Falmouth	29·982	91·0	62·6	27·0	43·2	18·4	54·95	...	...	46·6	·324	0·75	19·01	70	S. & N.N.W.	2·3	5·1
Launceston	30·018	91·0	64·5	24·9	43·6	20·9	55·1	143	20·5	47·3	·331	0·73	31·96	117	S.S.E., N.N.W.	1·8	4·4
Low Head	30·023	80·5	60·3	31·5	47·4	12·9	53·8	...	...	50·6	·375	0·83	25·66	128	S.S.E., N.E., & W.N.W.	3·3	4·4
Circular Head	30·021	77·5	61·2	28·0	46·9	14·3	53·1	...	...	48·3	·343	0·78	29·24	191	S.W., E.N.E., & N.	3·5	6·0
Corinna	30·026	86·0	61·0	30·0	45·4	14·6	53·7	...	...	...	...	...	80·11	215	S. & W.N.W.	2·2	6·0

MEAN AND EXTREME RESULTS FOR THE YEAR 1885.

From Observations taken at Hobart.

Barometer—

Highest reading	30·552 inches, on 18th April.
Lowest ditto	28·902 inches, on 14th August
Range for the year	1·650 inches.

Thermometer—

Radiation, Solar, maximum	153°, on 8th December.
Ditto, Terrestrial, minimum	22·5°, on 22nd July.
Maximum in the shade	91°, on 8th December.
Minimum ditto	29·5°, on 1st July.
Range for year	61·5°
Highest mean daily reading for one month	69·8°, January.
Lowest ditto ditto	44·2°, July.

Humidity—

Mean maximum for one month (saturation = 100)	·88, in July.
Mean for the year	·79.

Condensation—

Total for the year	28·29 inches.
Total Number of Rainy Days	176
Maximum fall for one month	7·39 inches, December.
Minimum ditto	0·78 inches, April.
Maximum fall in 24 hours	3·70 inches, 30 November.

RAINFALL IN TASMANIA DURING THE YEAR 1885.

Showing the Latitude and Longitude, and Distance from the Sea Coast of each Station, and Number of Days Rain fell during each Month, and Total Rainfall.

Name of Station.	Latitude, South.	Longitude, East.	Distance from Sea Coast.	JANUARY. Wet Days.	JANUARY. Rainfall.	FEBRUARY. Wet Days.	FEBRUARY. Rainfall.	MARCH. Wet Days.	MARCH. Rainfall.	APRIL. Wet Days.	APRIL. Rainfall.	MAY. Wet Days.	MAY. Rainfall.	JUNE. Wet Days.	JUNE. Rainfall.	JULY. Wet Days.	JULY. Rainfall.	AUGUST. Wet Days.	AUGUST. Rainfall.	SEPT. Wet Days.	SEPT. Rainfall.	OCTOBER. Wet Days.	OCTOBER. Rainfall.	NOVEMBER. Wet Days.	NOVEMBER. Rainfall.	DECEMBER. Wet Days.	DECEMBER. Rainfall.	TOTAL. Wet Days.	TOTAL. Rainfall.
	° ′ ″	° ′ ″	Miles.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.	No.	Inches.
Southport	43 26 0	147 1 0	Coast.	11	3·13	17	5·79	13	4·02	14	1·73	15	2·14	16	4·83	6	1·16	15	2·75	19	5·61	6	1·32	14	5·72	9	1·56	147	42·80
Franklin	43 5 0	147 3 0	15	16	2·84	20	3·57	19	6·61	11	1·31	16	1·41	15	3·56	17	1·29	21	3·24	17	5·72	12	0·90	21	9·14	12	1·16	197	40·75
Mount Nelson	42 55 0	147 21 0	7	14	2·53	15	3·01	13	3·42	7	0·85	9	1·00	9	1·57	5	0·76	10	0·81	15	3·74	5	2·22	11	7·40	9	2·11	122	29·42
Clarence Plains	42 54 0	147 24 0	8	11	3·08	14	2·90	11	3·39	5	0·75	6	0·49	9	1·42	5	0·71	10	0·62	15	3·09	8	1·41	10	0·82	8	1·74	112	24·50
Hobart	42 53 0	147 21 0	10	14	2·40	18	1·97	17	3·51	7	0·78	14	0·89	17	1·76	17	0·93	19	1·34	17	4·12	10	1·43	15	7·39	11	1·77	176	28·29
Botanical Gardens, Hobart	42 52 0	147 20 0	12	10	1·82	11	1·18	13	3·07	7	0·51	8	0·80	11	1·28	6	0·69	15	0·88	15	4·25	6	0·96	13	8·81	8	1·56	123	25·81
New Norfolk	42 37 0	146 55 0	23	9	1·93	10	1·34	14	4·62	4	0·56	12	1·54	10	1·52	7	0·79	16	1·76	16	3·54	6	0·96	16	5·53	5	1·44	125	25·54
Richmond	42 45 0	147 30 0	19	13	2·80	15	1·41	15	3·57	4	0·60	8	0·95	8	1·46	5	0·64	15	0·77	19	2·70	8	1·06	11	5·60	9	1·88	132	23·40
Carnarvon	43 8 0	147 53 0	2	11	3·83	21	4·38	15	6·67	12	1·65	17	2·84	15	6·56	15	2·42	13	1·63	19	2·79	10	1·56	13	7·63	11	1·99	172	44·15
Swansea	42 8 0	148 7 0	Coast.	5	2·90	5	2·35	4	2·30	3	0·75	5	0·98	3	1·41	2	0·01	4	0·71	9	2·20	4	2·20	8	8·42	3	2·55	55	24·76
Hamilton	42 34 0	146 52 0	30	10	1·97	7	1·29	10	4·12	3	0·22	11	1·38	12	1·76	7	0·63	11	1·26	16	3·57	9	1·46	12	4·27	8	1·88	110	22·81
Macquarie Plains	42 45 0	147 5 0	35	11	2·72	10	1·98	11	3·78	4	0·43	9	1·27	10	2·07	6	0·63	14	1·53	18	4·38	7	1·10	10	3·52	7	1·98	115	25·39
Oatlands	42 18 0	147 24 0	28	6	2·82	5	1·28	8	3·03	2	0·34	4	0·91	6	1·73	4	0·48	6	0·95	9	2·26	5	1·45	11	5·12	6	1·94	72	27·31
Campbell Town	41 56 0	147 34 0	38	8	2·31	9	2·18	9	2·64	4	0·46	8	2·01	11	1·95	5	1·08	13	2·21	8	1·47	7	0·69	13	3·46	6	3·01	101	29·47
Fingal	41 40 0	147 48 0	13	6	2·57	8	1·91	9	2·16	3	0·72	6	1·20	8	2·01	4	1·24	7	1·99	9	1·49	9	0·84	9	4·20	4	1·62	79	22·25
Killymoon, Fingal	41 35 0	148 10 0	9	6	1·85	12	2·48	11	1·83	7	0·52	6	1·44	13	3·95	6	0·43	8	1·36	13	1·45	7	0·83	10	4·26	5	2·86	101	23·46
Falmouth	41 32 0	148 19 0	Coast.	4	1·49	10	2·27	8	1·66	7	0·79	4	1·30	7	2·28	1	0·25	5	0·67	8	1·28	4	1·08	7	3·24	5	1·90	70	19·01
Gould's Country	41 15 0	148 0 0	13	5	2·46	13	6·32	12	3·15	8	1·09	11	3·60	12	7·08	9	3·99	17	8·04	13	4·25	8	2·35	9	3·31	7	3·17	128	47·21
Beaconvale	40 53 0	147 56 0	11	2	0·99	6	1·42	10	2·50	5	1·10	7	2·46	12	4·56	6	1·56	13	2·45	12	3·27	6	2·10	5	0·75	4	1·73	86	25·31
Low Head	41 3 0	146 48 0	Coast.	8	0·97	10	2·00	11	2·34	7	0·37	15	3·44	13	3·63	9	2·19	17	2·66	20	1·89	7	1·62	8	1·70	4	2·32	128	25·06
Launceston	41 26 0	147 10 0	28	7	1·61	8	1·79	12	2·74	4	0·14	9	2·65	15	4·76	8	3·06	17	4·31	13	1·98	9	1·97	11	3·18	4	3·27	117	31·96
Deloraine	41 30 0	146 40 0	23	10	1·91	14	1·75	14	2·91	12	0·44	14	5·11	16	5·55	12	4·12	21	5·28	17	2·35	9	2·66	13	2·44	9	2·69	161	37·71
Latrobe	41 13 0	146 26 0	3	6	2·55	11	2·27	10	2·24	3	0·39	11	4·67	12	6·34	7	5·02	15	6·66	9	2·70	7	2·73	8	2·13	4	4·05	109	41·74
Emu Bay	41 4 0	145 56 0	Coast.	12	2·11	17	2·63	18	2·77	16	1·89	19	3·81	18	6·47	18	4·51	22	5·38	16	3·12	9	2·80	—	—	—	—	—	—
Roosnaidh, S., Emu Bay	41 15 0	145 46 0	15	6	2·34	15	3·63	15	4·26	10	1·38	16	6·13	18	8·26	13	6·17	20	8·63	18	4·47	6	2·71	12	2·79	4	3·58	151	45·66
Mount Bischoff	41 25 0	145 24 0	28	21	3·24	23	7·66	25	9·55	21	4·13	27	9·39	24	11·52	23	5·48	29	13·08	25	9·62	24	4·23	24	5·08	16	3·73	282	86·61
Cuvular Head	40 43 0	145 17 0	Coast.	13	1·93	13	1·32	18	3·00	13	0·82	22	3·54	20	4·47	13	2·19	21	2·45	20	2·83	12	1·21	19	1·24	7	3·03	191	29·24
Corinna	41 41 0	145 2 0	Coast.	16	3·21	11	7·63	21	7·64	11	3·39	22	9·46	23	11·44	16	4·40	22	11·66	19	9·53	21	4·12	21	3·66	6	3·36	215	80·11

J. SHORTT, *R.N., Meteorological Observer.*

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