PAPERS & PROCEEDINGS

OF THE

ROYAL SOCIETY

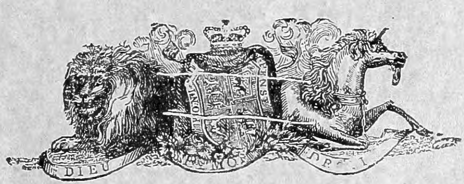
OF

TASMANIA,

FOR THE YEARS

1898-1899.

(ISSUED JUNE, 1900.)



Tasmania:

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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.

ROYAL SOCIETY OF TASMANIA.

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PAPERS 1898 AND 1899.

ABSTRACT

OF THE

Proceedings of the Royal Society of Tasmania, 1898.

OPENING MEETING, MAY, 1898 SESSION.

The first meeting of the session of 1893 was held by the Royal Society of Tasmania, at the Art Gallery on Monday, May 25. His Lordship the Bishop of Tasmania (Dr. Montgomery) presided. There was a large attendance. Apologies for non-attendance were received from His Excellency the Governor, Sir James Agnew, K.C.M.G., M.D, M E.C., and Mr. T. Stephens, M.A., F.G.S.

The following persons were elected members of the Society:—F. J. Drake, M.B., B.S., Melb. Univ.; Dr. Alsop, G. M. Anderson, M.B., C.M.; E. W. J. Ireland, M B., C.M., Edin.; Mr. E. T. Miles, M.H.A.; Mr. George Steward, Under Secretary; and Mr. O. E. White.

Before calling on the secretary to read the annual report, the CHAIRMAN referred to the death of the late Chief Justice, who had been one of the Vice-Presidents of the Society. He said they also keenly felt the deep loss occasioned by the death of the late Mr. Matthew Seal. A more recent and deeper loss, however, was the death of the late Chief Justice. Their late Vice-President had been a most regular attendant at all meetings, and the Society deeply lamented his death. There was still another loss to deplore. He referred to the death of Mr. F. Belstead, who had been one of their highest types of a public servant.

ANNUAL REPORT.

The SECRETARY (Mr. A. Morton) then read the following annual report:—

The Council of the Royal Society of Tasmania have pleasure in presenting this, their annual, report for the year 1897. During the session six meetings have been held. At the first meeting, His Honor Sir Lambert Dobson, K.C.M.G., C.J., F.L.S., Vice-President, presided. Before the business of the meeting commenced, the Chairman referred to the loss the Society had sustained in the death of Mr. James Barnard, Vice-President of the Society. A full account of the remarks of the Chairman is given in the 1897 Volume of Proceedings. At this meeting the Chairman read an address from the Society that had been decided to send to Her Most Gracious Majesty the Queen on the celebration of Her Majesty's Record Reign. Among the papers read at the May meeting, were one by Professor W. Jethro Brown, MA., LL.D., entitled, "The application of the Hare system in Tasmania." Mr R. M. Johnston, F.L.S., F.S.S., Government Statistician and Registrar-General of Tasmania, read a paper, "Observations on the working results of the Hare system of election in Tasmania" illustrated with diagrams. Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S., contributed an interesting paper on some microscopical studies of Tasmanian rocks. Mr. F. Back, A.M.I.C.E., F.S.S., General Manager of Tasmanian Railways, furnished a paper on the "Mount Dundas Narrow-gauge Railway." The paper was of particular interest, being illustrated with some specially prepared lantern slides, by Mr. J. W. Beattie, Hon. Photographer to the Tasmanian Government. At the June meeting Mr. T. Stephens, M.A., F.G.S., Vice-President, announced that Mr. R. M. Johnston, F.L.S., F.S.S., had been unanimously elected a Vice-President of the Society, taking the place of the late Mr. James Barnard. Dr. Gregory Sprott, Health Officer of the City of Hobart, read a paper that evoked some interesting discussion, entitled, "Disposal of our Dead by Cremation." Some interesting correspondence on the working of the Ben Nevis Observatory, by Mr. Alex. Buchan, President of the Scottish Meteorological Society, was read by Mr. H. C. Kingsmill, M.A., Meteorological Observer of Tasmania. At the next meeting congratulations were conveyed to the Vice-President, Sir Lambert Dobson, on the honour that had been conferred on him since the last meeting as K.C.M.G. Several interesting papers were read at the August meeting—"On the Topaz-quartz-porphyry, or stanniferous elvan dykes of Mount Bischoff," by Messrs. Twelvetrees, F.G.S., and Petterd, C.M.Z.S. Mr. J. B. Walker, F.R.G.S., added to the history of the Tasmanian aboriginal race a valuable paper from notes taken from the late Mr. Geo. Washington Walker's journal. At the September meeting Mr. W. R. Harper, member of the Polynesian Society, read a paper on the measurements of the Maori and Moriori crania. At the same meeting, a paper on the iron deposits of Tasmania, by Mr. W. G. Dauncey, C.E., and one on obsidian buttons, by Mr. T. Stephens, M.A., F.G.S., were read. At the October meeting Messrs. W. E. Harper, M. Polynesian Society, and Mr. A. H. Clarke, M.R.C.S,E., read a very valuable paper giving the measurements of the Tasmanian Aboriginal crania contained in the Tasmanian Museum. At the last meeting of the session Mr. L. Rodway gave a paper on the "Tasmanian Fungi," and a new "Trithuria." Mr. W. F. Petterd one on "Some Recently New and Rare Minerals Discovered in Tasmania." A paper by the same author and Mr. W. H. Twelvetrees on "The Occurrence of Spherulitic Felsite on the West Coast" was read, as also one by Mr. A. Mault, engineering inspector to the Board of Health, on

"The Great Lake and it's Water Power. A further paper, dealing with the "Aboriginals of Tasmania," by Mr. J. B. Walker, closed the session of 1897. During the year the evening meetings have been well attended and great interest taken. As will be seen by the report appendix A, the medical section have had several meetings, presided over by the president of the section, R. S. Bright, M.R.C.S.E. Several important subjects have been dealt with by the members of the medical profession.

COUNCIL.

Owing to the death of Mr. James Barnard, the vacancy on the Council was filled by the appointment of Mr. R. S. Bright, M.R.C.S.E.

LIBRARY.

The trustees of the British Museum presented a valuable collection of works. A full list is published in the proceedings, pp. XXII. and XXIII.; also a list of donations from kindred societies on pages XXV.-XXIX.

FELLOWS.

Four corresponding members and nine Fellows were elected during the year.

FINANCE.

The income has been: Subscriptions, £93, with 1896 balance, £89 13s.; total, £182 13s. Expenditure, £146 16s. 2d., leaving a balance of £35 16s. 10d.

APPENDIX A.

Towards the end of 1896 the medical members of the Royal Society established a medical section. Seventeen members joined the section. The following officers were elected in December, 1896, to hold office till March, 1898:—Patron: Sir James Agnew, K.C.M.G.; president, R. S. Bright; vice-presidents, G. H. Butler, E. L. Crowther; hon. treasurer, A. H. Clarke; hon. secretary, Gregory Sprott; members of committee: W. A. Harvey, J. E. Wolfhagen. Seven general meetings were held, and all were well attended, nearly every member contributing to the work of the section by papers or discussions. Papers—1. "A Plea for Circumcision," by Dr. A. H. Clarke. 2. "Notes of a Post Mortem," Dr. W. W. Giblin. 3. "Serum Diagnosis of Typhoid Fever, with Microscopic slides," Drs. Gregory Sprott and E. J. S. Spark. 4. "Friedreich Disease," by Dr. E. J. S. Spark. 5. "New Method of Treating Empyema," by Dr. S. C. Jamieson. 6. "Notes of a Case of Camphor Poisoning," by Dr. A. H. Clarke. 7. "Case of Suppuration of Eyeball during Convalescence from Typhoid," by Dr. S. C. Jamieson. Exhibits:—A large calculus, by Dr. Bright. Tasmanian skulls, by Dr. A. H. Clarke. Horseshoe Kidney, Dr. Gregory Sprott. The following exhibited cases of interest:—Dr. Chas. Crosby Walch, Dr. E. J. S. Spark, Dr. W. W. Giblin

The report was adopted.

The following members were re-elected members of the Council:—Sir James Agnew, K.C.M.G., M.D., M.E.C.; Hon. N. J. Brown, M.E.C., Speaker of the House of Assembly; Colonel W. V. Legge, R.A., Commandant of Tasmanian Forces; R. M. Johnston, F.L.S., F.S.S., Registrar-General of Tasmania.

PAPERS.

"NOTES ON A VISIT TO SOME OF THE ENGLISH MUSEUMS." By His Lordship the Bishop of Tasmania.

Bishop MONTGOMERY read a paper giving an account of his experiences in British Museums. An interesting description was given of the many exhibits seen in the museums visited. The paper stated that the well kept order of the Tasmanian Museum was referred to wherever he went. The advantage of exchanging exhibits was also referred to.

"NOTES ON THE GEOLOGY OF LA PEROUSE." By Mr. H. W. Nicholls.

Mr. R. M. JOHNSTON, F.L.S., read a paper on the geology of Mount La Perouse, which was written by Mr. H. W. Nicholls. The paper referred to the difficulties encountered in making an ascent of the mountain. The top of the mountain is composed of yellow clay slates. The deposit appeared to be about 100ft. in thickness, and rested on grey sandstone. Beneath the sandstone was a body of basalt. One of the hills to the north of Perouse also seemed to have a covering of grey slates. It appeared to the writer that the comparatively small elevation of the mountain accounted for the existence of the sedimentary deposits at the present time. The age of the deposits could only be hazarded. Anyone ascending La Perouse was advised to keep careful compass bearings when a fog prevailed.

"NOTES ON HUMERI OF A TASMANIAN LABYRINTHODONT." By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

The SECRETARY (Mr. Morton) read the following paper, prepared by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S. The paper stated that last year the writers received from Dr. H. Woodward, keeper of the geological collections in the British Museum (South Kensington), the replica of a cast in the British Museum collection, which had been obtained from Dr. Joseph Milligan, formerly of Hobart. Soon after informing Mr. Morton, Curator of the Tasmanian Museum, of the circumstance that gentleman brought under their notice and placed in their hands for examination a fossil bone (in two pieces) found in the sandstone quarry near Government House, in the Hobart Domain, and presented to the Museum in 1856 by Mr. Hay, Director of Public Works. Both the British and Tasmanian specimens are left humeri, and unquestionably belong to the same genus, if not the same species.

A very interesting description was given of the two bones, and also a list of the remains of the labyrinthodonts found in the different localities. The paper was accompanied with an excellent plate showing both the bones from the British and Tasmanian Museums.

"NOTES ON A VISIT TO PORT DAVEY."

By J. W. Beattie.

Mr. J. W. BEATTIE read a paper on a recent trip to Port Davey. The paper was illustrated with a number of limelight views. The scenery at Port Davey was said to have an individuality of its own. Steep hills prevailed in all directions, and afforded an endless variety of views. The first view shown was Adamson's Peak, which was succeeded by a picture of Southport Island. Other illustrations followed in quick succession, showing the various scenes of interest to be met with on a trip to Port Davey. The general features and early history of each view were briefly explained, and tended to increase the interest manifested by the gathering. A realistic illustration of Kelly's Basin was produced, and the quality of the oysters found therein extolled. The locality of Bramble Cove, where vessels trading to the West Coast sought shelter during storms, was pointed out, and the rugged grandeur of the scene explained. A tribute was paid to the harbour accommodation of Port Davey, and a suggestion made that one of the shipping companies should be induced to frequently run a vessel to the locality during the tourist season. As an agricultural settlement Port Davey had no future, but no doubt could be entertained with regard to its mineral possibilities. In conclusion, the speaker expressed a hope that before long Port Davey would prove to Hobart a mine of wealth and bring about a prosperity all hoped to see.

A brief discussion took place on several of the papers read.

The Hon. ADYE DOUGLAS, M.L.C., proposed a vote of thanks to those who contributed papers, and referred specially to the limelight views shown.

The Hon. C. H. GRANT, M.L.C., seconded the motion.

The motion was carried by acclamation.

At the close of the meeting the members and friends of the Society were entertained by the lady members of the Hamilton Literary Society. The tables were laid out in the board-room of the Royal Society.

JUNE, 1898.

There was a large attendance at the monthly meeting of the Royal Society of Tasmania on Monday evening, June 13, the Hon. C. H. Grant, M.E.C., C.E., presiding.

MR. W. C. PIGUENIT'S SUCCESS.

The SECRETARY (Mr. A. Morton) referred to Mr. Piguenit's great success with the pictures he had been exhibiting at the Grafton Art Gallery in London. On Saturday news came of all his pictures having been sold for higher prices than he (Mr. Piguenit) had expected; that his works were most highly appreciated; and he had been able to establish a good agency in London for the sale of his works, which would include many Tasmanian views.

Mr. R. M. JOHNSTON spoke with much gratification of the success of Tasmania's brilliant son in the world of art.

The CHAIRMAN was sure they all heartily congratulated Mr. Piguenit on his success in the old country, which abounded with artists of the highest order.

A VISITOR

Mr. Sadler, of the Great Boulder mine, Kalgoorlie, was introduced to the meeting as a visitor.

NEW MEMBERS.

Rev. C. R. Pollock, F.R.G.S., Mr. W. H. Wallace (Secretary of Mines), Mr. W. J. Watchorn, and Mr. R. C. Patterson, were balloted for, and elected members of the Society.

PAPERS.

"A LIST OF THE TASMANIAN MOLLUSCA."

By Miss M. Lodder.

The Secretary tabled a re-classification of Tasmanian marine mollusca, which, he said, was a very valuable list, by Miss M. Lodder. Miss Lodder had also re-arranged the collection in the Museum, and had also filled many gaps.

Mr. R. M. JOHNSTON assured the meeting that Miss Lodder's work was a very important one. She had, more than any other person, during late years made a very intimate study of Tasmanian mollusca, as well as many other Tasmanian natural history subjects. She had, with that energy, care, and ability that distinguished her, done a good work for the Museum by amending the list of names and identifying some varieties with the original names and types by the aid of specimens in Sydney and elsewhere, and so had been able to correct a large number of mistakes.

"ON THE OCCURRENCE OF A SEA SNAKE IN TASMANIAN WATERS."

By Alex. Morton.

The SECRETARY read the following notes on the occurrence of a sea snake in Tasmanian waters:—For the few notes I have to make to-night on the finding of a sea snake in Tasmanian waters I am indebted to Mr. A. Mault. During a recent visit to St. Mary's, Mr. Mault's attention was drawn to a specimen of a snake that had been preserved by Mr. J. Coombe, a resident of St. Mary's. On examination Mr. Mault found the specimen to be a true sea snake, and on his return to Hobart very kindly supplied me with the information he had been able to obtain; also suggesting that I should write to Mr. Coombe, which I did, and on the 10th inst. that gentleman furnished me with the following interesting account:—"St. Mary's, June 8, 1898. Dear Sir,—I must apologise for not having answered yours dated May 25, in which you ask for any particulars *re* the capture of the snake which was effected in our district a few weeks ago. I wished to ascertain from the man who secured the reptile first how he managed it, and he informs me he had set some night lines at the mouth of a small stream which flows into the sea at Picaninni Point, and on dragging the lines ashore in the morning he found this snake hooked. He thought it was some new kind of eel at first, never having seen anything of the kind before. The man procured a large billy, thinking he might be able to keep the creature alive, but it did not live more than a couple of hours, and never appeared very lively. I showed the specimen to Colonel Legge, who at once pronounced it to be a sea snake, but very uncommon in Tasmanian waters, being a habitant of tropical seas. Colonel Legge informed me that he has seen the species on the rocks on the coast of Ceylon. I do not care to part with the specimen at present, but expect it will eventually find its way to a place amongst your collection. Yours, etc., J. COOMBE." This is the first occasion that I have heard of a sea snake being found in Tasmanian waters. The late Dr. Gerard Krefft, at one time curator of the Australian Museum, Sydney, New South Wales, in his work, entitled "The snakes of Australia," gives a list of 13 sea snakes; no mention is made of any being found in the Tasmanian seas. As a rule the sea snakes are inhabitants of the tropical parts of the

Indian and Pacific Oceans, extending, as Dr. Günther, of the British Museum, says, from the coast of Madagascar to the Isthmus of Panama. They pass their whole life in the water (with the exception, perhaps, of *Platurus*), and soon die when brought on shore. They have very capacious lungs, extending backwards to the anus, and consequently all their ribs are employed in performing the respiratory functions. By retaining a portion of the air in these extensive lungs they are enabled to float on the surface of the water without the slightest effort. Cantor says that when the snake is out of the water and blinded by the light it freely makes use of its tongue as a feeler. The food of the sea-snakes consists entirely of small fish, among them species with very strong spines (*Apogon siluroids*). As all these animals are killed by the poison of the snake before they are swallowed, and as their muscles are perfectly relaxed their armature is harmless to the snake, which commences to swallow its prey from the head and depresses the spines as deglutition proceeds. There cannot be, says Dr. Gunther, the slightest doubt that the sea snakes belong to the most poisonous species of the whole order. Russell and Cantor, in the transactions of the Zoological Society, ii., p. 303, have ascertained it by direct observation. Tortoises, other snakes, and fish died from their bite in less than an hour, and a man succumbed after four hours. Accidents are rarely caused by them, because they are extremely shy, and swim away on the least alarm; but when surprised in the submarine cavities forming their natural retreats, they attempt to bite every object near them, even turning round to wound their own bodies. I hope Mr. Coombe will be able to present the specimen to the Tasmanian Museum; if so means will be afforded me to give a more detailed description of the specimen.

"NOTES ON A VISIT TO WEST AUSTRALIA." By Alex. Morton.

The SECRETARY then gave an account of his recent visit to Western Australia, notably in the Upper Murchison district, 600 miles from Perth. The paper was illustrated with numerous lantern slides prepared by Mr. Beattie from photographs taken by Mr. Morton whilst on his tour, the lantern being manipulated by Mr. Nat Oldham. In describing his journey to Western Australia, Mr. Morton remarked that it was stated by some writers that the harbour of Albany was one of the finest on the Australasian coasts; but he was of opinion that the harbour of Hobart was in more ways than one far ahead of that of Albany. If he were asked to place the harbours of certain centres of Australasia in order of accommodation, from a shipping point of view, he would do so as follows: —Hobart, Sydney, Albany, Auckland, Wellington. Having given a description of Perth he took his audience straight away into the strange, far-off inland districts of the great western colony, with its varied scenes of luxuriant vegetation, and arid, monotonous plains, deserts, scrub, rock, and sheep and cattle stations. Only a comparatively few years ago it was a *terra incognita*. His description of the natives was of an interesting and vivid character. Some of them, he said, were very finely grown men. The features of many of them were of a Jewish type. Professor Baldwin Spencer had noticed the same thing in the central parts of the Australian continent. He described their corroborees. There was no limit to the wives a man might have, and a child might be married to a man old enough to be her grandfather. The weird funeral and burial customs were described, also the medicine men or wizards, the native camps, cannibals, and so on. He said they were marvellously dexterous and clever trackers. The ground was an open book to them. A native would know the different tracks of every horse on a station, and could follow them. They were well fed and treated on the stations as a general thing. They fared very differently in their native camps and in the deserts. It was when they got to the mining districts that they became demoralised. The natives show an absence of malice after punishment. Cannibalism was not at all uncommon among them. He produced a number of native weapons, etc., and explained them. Some of the natives had learned to speak English very fluently, and made very good servants. The numerous slides served to illustrate all these points exceedingly well. Also several of the mining townships and mines, a good impression being vividly conveyed of the hard, rough life endured in these places, whilst the mortality among young men from typhoid was great. The scarcity of water and the droughts give rise to endless troubles, deprivations, and suffering. Still, with it all, the indomitable Britisher overcomes obstacles and flourishes in every district.

A hearty vote of thanks was passed to Mr. Morton for his interesting and instructive discourse. The CHAIRMAN remarked that they would all go away with a better idea of the parts of Western Australia which had been mentioned than they had possessed before.

A vote of thanks was also passed to Miss M. Lodder for her paper.

JULY, 1898.

The monthly meeting of the Royal Society of Tasmania was held on Monday, July 11, in the Art Gallery, Macquarie-street. The Hon. C. H. Grant, M.E.C., C.E., presided, and there was a crowded attendance of ladies and gentlemen. Apologies were received from the following Vice-Presidents :—The Hon. Sir James Agnew, K.C.M.G., M.D., M.E.C., His Lordship the Bishop of Tasmania, and Mr. Thos. Stephens, M.A., F.G.S.

ELECTION OF MEMBERS.

Mr. Malcolm Harrison and Mr. W. A. Kermode were elected members of the Society.

PAPERS.

"ON THE GENUS KRAUSSINA IN TASMANIA." By Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

Mr. ALEXANDER MORTON, secretary and librarian of the Society, read a paper entitled "On the Genus Kraussina in Tasmania," by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S. The paper dealt with an interesting group of mollusca found chiefly at the mouth of the River Tamar and in Long Bay at low water mark.

Mr. R. M. JOHNSTON spoke in praise of the important work in which the writers of the paper were engaged.

"TELEGRAPHY WITHOUT WIRES."

By Thos. Self.

Mr. THOMAS SELF read a paper on "Telegraphy without wires," and made some interesting experiments in the presence of the audience. There were two transmitters—one before the lecturer and the other entirely outside the room—and it was shown by the continual ringing of a bell in the apparatus in front of the lecturer that there was continual connection between the two, though the connection was invisible. When the door of the room was shut the connection continued. Mr. R. M. Johnston left the room and sent a message to Mr. Self, congratulating the Royal Society on the success of telegraphy without wires. Mr. Self promised that on some future occasion he would repeat his experiments, when he would open up communication between the Museum in Argyle-street and the Government Technical School in Bathurst-street.

The following is a condensation of Mr. Self's paper :—I am going to do my best this evening to introduce to you one of those unknown mysteries of the Great Master. By means of an electric spark we set in motion ethereal or magnetic waves, called the Hertzian waves, by which we are able to signal across space. It is often said that we do not know what this unknown, silent, unseen, and powerful thing called electricity is, and there is a considerable amount of truth in the statement. The more we learn the less we know about it. It is not so true, however, as it was some 20 years ago. Some things are beginning to be known about it ; and though modern views are tentative, and may well require modification, nevertheless great progress has been made. I shall endeavour to explain the means employed to control and use this unknown thing called the Hertzian waves —one of those hidden mysteries brought to light by Signor Marconi. There can be no doubt that Marconi is the true inventor. He was the originator of the elevated electrodes on the receiver and transmitter, and this detail appears to have contributed more to extend the possible distance of telegraphy by electric waves than anything that has been discovered since the time of Hertz and Branly. The term elevated electrodes in connection with wireless telegraphy is not a happy one. It does not convey a clear idea of the apparatus used for long distances. Signor Marconi attaches a vertical wire to one of the terminals of his instrument at each station, by means of a kite made of aluminium, or a balloon which is covered with tinfoil, or it may be a sheet of copper hung on a high pole to which a vertical wire is attached, and brought to one of the terminals of the instrument at each station, the other being put to earth. The wire is surmounted by a metal shape to give additional capacity, and experiments seem to show that slightly better results are obtained with the capacity than without it. However that may be, there is no doubt whatever that the vertical wire is the essential feature. To obtain good results the wire must be vertical, as may be seen from the following extracts from notes on actual experiments that have been carried out. 1. Vertical wire. 100ft. in height, earthed at transmitter and receiver, distance signalled 4 miles. 2. Same wire placed horizontally—150yds. 3. Vertical wire 100ft. at transmitter and copper strips at receiver—30yds. 4. Same wire fixed at receiver and transmitter fitted with spherical electrodes only—40yds. 5. Vertical wire 50ft. at both stations gave 3 miles. 6. Same wires placed horizontally about 50yds. 7. Vertical wires 50ft. at both stations earthed at transmitter only—1,100yds. 8. Same wires ; earth at receiver only — 2 miles. 9. Copper strips substituted at both ends—30yds. 10. A horizontal wire, 350ft. long, was erected 12ft. from the ground at each station. The transmitter was placed one mile from the receiver. No signals were observed, even with the most sensitive receiver. The horizontal portion of the wire was then cut off, leaving a 12in. vertical wire at each instrument. Perfect signals were received on a much less sensitive receiver. Experiments seem to indicate that the section of the vertical wire is unimportant, which I may state is in accordance with theory. The distance to which signals can be transmitted and received varies with the square of the height of the vertical wires, which is the mathematical theory, and has been verified beyond a doubt by actual experiments. The transmitter is an induction coil and gives sparks which are delivered between two spheres, one of which is to earth, the other in space. These sparks set in motion the Hertzian waves. These waves radiate in all directions, but can be controlled in any direction by means of a parabolic reflector. At the receiver there is a kite or balloon which collects the waves, and they are then sent to a Branly coherer, which has been improved upon by Marconi. The coherer which I am using to-night is simply a glass tube loosely filled with coarse brass filings, and closed up with corks, through each of which a copper wire projects into the filings. This tube is connected in circuit with a relay and a source of current, so that each time a spark occurs the tube becomes a conductor, the relay closes the local circuits and the tapper. The latter is thereby caused to strike lightly on one of the springs, and shakes the coherer, when the relay returns to its initial position, and is ready to receive a new signal. There had been no serious attempts made at signalling through space over considerable distances till Marconi went to England and gave a practical demonstration of how it was done; and if anyone else who claims priority had thought they were so near such striking results they would have been unceasing in their efforts to carry the experiments a little further than they did. At the same time, whatever may be the commercial future of systems of signalling across space, its development may be said to be the minds of many, although Signor Marconi, as I have said before, was the true inventor of the elevated electrodes, by means of which he brought to light the signalling across space to a considerable distance.

The CHAIRMAN spoke of experiments made in telegraphy without wires by Mr. W. H. Preece, Electrical Engineer to the British Government, by whom messages were sent across rivers and lakes, and to a distance of 12 miles. This was up-to-date electricity, and this mysterious force was progressing by such leaps and bounds that probably a few years hence we should know a great deal more about this mysterious agent.

Mr. SELF said he looked upon Mr. Preece as the father of signalling through space. The system had been handed over to the military for war purposes, and they might be sure this would not be done if the system was not already a success.

Mr. R. M. JOHNSTON offered some observations on the paper.

"EXCAVATIONS IN EGYPT."

By Rev. C. R. Pollock, F.R.G.S.

Rev. C. R. POLLOCK, F.R.G.S., delivered an address on "Excavations in Egypt," illustrated by 50 lantern slides, Mr. N. Oldham manipulating the lantern. The lecturer said that the antiquities of Egypt brought them back to the very horizon of time, yet to a civilisation and culture, artistic and domestic—to examples of engineering and architecture and work in metals—of which there were no examples in modern times. Although, nominally, Egypt was as large as two-thirds of Russia, it really shrank to the size of Belgium. It simply meant the Nile—the rest was arid desert and rock. The Egyptian periods were dynasties extending back 7,000 years or 5,004 years before Christ, though the marginal note of the Bible gave the date of creation much later than that. But the marginal note was no part of the sacred text. He showed a variety of views of modern Egypt, and also a number of pictures of the pyramids, and of statues and carvings excavated in our own day, as well as a photograph of the celebrated stone in three sets of characters which gave the key to all Egyptian inscriptions brought to light. He described in detail many of the Egyptian marvels in architecture and sculpture; and speaking of mummies, said he looked upon the very face of Rameses II., with whom Moses conversed in the ages long ago. This face was thrown upon the screen. The address was throughout of a highly interesting and instructive character, and was manifestly appreciated by those present.

Votes of thanks were accorded Messrs. Twelvetrees, Petterd, Self, the Rev. Mr. Pollock, and Mr. H. V. Bayly, Secretary of the G.P.O. and the Telegraph Department, Mr. W. F. Ward, Government Analyst, also to Mr. A. J. Taylor for granting the use of his Röntgen Coil.

AUGUST, 1898.

There was a large attendance at the monthly meeting of the Royal Society on Monday, August 8th, when the President, His Excellency the Governor (Viscount Gormanston, G.C.M.G.), presided.

Apologies were received from the senior Vice-President (Sir Jas. Agnew, K.C.M.G.) and His Lordship the Bishop of Tasmania.

The SECRETARY (Mr. A. Morton) also read a resolution passed by the medical section of the society, requesting Dr. Sprott to read his paper on Typhoid and the Metropolitan drainage scheme.

NEW MEMBERS.

The following new members were balloted for and elected:—Rev. C. H. Talbot, and Messrs. W. H. Dawson, Oscar E. Hedberg, and W. T. Brown.

TROUT FOR ENGLAND.

His EXCELLENCY called attention to the photographs in the room of some trout from the Great Lake, sent for exhibition to England. He had been allowed to select two of the fish to send to two of the principal sporting papers, in order that the great and grand sport in fishing—for it was such—to be obtained in Tasmania might be made more generally known in the Old Country. Sportsmen at Home might, during the close season there, come to Tasmania and enjoy splendid fishing.

PAPERS.

"NOTES ON A SURGEON OF THE TUDOR PERIOD, AND HIS WORK." By Arthur H. Clarke, M.R.C.S., etc.

Dr. ARTHUR H. CLARKE read a paper on the surgeon of the Tudor period and his work, which was full of quaint interest to the medical profession. The paper dealt mainly with a part of a book by Wm. Clowes, one of Queen Elizabeth's "chirurgeons," surgeon to St. Bartholomew's Hospital and to Christ's Hospital, and a prominent Fellow of the company of Barber-surgeons, and who had served as an army surgeon for many years. The description given of amputation of the limb in those days without anæsthetics was of a very striking character.

"CAUSE AND PREVENTION OF TYPHOID FEVER, WITH SPECIAL REFERENCE TO THE PROPOSED METROPOLITAN DRAINAGE SCHEME OF HOBART." (Diagrams.) By Gregory Sprott, M.D., etc., Health Officer for the City of Hobart.

Dr. SPROTT, who was received with applause, first spoke of the present being an opportune time to lay before the Society certain facts and figures connected with the cause of typhoid fever generally and modes of prevention, with special reference to the proposed metropolitan drainage scheme, as a guide to voting upon it. He traced the history of typhoid (also called enteric fever, and frequently designated as "low," "colonial," "fog," and "fall" fever) from the days of the early Greeks. It was found to-day in all parts of the world, and was the scourge of the new world. In 1830 Drs. Scott and Milligan reported that an epidemic of it occurred among British troops stationed at Hobart, and which was then described as "colonial fever." Experiments recently made proved that the vitality and multiplication of the bacillus were increased by the increase of temperature in the soil. It was found in the liver, spleen, and other glands, but very rarely in the blood. It was chiefly found, however, in the abdominal discharges of those afflicted, and, contrary to popular opinion, in the saliva and urine, and therefore great care had to be taken in effectually destroying these. In the soil, if it contained much organic matter, it multiplied to an alarming extent, and was common in every Australasian city in summer time; but in winter it was checked, because the temperature was not favourable. Operations for developing cultures of the bacilli were explained. The bacillus revelled in moist, porous soils, and especially in a filth-laden soil. He regretted to think that there were still citizens who argued that when Hobart had cesspits in use, and consequently soil pollution, there was no typhoid. The instance he had quoted showed there was then typhoid in the city; but if the argument was good, then we ought to revert to a system which had been characterised as one of the greatest blots of the 19th century. We were now suffering from the effects of that very system, which polluted the soil, and from the neglect and shortcomings of our forefathers in that very respect. Pollution of soil in yards and gardens was a very fertile means of increasing the trouble, unless very active vegetation was going on. Household slops, and other refuse thrown about, and surface gutterage led to soil pollution; also dirty interiors of houses of all kinds, which harboured the bacilli. The channels of infection were next explained, the lecturer laying especial emphasis on the dangers of unboiled milk, unboiled drinking water, and eating raw vegetables that had come in contact with the soil, such as tomatoes, lettuces, cress, watercress, etc. The water might be tainted at its source, in its storage, carriage, or distribution. In cities, with surface gutterage and incomplete flushing, with all household and bedroom slops emptying into the same, and probably containing not only the germs of typhoid but of other diseases, it was not to be wondered at that in dry, hot weather, the disease should spread. Flies often played a part in carrying the germs into houses under such conditions. Ice creams were condemned on account of the danger of conveying germs; also dirty cow sheds, and a tainted milk supply. Cows were often kept in small yards, without regard to cleanliness, and this often applied to country districts as well as to towns. A company was being formed to sell Pasteurised milk in the city, which should be a great public boon. There should be careful selection of building sites, so as not to build on ground made up of all kinds of filthy haulage; there should be good ventilation, with plenty of sunlight in the rooms; subsoil drainage to remove all dampness; paving of yards to prevent exhalations and soakage; active cultivation in gardens to keep the soil pure; removal of all garbage, and the destruction of the same; and a proper system of drainage to carry away all waste products. It was very necessary that all household garbage should be removed, and he trusted ere long to see in Hobart a Destructor in operation for this purpose. He next dwelt upon the necessity for a proper system of drainage to carry away all waste products as quickly as possible. It might be argued that drains and sewer gas were means of spreading typhoid, but that was very doubtful. With a properly constructed system of sewers, well ventilated and trapped, there need be no fear of sewer gas. The prevalence of typhoid fever had diminished in every city or town where underground drainage has been established. When Hobart got an underground system of drainage there was every reason to believe that the prevalence of typhoid would be greatly diminished, though it would be going too far to say that it would be eradicated—at any rate for some time to come. Great care would have to be exercised during the disturbance of the soil, in laying the sewers, to prevent the possibility of the disease increasing. In the end, however, the benefit must indeed be great, and typhoid, it might be reasonably hoped, reduced to an occasional visitor. The necessity for underground drainage was made very evident to those who had to do with the sanitary conditions of the city. He exhibited figures and charts showing the marvellous improvement effected by underground drainage as regards typhoid and the death-rate in numerous cities and towns. By these means typhoid in England had been reduced from 3·9 deaths per 10,000 in 1869 to 1·7 in 1891-1895. There was a reduction of 50 per cent. of typhoid cases in 25 towns after underground drainage was introduced. In Cardiff it was reduced from 17·5 in 1847 to 1854 to 4·0 in 1884-1888; Leicester, 14·5 to 2·2; Bristol, 10·5 to 1·4. Numerous other instances were quoted. In Sydney in 1886 it stood at 9·9, and in 1895 at 1·9. In Hobart it has been flitting up and down without any tendency to decrease. The death-rate from other causes was also much reduced by drainage. In spite of these figures there were some who continued to argue that underground drainage would not be the means of eradicating typhoid; and, further, that there were cities even within the boundaries of the Australasian Continent which had surface drainage and a pan system, and which enjoyed immunity from typhoid fever. Ballarat had been cited. A member of the House of Assembly during the discussion on the Drainage Bill gave that city as an example of what could be done without a drainage scheme. He (Dr. Sprott) had taken the following figures from the health reports of Victoria. In 1892-3-4 there were reported in the city of Ballarat, with a population of 22,199, 55, 53, and 125 cases of typhoid in those respective years. In 1896, typhoid was so prevalent there that the Ballarat City Council asked Dr. Gresswell to advise as to the best means of preventing the annual recurrence of typhoid in that city. During the first two months of this year there were registered in Ballarat and suburbs, with a population of about 40,000, 13 deaths from typhoid—a higher rate than in Hobart during the same two months. How, then, could anyone quote Ballarat as being free from typhoid? A recent report by the Health Officer of Nottingham reported that there, while other conditions were uniform, there were three classes of houses, namely, (1) those with midden privies, (2) pans, (3) water-closets. The Health Officer took the average number of cases from 1887 to 1896, and reported as follows: — There was one case of typhoid per annum for every 37 houses with midden privies; one in every 120 houses where pans are used; and only one in 558 houses provided with water closets. Many of the first group were houses of a good character, while the water-closets were by no means confined to superior neighbourhoods. Such a report as that (Dr. Sprott continued), with other facts already given, should convince anyone that the water-carriage system, as far as the prevalence of typhoid fever was concerned, had everything to recommend it. As far as cleanliness and comfort were concerned, no one could doubt the superiority of the one over the other—in fact, people who had been accustomed to the water-carriage system had a horror of being anywhere in the vicinity of a conservancy system. It must be remembered that Melbourne would shortly have what Sydney and Adelaide had already accomplished; and if Hobart refused to follow the example of those large centres, she would be the only capital city without a proper drainage system for the disposal of organic refuse. There were three objections which had been urged against the metropolitan drainage scheme:—(1) It would cost too much money. (2) If the outlet be at Macquarie Point, the River Derwent would be polluted, and the health and comfort of the residents of Sandy Bay and Lower Queenborough would be interfered with. (3) The water supply was inefficient. As to the first objection he believed the cost would be money well spent. They were assured that it would not involve a higher rating than the present sanitary rate; but if an extra penny had to be paid, he believed the citizens would not grumble. The present system entailed a rating of 5d. in the £1, which gave an annual amount of £4,365. This amount, however, did not represent the actual cost to the ratepayers and owners of property. Owners were continually called upon to provide proper drainage to their houses, and the cost of this, to his knowledge, in many instances had been very great. Unless a comprehensive scheme such as was now proposed was introduced, the present patchwork and expensive system must continue. The present cobble gutters were, in many instances, quite good enough to carry away storm water, but wholly unfit to carry sewage. If, therefore, these gutters had to be taken up, and cement or cube stone substituted, the expense would go a long way towards the drainage scheme. He did not mean to say that the cobble gutters were to be allowed to remain in the centre and more populous parts of the city. It would be desirable to have the side channels in the well-formed and busy streets nicely made, and attractive to the eyes of visitors, even with underground drainage. Labour, in the way of scavenging and street-flushing would be to a great extent lessened, and all this meant money. They were informed that the drainage scheme would cost £75,000—£45,000 for sewers and £30,000 for house connections, the cost of which, with house fittings, were to be capitalised. They were told that the money could be borrowed, under a Government guarantee, at 3 per cent., and a sinking fund of 1 per cent. to be added. Repairs were put down at 1 per cent. Labour, flushing, and administration at £1,000 per annum, so these figures came out thus :—Interest on £75,000, at 3 per cent., £2,250 per annum ; sinking fund, at 1 per cent., £750 ; repairs, at 1 per cent., £750 ; flushing and administration per annum, £1,000. Total cost per annum, £4,750. The ratable value of all the properties in the area, including Crown property, was at present £230,000, on which a rate of 5d. in the £1 would amount to £4,790. It was evident, therefore, that the present rate of 5d. was correct, and would give a little more than was necessary. Dr. Sprott then contrasted this with the present cost of typhoid fever, referring to what each case cost in medical assistance, nursing, extras, and loss of earnings, to say nothing of the death of bread-winners and those nearest and dearest. As to the allegations that if the sewage was discharged into the Derwent at Macquarie Point it would cause river pollution and nuisances, he held that it would not be so. Sanitary engineers, including Mr. Napier Bell, had said it would not be a nuisance, and regarded assertions about nuisances being created as exaggerations. A large number of the most pleasant towns in England discharged their sewage into the sea, or into the harbour in front of the town, without any ill-effect. Much of lower Hobart sewage, including a great number of water-closets, already discharged into the harbour. He quoted Mr. Napier Bell's report on this point. Because certain matters, such as apple peelings, stalks of cabbage, driftwood, shavings, etc., could be seen on the shores of Sandy Bay, it did not follow that sewage would be carried in the same way. It would be discharged into deep water, and would at once mix. Should it be found, however, that the river became polluted by the discharge of the sewage, it would be quite competent for the Drainage Board to have the sewage purified before discharging, but he did not think any process of the kind would be necessary. He referred to the rivulet's discharges and the numerous discharges of closets, of slops, etc., into the river now. And not into the current, but into the shallow water at the margin. All that would, with a proper system of drainage, be obviated. It might be well, in taking the vote of the ratepayers, to ask them to also declare whether they were in favour of emptying at Macquarie Point or incurring the extra expense of £40,000 in going to One Tree Point. Perhaps the objection raised with most force had reference to the water supply. The present supply was 63 gal. per head per day. In April, 1896, the Director of Waterworks reported that 200,000 gal. were to be accounted for by leakage or illegal use, which meant 6½ gal. to each person for water-closet flushing. During last summer, the driest time for 25 years, the supply was 50 gal. per head per day. That should be sufficient for all purposes. Sydney had carried on an underground sewerage system for nine years with between 32 and 42 gal. per head. Munich did so with a supply of 33 gal. per head ; Brisbane, 33 ; London, 28 ; Liverpool, 19 ; Southampton, 35 ; Sheffield, 20 ; Edinburgh, 35 ; and Paris, 31. Seventy-two

English and Scotch towns averaged 26·7 gal. per head of the population, including factories, for water supply and underground drainage purposes. At Glasgow, the best drained city in the world, and managed on the most modern, up-to-date principles, with an unlimited supply of water if desired, they never exceeded 50 gal. per head per day, and there they had water-closets in every house. In the very driest season Hobart had never a less supply than Sydney. He had been told that in Hobart so much water was used for irrigation. Well, the greater shame that people should so use the water if there was not enough for the health of the city. The Board and the engineer held that the present supply was sufficient for an underground drainage system; so also thought the City Surveyor and Director of Waterworks. In conclusion, he urged that no private or selfish interests should be allowed to interfere with an effort being made to improve the health of the people of the city, the health of a people being the wealth of a nation.

Dr. Bright moved a hearty vote of thanks to Dr. Sprott for his able paper, and that discussion on it be postponed till the next meeting; also a vote of thanks to Dr. Clarke for his interesting paper. In doing so the speaker said Dr. Sprott's paper must have involved a very large amount of labour, research, and study, and was one of the ablest and most valuable he had heard read in that room. He hoped it would be printed by the next meeting. The present drainage system was evidently so bad that it ought to be altered if possible.

Mr. A. G. Webster seconded.

His Excellency, in putting the motion to the meeting, said he quite agreed with the hint that such a valuable paper should be printed and then fully discussed, and he hoped, if possible, to be present at the discussion of it. As regarded Dr. Clarke's interesting, and in parts amusing, paper, he would not refer to it at that late hour, though he could tell some few things he happened to know appertaining to it.

The motion was then passed.

Description of a new "Cordyceps."

By L. Rodway.

Mr. L. Rodway read a paper on a new Cordyceps. He explained that it dealt with a fungus that attacked the caterpillar. It was a fourth species, and was found in Tasmania by Mr. H. Stewart Dove, at Bischoff, and named after him.

A meeting of the Royal Society of Tasmania was held on Monday, August 22, at the Tasmanian Museum, when a discussion took place on a paper lately read by Dr. G. Sprott on "The Causes and Prevention of Typhoid Fever." The Hon. C. H. Grant, M.L.C., presided.

Dr. R. S. Bright spoke of Dr. Sprott's paper as an admirable and highly instructive one. We could have the same good results here with respect to typhoid as Dr. Sprott showed had been obtained elsewhere. There was very little that was debatable in the paper. He entirely agreed with all that it contained. He placed contagion amongst the first as a cause of typhoid, though Dr. Sprott did not attach much importance to it. We had had a considerable amount in nurses and other people which could not be explained except by contagion. He was a very firm believer in typhoid being taken by inhalation—of which he had seen examples. He had seen instances of where it was caused by old disused and foul cesspits which had been forgotten. The use of disinfectants ought to be continued for some weeks after the patient became convalescent. The foul odour from the so-called sanitary carts had caused typhoid by inhalation. Another *causis* not generally recognised was the failure to report cases to the Central Board of Health, especially if the ordinary precautions had not been taken. However, there was less carelessness in this respect than there used to be. He agreed with Dr. Sprott as to the contamination of milk and water by sewage being a common cause of typhoid. He was afraid the boiling of milk and water before use was very seldom done. There was a widespread fallacy that drinking water from a running stream was safe. The fact was that such water was often exceedingly dangerous. Dr. Sprott mentioned that typhoid had been caused by eating oysters taken from the mouth of a sewer. Cases of that kind had occurred at Dublin and Brighton. There was another fallacy he should like to contradict—that when there were cesspits in Hobart there was no typhoid. That statement was incorrect; but there was certainly less than there was now under the pan system. There was typhoid in Hobart a great deal longer ago than some people admitted. With respect to the burying of nightsoil, soil was a great purifier, but there was a limit to what it could do. A strong point made by Dr. Sprott was that the germs of typhoid lived 268 days in the ground. Those germs might be brought to the surface by earth worms, as occurred when cattle that died of the Cumberland disease some years ago were buried. With regard to prevention, the early recognition of the disease and the seeking of medical advice at an early stage was of importance. Cases were made more serious by delay. It was appalling the distance some patients were brought when they were three weeks ill with the fever. Burning was the best plan for the disposal of excreta. Water mains, 25 or 30 years old, should be taken up or cleaned, or looked into. A large amount of impurities must remain in those mains. In other places than Hobart he had seen the mains cleansed with a brush. Dairy inspection in town and country was highly necessary. Many who kept cows did not realise the importance of keeping the dairy and cattle in a cleansed condition. Milk was a highly absorbing substance. The water supply of the cattle should also be inspected. The selection of building sites, drainage, and the pavement of yards were all admirable. He believed thoroughly in underground drainage, and its applicability to Hobart. We were assured there was sufficient water if it were not wasted. It should be seen that the water was not wasted, and the supply might be arranged more advantageously as to area. Personal and domestic cleanliness was of great importance. If people kept themselves, their houses, and back yards clean they would have better health, and be far less liable to disease. The pans were now found to be far worse than the cesspits, and it was time we tried the water-closet system. When it was remembered that a pound of sewage would mix with 4,000 or 5,000 gallons of water in the Derwent there was nothing to be afraid of in connection with that system.

Dr. Benjafield criticised Dr. Sprott's paper adversely at considerable length. He said that if there was more typhoid in the big houses, those were the houses that had water-closets. He expressed himself as opposed to the water-closet and deep sewerage system. It was erroneous to attribute the reduction of typhoid in other cities to drains.

Mr. A. Mault said he listened to Dr. Sprott's paper with unmixed pleasure, and to Dr. Benjafield's criticisms with unmixed astonishment. The latter's arguments were captious, and he utterly misunderstood Dr. Sprott. Mr. Mault confined his further observations to an explanation of the proposed system of metropolitan drainage.

Alderman G. S. Seabrook stated that the Corporation obtained from Melbourne the apparatus for cleansing the water mains, but it was found it could not be used here because the pipes were not all of the same size bore. If the water-closet system were introduced he had no fear on the score of water. The question of cost was the one which gave him anxiety.

Mr. R. M. Johnston said that though an improved sanitation would not prevent epidemics it would reduce the death-rate. He believed in deep drainage for a city like this into the deep water of the sea. Let them look at the matter from a practical and not a narrow point of view. The town should be made pure and sweet apart altogether from the question of typhoid. The strong smells, though the least harmless, were very offensive and prejudiced the people against the city. Let us carry out the first stage of our scheme, and extend or correct it in the future as might be necessary. He would say that too little credit was given in the lowering of the death-rate to increased skill in treatment and nursing.

Dr. Sprott, in reply, requested Dr. Benjafield to furnish him with the title of the book containing an adverse criticism of the experiments he had quoted by Drs. Martin and Robertson.

Dr. Benjafield: Dr. Vivian Poore's "Rural Hygiene," which I now hold in my hand.

Dr. Sprott, continuing, said that statement was like many others made by Dr. Benjafield, not in accordance with fact. He knew the book mentioned, which was a good work on Rural Hygiene, but he wished to inform his audience that this book which Dr. Benjafield had said condemned these experiments was published in 1894, while the experiments performed by Drs. Martin and Robertson were not begun till 1896, and not completed till nearly the end of 1897. How then could Dr. Benjafield stand up and say that Dr. Poore's book refused to recognise these experiments as being of any value? He was inclined to believe that Dr. Benjafield had taken upon himself to use Dr. Poore's name to give weight to his own arguments. It was a great pity that the subject had not been dealt with on its merits in the interest of science and truth. If Dr. Benjafield was a believer in returning all sewage to the soil, he had a right to his opinions, but it was not a practical way of dealing with the sewage of large cities like London or Glasgow, and could not even be carried out effectually in Hobart. To tell the citizens of these towns they would have to revert to the earth system would be the signal for a rebellion amongst them. It was simply absurd to talk of every householder burying the excreta in his garden or yard; besides, it has been conclusively proved that the pollution of soil is an important factor in the production of disease. Dr. Benjafield had stated that water closets were the principal cause in the production of typhoid fever, and he instanced the illness of the Prince of Wales as being a case in point. Now Professor Corfield's report shows that he believed the Prince of Wales got typhoid through eating some contaminated food. The W.C. was certainly not at fault. If drainage and sewerage were not the means of reducing the prevalence of typhoid, it was peculiarly interesting to note that in every city there was a marked reduction of typhoid after drainage had been effected. He did not contend for one moment that typhoid would be eradicated from Hobart if the proposed scheme was carried out, but from the results obtained in other cities he believed this prevalence would be much reduced. Dr. Benjafield had further alleged that sewer air would be admitted into the dwellings, and that typhoid would be produced rather than lessened. There was no likelihood of this if the system was properly constructed. Ventilation would be amply provided for, and with proper trapping no such result was possible. In Bristol there was a system of sewerage without any ventilators at all, and although this was a novel system, judging from the typhoid death-rate Bristol was indeed a sanitary city. He did not believe sewer air was the means of conveying the typhoid bacilli, the weight of evidence was very much against this idea. Koch, Miguel, had both failed to detect the typhoid organism in sewer air, and in a recent report "On the result of investigations on the Micro-organisms of Sewage," by Dr. Andrews and Parry Laws, for the London County Council, it is stated "That the air of sewers themselves should play any part in the conveyance of typhoid fever appears to us as the result of our investigations in the highest degree unlikely." He did not believe altogether in the theory of aerial infection. From his three years residence in the General Hopital, he had not observed a single case amongst the nurses. He agreed with Dr. Bright that infection was undoubtedly spread by patients convalescent from typhoid. In conclusion, he expressed a hope that the proposed drainage would become an accomplished fact. With such a system Hobart would not only be one of the healthiest cities, but one of the cleanest in the Australasian colonies. He had been in India, America, and other countries, but had never been in a place he liked better than Hobart, which was the finest city in the colonies. It would be a good business speculation to have the city not only healthy as it was, but clean and attractive to visitors.

The CHAIRMAN, who mentioned he had had typhoid fever in an American city, said he thought more noise was made about it than was necessary. He would prefer to see a good water supply to a system of underground drainage.

A vote of thanks to Dr. Sprott terminated the proceedings.

OCTOBER, 1898.

A meeting of the Royal Society was held in the Art Gallery at the Museum on Monday, October 18, 1898. Mr. R. M. Johnston presided, and there was a moderate attendance. Messrs. R. J. Rogers and G. E. Bernard were elected members of the Society.

The CHAIRMAN announced that it had been thought desirable for steps to be taken to receive the members of the Antarctic expedition which would soon call at Hobart on the way to its field of exploration. In accordance with that feeling arrangements were being made to welcome the explorers.

A report was presented by a sub-committee that had been appointed to consider the question of establishing a geographical and historical section in connection with the Society. A number of rules had been agreed upon, which would be presented at a future meeting.

BOTANICAL NOTES.

Mr. L. RODWAY read a paper relating to botany. He said that such papers, as a rule, were more satisfactory when taken as read. Botany in Tasmania was not followed by such a large number of workers as enabled it to be thrashed out as well as it had been treated in older countries. Students of botany experienced a great deal of difficulty in their studies owing to the complicated character of the gums of Tasmania. He did not think that any person in Tasmania knew the whole of the varieties of gum trees in the colony, and was certain that no one in the world was familiar with all the gums of Australia. A description was then given of the different kinds of eucalyptus trees which grow throughout Tasmania.

THE MUTTON BIRD INDUSTRY.

The Bishop of Tasmania, the Right Rev. H. H. MONTGOMERY, D.D., read a paper dealing with the protection of the mutton bird industry. He said that each succeeding year made it more necessary that the question of protecting the birds should be faced, if it was desired that the mutton bird industry should be preserved. Six or seven years ago the industry was not regulated at all. The Government of that time acted wisely, and certain islands were now preserved as rookeries. Mutton birds paid better than cattle, and required but little attention. The question now arose, was there need for further regulation? All agreed in saying that the inhabitants of the islands were increasing, and one, if not more, of the rookeries was becoming overcrowded. Had not the time come, then, to preserve Chapel Island? If that fact were established details could be arranged by the Government, and if action was taken at once fewer difficulties would be met than if delayed. During the present year the birds had been particularly abundant, and not so much harm had taken place. Something must be done in the interests of the industry, and persons forced to go to Babel Island. At present the system of working one island out and neglecting another was absurd. Chapel Island was conveniently situated, and everyone wished his neighbour to go to the more distant rookeries. Would it not be wise to require a license to be taken out for birding on Chapel Island? This would afford a measure of protection. He longed for the day when egging would be stopped and steps taken to spread the industry. The demand for mutton birds was increasing, and he made no apology for referring to the necessity of something being done to foster the industry. The matter was one that required careful consideration.

A general discussion took place on the papers read, and a vote of thanks accorded those who had compiled them.

WIRELESS TELEGRAPHY.

A paper on "Wireless Telegraphy" was to have been read by Mr. Self, but was unavoidably held over.

This concluded the business of the meeting.

THE BRITISH ANTARCTIC EXPEDITION.

WELCOME TO THE LEADER

AND OFFICERS OF THE SOUTHERN CROSS.

A conversazione, given under the auspices of the Royal Society of Tasmania to Mr. Carsten E. Borchgrevink, F.R.G.S., the leader of the Antarctic expedition promoted by Sir George Newnes, Bart., and the officers of the discovery steamer Southern Cross, took place at the Town Hall on Friday evening, Dec. 2nd, 1899. The welcome given to the expeditionary party was brilliantly successful. The hall was filled by about 800 citizens, representing all classes of society, and justified the comment made by His Excellency the Governor, that the gathering was the largest he had ever presided over in Tasmania. Most of those present were in evening dress, and the hall presented a brilliant appearance. Probably not for many years past have so many men, representing diverse opinions and interests, been assembled on the same platform in Hobart. The decorations of the platform were queer and uncommon in this part of the world, comprising as they did snow shoes, skis, canoes, and a variety of other articles of equipment for a voyage poleward. The table before the chairman was covered by the Union Jack presented to the expedition by His Royal Highness the Duke of York, and which it is hoped will be hoisted on some new territory in the far South, secured as the latest addition to British territory. Admission to the hall was by card of invitation. The invited began to arrive about half-past 7 o'clock, though the hour fixed for proceedings was 8. All the arrangements were admirably carried out under the direction of Mr. Alexander Morton, the secretary of the Royal Society. The seats in the body of the hall were left in position as if for a public meeting, and the refreshments were supplied in the ante and committee-rooms when the speaking had been concluded. Thus inconvenience of any kind was obviated. As the invited entered the hall they passed between a pair of Finns in the picturesque costume of their country. His Excellency the Governor, Viscount Gormanston, presided, and had on his right Mr. Borchgrevink and on his left the Mayor of Hobart (Alderman George Hiddlestone). Immediately in front of the platform were seated the Viscountess Gormanston, the Hon. Ismay Preston, and Miss McKinnon. Amongst those on the platform were Mr. J. F. A. Rawlinson, Private Secretary to His Excellency the Governor; the following members of the expedition:—Scientific staff, H. Klovstad, M.D.; W. Colbeck, R.N.R., L. Bernacchi, magnetic observers; N. Hanson, H. Evans, zoologists; A. Fougner, navigator; Captain B. Jensen, and officers of the s.y. Southern Cross; Right Rev. Dr. Montgomery, Bishop of Tasmania; the Hon. A. T. Pillinger, Minister of Lands and Works; Sir Philip Fysh, Treasurer of Tasmania; Hon. D. C. Urquhart, Attoney-General; Right Rev. Dr. Delany, Bishop of Laranda; the Rev. P. O'Rielly; the President of the Wesleyan Conference; the Chairman of the Congregational Union; the Hon. Adye Douglas, President of the Legislative Council; the Hon. Nicholas Brown, Speaker of the House of Assembly; Mr. J. G. Davies, M.H.A., Chairman of Committees; Mr. Geo. Steward, Under-Secretary; Mr. E. C. Nowell, Clerk of the Legislative Council; Mr. J. K. Reid, Clerk of the House of Assembly; Colonel Legge, R.A., Commandant of the Defence Forces; Mr. J. W. C. Hamilton, Town Clerk of Hobart; His Honor, Mr. Justice McIntyre; Rev. George Clarke, Chancellor of the University of Tasmania; Mr. J. B. Walker, F.R.G.S., Vice-Chancellor of the University; the Consuls for the United States (Mr. A. G. Webster), France (Hon. W. H. Burgess), Sweden and Norway (Mr. Jas. Macfarlane), and the Netherlands (Hon. W. Crosby); Hon. C. H. Grant, M.L.C., President of the Chamber of Commerce; the Acting-Master Warden of the Hobart Marine Board (Captain J. W. Evans, M.H.A.); Messrs. Bernard Shaw, P.M., A. G. Webster, Russell Young, R. M. Johnston, R. S. Bright, M.R.C.S.E., members of the Caundil of the Royal Society of Tasmania; Alexander Morton, secretary to the Royal Society of Tasmania; Mr. F. Back, General Manager of Tasmanian Railways; Mr. J. W. Israel, Auditor-General; Mr. E. A. Counsel, Surveyor-General; Mr E. Hawson, Secretary of the Chamber of Commerce; Mr. J. Adams, Secretary Hobart Marine Board.

On the vice-regal party entering the hall the large assemblage rose, and Mr. T. Julian Haywood, the city organist, played the National Anthem on the organ.

The following is a *précis* of correspondence read addressed to Mr. A. Morton, Secretary and Librarian, Royal Society of Tasmania:—

Apologies from the Premier, Right Hon. Sir E. N. C. Braddon, K C.M.G., P.C., and His Worship the Mayor of Launceston (Alderman Sutton) were read.

Government House, Hobart, October 16. From the Private Secretary, intimating that His Excellency Viscount Gormanston would have great pleasure in presiding at the welcome to be accorded Mr. Borchgrevink and officers of the expedition.

Hobart, November 30, 1898. My dear Mr. Morton,—Please let Mr. Borchgrevink know I regret very much my inability to be present at the Royal Society's *conversazione*, especially as being now the only survivor of the Parent Society when its President, Governor Sir John Franklin, took such a keen interest in Sir James Ross's expedition. I should have been glad, had health permitted, to take a part in the public welcome to the leader of the present expedition and his companions. I heartily wish them every success in their explorations of Antarctica, and hope they may even perhaps have the glory of planting the Union Jack of England on the Southern Pole.—Very truly yours, J. W. Agnew.

Town Clerk's Office, Hobart, October 18. From J. W. C. Hamilton, Town Clerk, intimating that the Mayor and aldermen accepted with pleasure invitation to take part in the welcome. Also that the Mayor had placed the Town-hall at disposal of the committee.

Marine Board Office, Hobart, October 20. From J. Adams, acting-secretary, intimating acceptance of invitation by Warden and officers of the Board.

Chamber of Commerce, Hobart, October 24. From E. Hawson, secretary, accepting invitation with thanks.

Royal Society of Victoria. Melbourne, November 29. From W. C. Kernot, president. (Telegram): — "Congratulations and best wishes for success of Antarctic expedition."

Sydney, November 30, 1898. Council Royal Society wish Antarctic expedition every success.—J. H. Maiden, Hon. Sec. Royal Society of New South Wales.

South Australian Institute, Adelaide, October 19. From G. G. Mayor, hon. secretary Royal Society of South Australia, sending greetings to the leader of the expedition, and expressing hopes that he may successfully carry out the work, scientific and commercial, that he has so enthusiastically undertaken.

Australasian Association for Advancement of Science, University, Sydney, October 22. From Professor A. Liversidge, F.R.S., permanent hon. secretary, intimating that if the Council of the Association meets in time, he will have much pleasure in moving an address of welcome to M. Borchgrevink. Also conveying his personal good wishes and sincere trust that scientific results of expedition will be all that the most sanguine could desire.

Adelaide, October 14, 1898. From T. T. Read, secretary of Royal Geographical Society (South Australian Branch), covering letter to Mr. Borchgrevink from President, on behalf of the Council, expressing warm congratulations and earnest wishes for success of the expedition.

Royal Geographical Society of Australasia (S.A. branch), Adelaide, October 14. From S. Newland, president, to C. Borchgrevink, leader of the Antarctic Expedition, as follows :—"I have very great pleasure, on behalf of the Council of this branch of the Royal Geographical Society of Australasia, in conveying to you their hearty congratulations on your arrival in Australian waters as leader of the Antarctic Expedition so generously fitted out by Sir George Newnes, Bart. In conveying to you this expression of the Council's goodwill, I should add that it is their wish to record their deep appreciation of your energy and perseverance which led to the formation and equipping of the expedition over which you have been most deservedly placed in command. Whilst it is a matter for regret that your expedition is neither officially aided, nor officially recognised by the Australian Government, yet the fact of its being a privately equipped expedition will not detract from its scientific value, and we shall watch with the greatest interest your explorations in the Antarctic regions, both as to the scientific and geographical results. With the warmest wishes of the Council for the success of your bold and adventurous enterprise, and for the safe prosecution of the important labours of yourself and of your fellow explorers."

Royal Geographical Society of Australasia, Melb., Oct. 15. From A. C. Macdonald, F.R.G.S., hon. secretary, to A. Morton, covering the following message :—"The President and Council of the Royal Geographical Society of Australasia, Victoria, send a hearty welcome to C. E. Borchgrevink (leader) and to the officers and crew of the Southern Cross, and wish them every success in their hazardous undertaking, looking forward at the same time to the great benefit that will be conferred on the world in general, and scientists in particular, by a successful exploration within the Great Antarctic Circle."

From the Royal Geographical Society of Australasia, New South Wales.—Dear Sir,—I am requested by my Council, in response to the information received regarding the movements of Mr Borchgrevink, whose arrival at Hobart in the s.s. Southern Cross is expected early in December next, to congratulate him on his progress, so far, *en route* to the Antarctic continent, and hope that his future operations on this perilous undertaking may, in all respects, prove successful and be the means of extending not only our present limited geographical knowledge of this part of the world's surface, but of affording an opportunity for investigating the numerous and varied phenomena which occur is this vast unexplored region. Trusting that Mr.

Borchgrevink and party may return in safety. I have the honour to remain yours faithfully,—JOHN F. MANN, Hon. Sec. R.G.S.A.

Field Naturalist Club of Victoria. Melbourne, November 14. From George Coghill, hon. secretary, conveying to Mr. Borchgrevink sincere well wishes and hopes for the scientific success of his expedition.

From Royal Geographical Society of Australasia. Brisbane, November 15. From E. Dove Jones, for hon. secretary. (Telegram):—"The president and Council desire that an expression of their heartiest sympathy with his great enterprise may be conveyed to Mr. Borchgrevink. The developments of his expedition will be awaited with the deepest interest."

"Launceston Microscopical Club, Launceston, Tasmania. November 30, 1898. Monsieur C. Borchgrevink, F.R.G.S., Commander of Southern Cross Expedition. Sir,—We have the honour to transmit to you and the honourable members of your expedition the hearty congratulations of the Launceston Microscopical Club upon your arrival in Tasmania in the course of your voyage to Antarctic parallels. Our members desire to convey the expression of their admiration of your courage and enthusiasm in leading a force of explorers to the unknown Continent, whence we trust in due time to be able to welcome you back laden with trophies of victories achieved for science—We have, etc., W. F. PETTERD (President), W. H. TWELVETREES (Hon. Sec.).

HIS EXCELLENCY THE GOVERNOR, Viscount Gormanston, G.C.M.G., who on rising was received with loud applause, said:—My Lord, ladies, and gentlemen,—We are assembled here this evening to welcome to the shores of Tasmania Mr. Borchgrevink and his companions, who are about to undertake a most arduous and most difficult expedition to clear up the various doubts which exist regarding the condition of the vast Antarctic region situated not so many miles from the coast of this colony. I therefore venture, not only on behalf of you present, but on behalf of all the people of Tasmania, to tender you, Mr. Borchgrevink and your companions, our most hearty welcome to Tasmania, and express our sincere wish that you may succeed in your expedition, and return in safety therefrom. The Polar Arctic regions of the North have been for some centuries, and still are, engaging the attention of many scientists and explorers; but the Antarctic regions of the South have been, I may say, more or less neglected. They have been explored slightly here and there by explorers, but few have entered upon them for any distance, the great ice barrier which extends for hundreds of miles preventing them; and the object of this expedition is to penetrate further into the interior of that country. The only expedition of note made into the Antarctic regions was that which was instituted by the Government of our country, when they sent Her Majesty's ships Erebus and Terror, under the command of the late Sir James Ross, and which started, as the present expedition is about to start from Hobart. Many, I dare say, present in this room can remember when that expedition arrived, and what took place at the time. But, though much information was obtained by that expedition far more was left behind. In fact, in may be said, that the Antarctic regions are in a true sense of the term a *terra incognita*. It is to explore and clear up the mystery in which that land is enveloped that Mr. Borchgrevink and his companions have undertaken their arduous and difficult task. (Applause.) All honour to them for it. (Cheers.) Hard will be their labours, and harder still the effort, to carry out the object of their expedition in a proper, efficient, and fit manner. It may be said that owing to the many scientific and economic inventions of the latter half of the century, Mr. Borchgrevink and his companions will be better provided for than those who took part in the expedition of Sir James Ross in 1839-43. But they would have the same climatic difficulties to encounter, the same storms to battle with, and the same fearful barrier of ice to face as Sir James Ross. I hope they will have the same good fortune that attended Sir James Ross in the matter of the health of their crew. (Applause.) Most of the members of this expedition are Scandinavians—belong to the great Scandinavian race which in the far back days of history, laid the foundation of the Great British nation to which we are so proud to belong. Their blood flows in the veins of most of us, and it is known that some of our chief charteristics we have derived from our Scandinavian ancestors. Mr. Borchgrevink is, however, only partly a Scandinavian. He is a British citizen and a loyal subject of Her Majesty Queen Victoria. (Cheers.) The vessel in which he proceeds to the South, and all belonging to it, have been made and manufactured in the United Kingdom—(applause)—and the expedition is sailing under our old flag, which has braved the battle and the breeze for a thousand years. (Cheers.) More I need not say, except this: I am sure you all here, and all the colonists of Tasmania, wish and pray the great God Almighty to bless and protect these gentlemen and their expedition, and to grant them to return in safety from the great and difficult work which they have undertaken. (Applause.)

Mr. Haywood then played "Rule Britannia" upon the organ.

Sir PHILIP FYSH, K.C.M.G., who was received with applause, said they gave the heartiest welcome they could to the scientific gentlemen forming the expedition, and to the crew of the Southern Cross. (Applause.) He remembered, by the very locality on which they stood, speaking as he was almost in the shadow of the statue of Sir John Franklin—(applause)—that we had had here amongst us for some years one who sacrificed his life in Arctic exploration, and whom Carlyle might have included in his heroes. In erecting that statue to Franklin we were actuated, not so much by the fact that he had been Governor of this colony as by a desire to be associated with the work which he undertook. Speaking, then, at the foot of the Franklin statue, he bade Mr. Borchgrevink and his fellow-voyagers God speed. (Applause.) If Britons regarded exploration almost as a duty, we here, as masters of the Southern seas, were bound to be foremost in promoting an expedition of this kind, and not having been actively engaged in the work we ought to be grateful to Great Britain for having undertaken it. A few years ago when Mr. Borchgrevink was here before he suggested our taking part in this expedition, but the time had not come, and we had still our duty to do. We were indebted in a primary degree to the large-hearted British baronet, Sir George Newnes, who, out of his plenty and setting a grand example to the world, conferred on the people of the world the benefits of this expedition. (Applause.) We also owed a debt of gratitude to the men who now sat by them, who were about to set out for unknown seas and an unknown land, and who went to plant the British flag on some soil where perhaps no human foot had yet trod. When the Erebus and Terror went South it was thought we should have a commercial result. But we really did not know whether the result of this expedition would be commercial or scientific. There was reason to hope that geography, history, and science would be benefited by it. It was now 57 years since the Erebus and Terror went South, and that expedition left the name of Erebus upon one mountain, and the name of our Gracious Sovereign Victoria upon the land they discovered. (Applause.) We hoped these gentlemen would return with further information of the great unknown sea, and when they returned to Hobart they would be even more heartily welcomed than they were now. It was very gratifying to have Scandinavia and England associated in a matter of this kind. He hoped the Almighty would have the expedition in His keeping. On behalf of the Government and people of Tasmania he gave the expedition a hearty welcome, and wished them God speed in the work they undertook.

The Hon. ADYE DOUGLAS, President of the Legislative Council, said it was 58 years last month since the Erebus and Terror sailed from Hobart. In 1841 Sir James Agnew welcomed the return of the party, and he was sorry he was not there that evening. That expedition was a comparative failure, but the present one had the advantage of steam, and it was to be hoped would be more successful. It was almost a disgrace to Great Britain that the present attempt was not made on a more extended scale, and that it should be left to the generosity of an individual to make it. In a commercial sense it might not be of much value, but to science it would be of vast importance. He wished Mr. Borchgrevink, on behalf of that magnificent assemblage, all success to his expedition. (Applause.)

"The Star Spangled Banner" was played on the organ by Mr. Haywood.

The MAYOR (Alderman Hiddlestone) then read the following address to Mr. Borchgrevink and his colleagues :—

Gentlemen,—In the name of the citizens of the city of Hobart, it is with extreme pleasure we welcome you to our shores, and trust that during your stay amongst us you will enjoy yourselves to the fullest extent. Faithful to your promise, when last visiting Tasmania, "That should you succeed in fitting out an expedition to the Antarctic regions, that Hobart should be the first port of call." We esteem your presence amongst us as a great compliment to our city and the colony generally. I need hardly assure you that any attention on our part to render your stay both enjoyable and profitable will be heartily extended. Having faithfully fulfilled your first promise, we shall look forward with interest and expectation to the safe return to Hobart of yourself and party in health and strength, and your ship filled to the hatches with trophies of your successful undertaking, and yourselves charged with scientific information which will benefit the world at large and fully repay yourselves and your generous patron, Sir George Newnes, Bart. Again, extending to you our sincere wishes for the success of your hazardous expedition.

The Right Reverend H. H. MONTGOMERY, D.D., Bishop of Tasmania, and Vice-President of the Royal Society, said :—I have the great pleasure of representing to-night the Royal Society of Tasmania. and as this is the only port on the outward voyage at which the Southern Cross will call, we feel that we represent to-night not only our own society, but the societies of all the other colonies as well. And in saying that we are proud to know what perhaps all of you do not know, that our society in Tasmania was one of the first to receive Royal patronage—(applause)—and in consequence of that we hope always to keep in the van in regard to all scientific discovery, and, perhaps, we may say we are well fitted to represent all the other societies on the adjacent continent of Australia. (Laughter and applause.) We all regret that Mr. James Barnard, who died only last year, was not spared to be here on this occasion, for he was a member of the society when Captains Ross and Crozier anchored in this port in 1840. But although death has taken him from us, we still have Sir James Agnew, whose letter you have heard read. (Applause.) He joined the society in that very year, 1840, and there are two at least in this assembly who visited the Erebus and Terror in this harbour. I mean Mr. Charles Butler and Mr. A. G. Webster. (Applause.) It may well be asked, your Excellency, why Australasia has not equipped this expedition. The answer must be, I suppose, that new countries have not often found it possible to spend large sums on these scientific expeditions outside their own borders. We have not discovered Tasmania yet. Australia has still thousands of square miles capable of concealing many de Rougemonts. (Laughter and applause.) Nor, indeed, has it been Canada which has laboured to reach the North Pole, though it may almost be said to be part of her own territory. It is the mother country which has done so much for discovery. But in the present case we note this important difference. Previous expeditions have been conducted by naval men under the Government itself. For Cook and Ross and the Challenger Expedition were sent by the State. It has been left to a private individual to expend some £50,000 on this expedition in the furtherance of science. The Royal Society of Tasmania cordially recognises the public spirit of Sir George Newnes, and wishes him good success. (Applause.) Perhaps now it will be not out of place if I put before this assembly, representing every phase of society, some of the plain reasons why such an expedition to the Antarctic Continent ought to be welcomed. I am myself no expert in these questions: I can but give you the dicta of those best qualified to speak, chiefly the opinion of Dr. Murray, of the Challenger Expedition. No unknown area of land or ice surface so large as that at the South Pole exists anywhere else on the earth. By some it is computed to be 4,000,000 square miles — far larger than the area of Australia. Nor has any area of anything like the same extent ever failed to yield results of practical value by its exploration. The Challenger made but eight hauls in these Antarctic regions, but they were by far the richest in their results of any that were made during the entire cruise. The question of glacial action is far from settled, and here southward we find it in its highest form; to study them there will be to help to solve some of the most interesting questions of geological science. Further, this vast unknown region can help us to explain far be ter than we can at present the distribution of organisms over the entire surface of the globe, and so aid us to understand the method of their distribution everywhere. Fossil remains also will teach us more of the history of our planet, and indeed as that history can also be determined in its degree by living fauna and flora, it is still to settle whether there are any land birds or animals in these regions at present hidden away by barriers of ice. No such life has yet been noted. But it is above all in the direction of magnetism and meteorology that the greatest benefits are to be expected. In 1831 Ross discovered the North Magnetic Pole. In 1841 he came, as he believed, within 160 miles of the South Magnetic Pole. It remains to be seen whether he was right. Says Dr. Murray: "The problem of the earth's magnetism cannot be solved without Antarctic exploration," and the establishment of one magnetic observatory for at least one year in the Antarctic region will be of the greatest benefit. (Applause.) In regard to meteorology, "It is worth remembering," says Dr. Neumayer, "that not a single direct winter temperature has ever been observed within the Antarctic circle; and little is known about atmospheric phenomena beyond the 60th parallel of south latitude." I cannot help quoting also some words of Professor Thoulet on the immense interest of this southern region. "To tell you the truth," he says, "I have never been very much enamoured of Arctic exploration. The North Pole is continental, and is in consequence the domain of irregularity, and in my opinion its conquest is not worth the efforts which it has already cost. But it is quite otherwise with Antarctic regions, which are oceanic, and, therefore, subject to rule. The Arctic phenomena are complications and exceptions. The Antarctic are general phenomena, and their discovery is bound to conduce to the formulation of natural laws, which are the final aim of science." Once more, Dr. Murray points out that in our present Queen's reign we have gained accurate knowledge of three-quarters of the earth's surface covered by the waters of the ocean, the work chiefly of naval men and of telegraph ships. This is the most splendid addition to our knowledge of the earth since the circumnavigation of the globe, and now we long to present to Her Majesty our knowledge of the only remaining portion of the oceanic world. It will be seen then how vast is the work to be done. Nothing less than to chart a region of some 4,000,000 square miles. It is this upon which scientific men fix their eyes, not upon a dash to the South Pole as is popularly supposed. No one expedition can of course do it. It means the accurate, steady, laborious accumulation of facts by many expeditions over a great many years with the assistance of the best modern appliances. The Royal Society of Tasmania does not expect impossibilities from the present expedition: but recognising the pluck and determination of the leader and of his staff, and of captain and his crew believe a fresh step will be taken. We are proud that they start from Hobart. We shall follow them with the keenest interest, and promise them a royal welcome upon their return. In the name of the Royal Society of Tasmania we wish them God speed in their expedition. (Loud applause.)

Hon. N. J. Brown (Speaker of the House of Assembly) also spoke on behalf of the Royal Society, hoping the expedition would be a success, and that Hobart would be able to welcome it back with stores of knowledge, which would be beneficial to mankind scientifically and commercially. He thought it was a great mistake for anyone to think that the expedition would be of no commercial value. It would be of commercial value, and in whatever form that would be Tasmania would share. (Applause.) They ought not to fail to express their admiration of the liberality of Sir George Newnes in fitting out such an expedition. (Applause.)

Captain Evans, the Acting Master Warden of the Marine Board, read the following address to Mr. Borchgrevink and his party :—

Gentlemen, — We, the members of the Marine Board of Hobart, have much pleasure in extending to you a very hearty welcome to the port of Hobart. We are pleased to see you enjoying such good health after your voyage from England, and trust that you may be equally favoured in that respect throughout the long months in the far south. During your stay in port we hope you may have an enjoyable time, and that your visit may have a place amongst your most pleasant memories after leaving these shores. If we can afford you any assistance whilst you are with us we shall only be too glad to render it, and the officers of the Board will at all times be pleased to give you any information or help within their power. We sincerely trust that the results of your expedition may be satisfactory, adding much to the world's knowledge of the Antarctic regions, hitherto practically unexplored, and that we may see you again in good health and spirits after your work is completed.—We are, gentlemen, yours very sincerely, E. T. Miles, Master Warden; Wardens J. W. Evans, R. R. Rex, Robt. Snowden, Hy. Chesterman, Thos. Moore Fisher, W. J. Watchorn, Ed. Burgess, Chas. Jorden.

Continuing, Captain Evans said he had to apologise for the absence of the Master Warden (Captain Miles, M.H.A.,) who would have been delighted to have been present if he could. The Marine Board of Hobart congratulated Mr. Borchgrevink upon having the command of such an important expedition, and upon having such a fine ship. From truck to keelson she was a perfect vessel. (Applause.)

Hon. C. H. Grant, M.L.C., President of the Chamber of Commerce, read the following address :—

Dear Sir,—On behalf of the members of the Chamber of Commerce and the mercantile community of Hobart, I desire to join in the congratulations that you have already received upon your and your party's safe arrival at this port, *en route* to your voyage of exploration within the Antarctic circle. In you as leader the expedition has the great advantage of your previously gained experience of the southern regions, and your well known skill, intrepidity, and resources under the very trying difficulties to be encountered will, doubtless, ensure a result that will be in the highest degree beneficial to the scientific, commercial, and general interests of the whole community. I am able to assure you that the public of Tasmania are intensely interested in the noble object of your mission, and sincerely hope that yourself and staff will all maintain good health, and that your high aspirations will be crowned with complete success. We most heartily wish you and your party *bon voyage*.—Yours, etc., C. H. Grant, President.

Mr. Haywood then played the Norwegian National Anthem on the organ.

Mr. Borchgrevink, in rising to reply, received a tremendous ovation. He said he found himself wanting in words to adequately express his feelings of gratitude for the cordial reception that had been given himself and party, and for the kind and generous words expressed towards them. The present, when they were setting out on the expedition, was the wrong time to boast about it, so he would not say much. He felt only too keenly the weight of the task and responsibility that devolved upon his young shoulders, and especially being the first to take up the work begun by that illustrious Briton, Sir James C. Ross. It seemed remarkable that now, near the close of the 19th century, comparatively little had been done to explore the vast continent which it was believed lay at the Southern Pole, and which was not further south of the Equator than the northern part of Norway lay north of the Equator. From what had already been learned they supposed that there was a South Antarctic Continent because of the appearance of the rocks already collected down there, and secondly because of the altitudes. Theory told them that there was a continent in the South Antarctic Sea, and not merely an accumulation of islands and water. They knew that there must be certain areas of land in those regions to make up the equilibrium of the globe. The deep soundings taken down there pointed to the same conclusion. It was not surprising to find that Dr. Nansen found deep water flowing out in the North on the very same principle. The reasons for the expedition he would rather not go into, preferring to let the results justify them. Suffice it to say that it was a scientific expedition of discovery. If they found a gold nugget there they would make a note of it. (Laughter.) He was glad to see so much enthusiasm displayed in this Antarctic exploration, and hoped the expedition would bring back such facts, and information as would justify a larger and a more expensive expedition in the future. (Applause.) He could not on this occasion promise more than that he and those associated with him would do their best. (Loud applause.) However difficult the work might be, if they could succeed in adding something to the sum of human knowledge of those Antarctic regions they would feel more than repaid for their trouble. (Applause.) They had the honour of flying a flag presented to them by H.R.H. the Duke of York, and as they would look upon it, they would feel that England and the great British nation expected every man to do his duty. (Loud applause.) Once more he returned his sincere thanks for such a splendid reception in Hobart—the beautiful pearl of cities in the Southern Hemisphere. (Warm applause.) He hoped Hobart would be their first port of call on their return in 1900. (Loud applause.) He, of course, felt highly delighted, thanks to Sir George Newnes, that he had been able to carry out the South Antarctic exploration scheme before the close of the present century, and because when he had the honour of laying his modest scheme before the British Association, and before the International Geographical Congress in the Imperial Institute in 1895, a resolution was unanimously carried that the further exploration of the southern Antarctic Continent was the greatest geographical and scientific work of the century that remained to be undertaken. He regretted that there was not a Briton bred and born in command of the expedition, but he assured the audience that his heart was truly British. (Loud applause.) He was very proud to lead this British expedition, and he thanked them all for their kind reception. (Prolonged applause.)

Mr. Louis Bernacchi, who was most warmly applauded upon rising to speak, responded for the members of the scientific staff. He was sure the remembrance of the evening would remain indelibly imprinted on the memories of all of them. Also of the many kindnesses received and the charming ladies of Hobart. It would be something to look back upon during the long winter nights in that ghostly frozen world to which they were bound—Antarctica. In regard to the scientific work of the expedition, it would be premature to yet say much, but they had the very best instruments on board—instruments for meteorological work for determining the force of gravity at the South Pole, the intensity of atmospheric electricity, and instruments for taking an adequate photographic survey of the coast of Antarctica. Many discoveries of great interest to mankind, and many and splendid victories in the cause of science, were to be made in those polar regions and seas. Peace had its conquests and science its glories, and no brighter chaplet had been won than in the work of scientific research and geographical discovery. (Applause.) In conclusion, he ventured to believe that the unity and spirit of good fellowship existing on board the Southern Cross, and the absolute confidence they all had in the leader, would conduce to successful results. (Loud applause.)

Mr. Haywood played "Auld lang syne" on the organ, and a vote of thanks having been passed to His Excellency, on the proposition of the Mayor, the proceedings terminated.

Refreshments were served in the anteroom and committee-room by Mr. C. D. Haywood.

In the library of the Royal Society of Tasmania there are the original minutes of the society of the year 1841. The following record is to be seen :—"Wednesday, April 7, 1841. Present :—Sir John Franklin : Messrs. Bedford, Kay, Lillie, Dr. Turnbull, Captain Ross, R.N., Captain Crozier, R.N. [N.B.—This day arrived Her Majesty's ships Erebus and Terror, Captains Ross and Crozier having ascertained the true position of the South Magnetic Pole.] (Signed) F. H. Henslowe, hon. sec. During that year Captains Ross and Crozier were elected members of the society, as also Hon. Sir James Agnew, who still takes the keenest interest in the Royal Society of Tasmania.

Royal Society of Tasmania.

ANNUAL MEETING, 1899.

The annual meeting of the Royal Society of Tasmania was held on Monday, March 27, at the Museum, Argyle-street. The Hon. C. H. Grant, M.E.C., presided.

CORRESPONDING MEMBER.

On the nomination of Sir James Agnew and others, Mr. A. Waugh, R.N., Navigating Lieutenant of H.M.S. Penguin, was elected a corresponding member.

Mr. R. M. JOHNSTON spoke gratefully of the services that Mr. Waugh had rendered the Museum, and the valuable gifts he had made to it.

The CHAIRMAN said that Mr. Waugh had been a valued contributor to the Museum, and he was glad it was proposed to elect him a corresponding member.

NEW MEMBERS.

The following new members were elected:—Messrs. Charles Booth, Resident Secretary Australian Mutual Provident Society; W. A. McLeod, B.A., B.Sc.; Alfred Winter, H. W. Griffith; A. M. Lea, Government Entomologist.

ANNUAL REPORT.

The SECRETARY (Mr. Alexander Morton) read the annual report as follows:—

The Council of the Royal Society of Tasmania have the pleasure of presenting their report for 1898, the 56th year of the Society's existence.

MEETINGS.

Eight meetings were held during the session, at which 19 papers and 8 papers in the Medical Section were read, one of the most important being by Dr. Gregory Sprott, M.D., Health Officer for the city of Hobart. The paper was entitled "The cause and prevention of typhoid fever, with a special reference to the proposed metropolitan drainage scheme of Hobart," and aroused so much interest that a special meeting was given up to discussion of the subject. Other papers read were:—

Notes on a visit to some of the English Museums. By His Lordship the Bishop of Tasmania.

Notes on a visit to Port Davey, illustrated with lantern slides. By J. W. Beattie.

Notes on the Geology of La Perouse. By R. M. Johnston, F.L.S. (Communicated by W. H. Nicholls.)

Notes on Humeri of Tasmanian Labyrinthodonts. By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

A classified list of the marine shells of Tasmania. By Miss M. Lodder.

On the occurence of a sea snake in Tasmanian waters. By Alexander Morton.

Notes on a visit to West Australia, illustrated with 40 lantern slides. By Alexander Morton.

Excavations in Egypt, illustrated with 50 lantern slides. By Rev. C. R. Pollock, F.R.G.S.

Telegraphy without wires, with experiments. By Mr. Thos. Self.

On the Genus Kraussina in Tasmania. By Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

Notes on a Surgeon of the Tudor period and his work. By Arthur H. Clarke, M.R.C.S., etc.

Cause and Prevention of Typhoid Fever, with special reference to Hobart. (Diagrams.) By Gregory Sprott, M.D., etc., Health Officer for the city of Hobart.

Description of a new "Cordyceps." By L. Rodway.

Supplementary Note on Limurite in Tasmania. By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

Description and Measurements of some Mallicolo Crania. By Arthur H. Clarke, M.R.C.S., E.

The Mining Industry of Tasmania (illustrated by lantern slides). By W. H. Wallace, Secretary of Mines.

Notes on further regulations in reference to the Mutton Bird Industry. By the Bishop of Tasmania.

Botanical Notes.

Additions to the Fungus Flora of Tasmania. By L. Rodway.

THE SIR GEO. NEWNES ANTARCTIC EXPEDITION.

An incident of some interest to the Royal Society, and to the people of Hobart generally, was the arrival, in November, of the s.s. Southern Cross, which called here *en route* to Cape Adare with the scientific staff, under the leadership of Mr. C. E. Borchgrevink, who intended to make a determined effort to reach the South Pole. As they were accredited to this Society, and as, moreover, this was the first time a ship bound for the Antarctic regions had called at Hobart since the visit of H.M.S. Erebus and Terror in the year 1841, it was decided to give the leader, Mr. Borchgrevink, the commander, Captain Jensen, the members of the scientific staff, and the officers of the ship a public welcome. The Government kindly undertook to defray the necessary cost, and a most successful *conversazione* was held in the Town-hall, attended by over 800 people, and presided over by His Excellency Viscount Gormanston, G.C.M.G.

Congratulatory addresses were presented to Mr. Borchgrevink and his party from your Society, from the Municipal Council (Hobart), the Chamber of Commerce, and the Marine Board of Hobart, the Microscopical Club (Launceston), and the leading scientific societies in Australia. The Southern Cross sailed from Hobart on December 17, and the party have since been safely landed at Victoria Land. It is a matter for congratulation that England still possesses men so public spirited as Sir Geo. Newnes, who defrays the entire cost of this large and well-equipped expedition.

PROPOSED HISTORICAL SECTION.

The Council have decided to start an historical section in connection with the Society.

LIBRARY.

The usual contributions from kindred societies have been received during the year.

FINANCE.

The income has been—Subscriptions, £177/11/3; balance, 1897, £35/16/10; total, £213/8/1; expenditure, £160/18/4, leaving a balance of £52/9/9.

MEDICAL SECTION.

The members of the Medical Section have had several meetings. The report of the section has been furnished by the hon. secretary, Dr. Gregory Sprott.

OBITUARY.

In the death of Sir Lambert Dobson, one of the vice-presidents, the Society sustained a great loss. The late Chief Justice took a warm interest in the Society, was an occasional contributor of papers, and a constant attendant at the meetings of the Society. Another very old member passed away during the year in the person of Mr. Matthew Seal. In what might be called the practical side of the Society's functions Mr. Seal was of the greatest help, and his loss is much deplored, especially by those members of the Royal Society who are interested in the Tasmanian fisheries.

THE COUNCIL.

The vacancy in the Council, and also as vice-president, caused by the death of Sir Lambert Dobson has been filled by the appointment of the Right Rev. H. H. Montgomery, D.D., Bishop of Tasmania.

MEDICAL SECTION REPORT.

Dr. G. Sprott read the following report of the Medical Section of the Society for the past year:—

The following is the report of the proceedings of the Medical Section for the session 1898-99:—The total number of members is 19. Four joined during the year, and two resigned owing to their leaving the colony.

The officers for the year were:—Patron, Sir James Wilson Agnew, K.C.M.G.; president, R. S. Bright; vice-presidents, G. H. Butler, E. L. Crowther; hon. treasurer, A. H. Clarke; hon. secretary, Gregory Sprott; committee members, J. E. Wolfhagen and C. E. Barnard. C. E. Barnard was elected *vice* W. A. Harvey, resigned.

Besides the monthly meetings held from March to October inclusive, four special meetings were held during the year. All the meetings were well attended, and many interesting papers were read and discussed by the members.

PAPERS.

1. Notes of a case of Intussusception in an Infant. Dr. Macgowan.

2. On some unusual Complications after Laparotomy. Dr. Wolfhagen.

3. Notes of three cases of Appendicitis. Dr. Drake.

4. Cause and Prevention of Typhoid Fever, with special reference to the proposed metropolitan drainage scheme. Dr. Sprott.

5. Typhoid Fever, accompanied by Hæmorrhage and Collapse. Intravenous injection of saline solution—recovery. Dr. Drake.

6. Notes of a case of Extra Uterine Pregnancy. Drs. Bright and Spark

7. History of a case of Typhoid Fever, accompanied by gangrene of leg. Amputation—recovery. Dr. Spark.

8. Interesting case of Chorea. Dr. Macgowan.

EXHIBITS.

1. Skulls of different racial types. Dr. A. H. Clarke.

2. Photo of a foot after Fitzgerald's operation for club foot. Dr. Wolfhagen.

3. Case of Primary Spastic Paraplegia. Dr. Ireland.

4. Case of Tubercular Synovitis of the phalangeal joints. Dr. Walch.

5. Two ruptured hearts. Dr. Spark.

6. Brain with Hydatid Cyst. Dr. Sprott.

Library.—A considerable number of the latest medical works have been added to the Medical Library, and several handsome contributions were made by members, and especially by Drs. Crouch and Clarke.

Cordial relations continue to exist between the Launceston Medical Society and the Section, with the result that many matters of mutual interest have been discussed, and important decisions arrived at.

In conclusion, the members of this Section desire to place on record their hearty appreciation of the liberality which the Royal Society has so generously extended to them by the monetary grant to assist in establishing a Medical Library, and also for the use of the Royal Society's room for the meetings.

To Mr. Morton for his kind assistance we owe a special vote of thanks.

The President of the Medical Section, R. S. Bright, M.R.C.S.E., thanked the Society for its generous support to the Medical Section, which was now universally recognised.

The Chairman moved the adoption of the annual report. He spoke of the loss the Society had sustained in the death of Sir Lambert Dobson, Mr. Matthew Seal, and Lieut. Beddome, C.E. Sir Lambert Dobson was a most energetic and useful member, a good friend and patron of the Society. Mr Seal was also a useful and practical member. During the past year 19 new members had been elected, and only six had resigned, so that the Society had been strengthened by 13 members independently of those just elected. The funds were also in a very satisfactory condition. He regretted that the Government had given the Society no assistance. In the other colonies the Royal Societies were recognised as public bodies which conferred benefits on the community, and they were assisted, more or less, by the local Governments. Now that the finances of Tasmania were in a better condition than for some years past, perhaps if the Government were approached on the subject they might be induced to give the Society the financial recognition which was afforded to the societies in the other colonies. The reception given to the Antarctic Expedition was no more than they deserved. He hoped success would attend the efforts of the members. They heard of a German and other expeditions, but the British one would have priority in the work of the examination of the South Polar regions. He hoped that when they returned to Tasmania they would bring advanced news from the far south. Sir George Newnes deserved credit for the liberal expenditure he made on the expedition. There was an element of commercial speculation in the enterprise, but the expenditure was much to risk for an uncertain end. A new Historical Section was about to be created with the assistance of Mr. J. B. Walker, and, beyond doubt, the section would be of great interest to the Society. The collection of historical facts would be of great advantage to the colony. The Society's list of exchanges showed that their papers extended over a very wide area. They were in communication with 200 societies, and were therefore favourably known to the scientific world.

Mr. J. B. Walker, F.R.G.S., seconded the motion. He said that, following the example of the medical profession, the members interested in the geography and history of Tasmania were desirous of founding a section in which they might be able to discuss questions specially interesting to them more profitably than they could at general meetings of the Society. Our history was not long, nor our geography extensive, but there was a good deal to be done. The object of the new section was to gather materials for the history of Tasmania, and it was a pity that some efforts in that direction had not been made earlier. He was aware that already valuable public records had been lost to the colony, and it was not creditable to the keepers of the records that such things should happen. The Hobart Public Library was disgracefully deficient in works relating to Tasmania. Not one-tenth of the books written on Tasmania were to be found there. Our young people and all educated people ought to know something about the history of the colony. A short and brightly-written school history of Tasmania ought to be in existence.

Discussion followed, in which Mr. J. W. Beattie, Colonel Legge, R.A., and Mr. R. M. Johnston, F.L.S., took part.

The Secretary mentioned that in most of the other colonies the scientific societies got £1 for £1 aid from the Government, or, at all events, 10/ or 15/ for every £1 raised.

The report was adopted.

MEMBERS OF COUNCIL.

The following retiring members of Council were re-elected: — Messrs. T. Stephens, M.A.; J. B. Walker, F.R.G.S.; R. S. Bright, M.R.C.S., E.; and A. G. Webster.

VOTE OF THANKS.

Mr. Morton moved a vote of thanks to the press of Tasmania for the careful and general support given to the society.

Mr. R. M. Johnston seconded the motion, which was agreed to.

PAPER BY MR. NAPIER BELL, M. INST. C.E.

The Chairman announced that at the April meeting a paper on Macquarie Harbour would be read before the Society by Mr. Napier Bell, M. Inst. C.E.

APRIL, 1899.

There was a large attendance at the monthly meeting of the Royal Society of Tasmania (the first of the 1899 session) at the Museum on Tuesday, 11th April, when Mr. Napier Bell's and other papers were read. His Lordship the Bishop of Tasmania (the Right Rev. Dr. Montgomery, D.D.) Vice-President, presided.

Apologies were read from the President (His Excellency the Governor), regretting his inability, through ill-health, to be present; Sir James Agnew, V.P., Mr. T. Stephens, V.P., and Hon. F. W. Piesse, M.L.C.

HISTORICAL SECTION.

The CHAIRMAN said the Society had seen fit to inaugurate a historical and geographical section, so as to obtain all that could possibly be gathered concerning the past history of the colony before it became too late. The section had now been formed, and he hoped every member interested in historical and geographical knowledge would give their names to Mr. Morton, so that the first meeting of the section might be called as soon as possible. (Applause).

PORT CYGNET ROCKS.

The SECRETARY (Mr. Alex. Morton) read a paper by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S., on Haüyne-trachyte and allied rocks in the district of Port Cygnet and Oyster Cove. Igneous rock at Port Cygnet, in Southern Tasmania, has been well known for a long time by the name of felspar porphyry. The authors submit in this paper the results of field work and misroscopical examination, showing these porphyries to be soda trachytes containing the sodic minerals haüyne, aegirine, analcime, cataphoritic-hornblende, with melanite-garnet, sphene, zircon, and apatite as nearly constant accessories. It is pointed out that as haüyne in the first British phonolite (wolfrock, Cornwall) was discovered by the late Mr. Allport in 1871 by means of the microscope, the same instrument has led to the discovery of the same mineral in Tasmania. Geological sections round Lovett show the haüyne and garnetiferous trachytes to be interbedded with the permo-carboniferous beds, and consequently, geologically, contemporaneous with these. Beside these volcanic sheets, intrusive haüyne and other dyke rock have been found, as well as syenites containing elacolite and analcime. The group is thus represented by effusive, intrusive, and plutonic members, and the complete series forms a unique set of rocks, so far as Tasmania is concerned, as well as being apparently the first authentic occurrence in Australia. They are geologically important, as being the youngest matrix of gold in the colony. The trachytes appear to have shed the gold which has been won on the alluvial field at Lymington, and found in the gullies on Mount Mary. The authors also refer to sand from a creek a mile back from Little Oyster Cove, which contains flaky gold, numerous melanite-garnets, zircons, and small crystals of sphene. This sand is the detritus of the garnetiferous trachytes, and the occurrence in it of gold, associated with the minerals just named, supports the idea that the trachytes are the source of the gold throughout the whole province. At present there is no trustworthy evidence to show that the Port Cygnet quartz veins are auriferous, while on the other hand there is some reason for believing the trachytes themselves to contain, sparingly disseminated, gold, especially where they are silicified and brecciated. The miners are pursuing the right course in selecting these tuffaceous and siliceous zones for exploration. Whether the gold has been concentrated anywhere to a greater extent than in the parts hitherto exploited remains for future search to decide. The pyrite in these rocks has so far proved non-auriferous. Appearances are against the quartz veins being true lodes, and the quartz is so closely associated with and banded with trachyte that the assay results are inconclusive upon the question of the auriferous nature of the quartz. There is a remarkable development of melanite garnet in the trachyte and syenite, and this mineral runs through the whole series of rocks. The trachyte rock on the Livingstone Hill, N.E. of Lovett, crowded with large tabular crystals of orthoclase, furnishes the largest and most remarkable felspars in the island. Detached from the matrix they form fine cabinet specimens. The dark green, sometimes fissile, metamorphic looking rock on Mount Mary, west of Lovett, has been ascertained to be an aegirine trachyte, owing its colour to the needles of green soda pyroxene (aegirine) with which it is crowded. The syenitic looking rock on the back road N.E. of Lymington called "granite" locally, is shown to be a typical trachyte, while the dark rock on Cranny's farm, known as "basalt," is a dyke-diorite (malachite), a somewhat abnormal occurrence in this group of rocks. The Port Cygnet series extends to Oyster Cove. This small and peculiar petrographical province is a purely local one, confined, so far as is known to the authors, to this part of Tasmania. Its unexpected discovery may be placed to the credit of the young and expanding science of microscopical petrology.

Mr. R. M. JOHNSTON, F.L.S., spoke eloquently of the splendid service rendered by the two gentlemen in the geological and mineralogical interests of the colony. He looked upon the information contained in the paper as calculated to interest geologists and other scientists throughout the world. (Applause.)

FOSSIL CORAL.

A paper by Mr. Robert Etheridge, jun., Curator of the Australasian Museum, Sydney, was read by the Secretary, which, he explained, was descriptive of a Tasmanian species of Halysites, a fossil coral obtained from the River Mersey. Mr. Stephens presented the Museum a polished specimen of the coral referred to by Mr. Etheridge in his paper.

Mr. JOHNSTON explained the importance of the paper.

MACQUARIE HARBOUR:

ITS PHYSICAL ASPECT AND FUTURE PROSPECTS.

BY C. NAPIER BELL, M.INST.C.E.

In the absence of Mr. Napier Bell from the meeting of the Royal Society of Tasmania on Tuesday evening, Mr. F. BACK, A.I.C.E., F.S.S., etc., read Mr. Bell's paper on Macquarie Harbour as follows:—

Macquarie Harbour is an immense lagoon of 72,000 acres in extent (a lagoon being defined as a lake which has an entrance into the sea); it is about 25 miles long, and from five to seven miles wide, with several islands in it, and many deep bays and inlets on its shores. It lies in a S.E. and N.W. direction, nearly parallel to the sea coast, from which it is separated by a tongue of rough, rocky country only a mile or two wide at the entrance, but increasing in width towards the south end of the harbour. This tongue of land, separating the harbour from the sea, is, for several miles from Cape Sorell southward, composed of quartz rock with thick beds of sandstone altered into quartzite, and underneath this quartz is hard slate rock which outcrops on the seashore. Towards the south end of the harbour the land separating it from the sea rises into rough hills of slate covered with bush.

On the west side of the harbour the land is undulating, and slopes up to the high mountains at the back; it is mostly soft sandstone, shale, gravel, and other sedimentary strata, getting more sandy as you approach Strahan, between which and the sea the land is entirely made of white sand, with occasional beds of gravel and peat among it.

The harbour receives the rivers Gordon and King, with a combined watershed of 2,500 square miles, over which the yearly rainfall is about 100in. Very heavy storms of rain are frequent in this country, and a downpour of $2\frac{1}{2}$in. in 24 hours is capable of filling the harbour $4\frac{1}{2}$ft. above its ordinary level if this surplus was not emptied into the sea as fast as the rain supplied it.

A noticeable peculiarity of Macquarie Harbour is its great depth, which is from 80ft. to 120ft. all over its area, and even the narrow cove or inlet which forms the harbour at Strahan has over 90ft. of water, while at the south end is Kelly's Basin, a land-locked bay in which the largest man-o'-war could anchor. This peculiarity of great depth of water is found also in most of the rivers of this neighbourhood; thus the Gordon carries a depth of 40ft. to 60ft. for 15 miles from its mouth, although it has a bar of 12ft. where it enters Macquarie Harbour. The King is 30ft. to 40ft. deep for some miles up, though it has a bar of only 2ft. at its entrance with the harbour. But I am told that the Henty and Pieman, which discharge direct into the sea, are also very deep inside their bars.

I have thought much on this subject, but I have never found a satisfactory explanation of the unusual depth of these rivers; in New Zealand, rivers quite as big and quite as subject to floods are very shallow; the Brisbane River has more than twice the water-shed of the Gordon, and is visited by tremendous floods, but it is not half as deep; the Fitzroy River has 25 times the water-shed of the Gordon and floods up in places 70ft. high, but it is very shallow in its ordinary condition.

Speculations as to the origin or mode of formation of a lagoon like Macquarie Harbour are very uncertain in the absence of a thorough knowledge of the geology of the surrounding district. It appears to me that this locality was once a wide, open bay of the sea, bounded on the west by the rocky hills of the peninsula which ends in Cape Sorell, on the south, east, and north-east by the detached ranges of mountains and their projecting spurs which now lie a long way inland from the harbour, and reach the sea coast near the Pieman River mouth. The gravel, sand, and mud from the rivers and creeks would then have gradually made the sea coast on the south, east, and north-east sides to encroach on the bay until it began to assume something like its present shape, and then the action of the sea and the currents caused the formation of the great spit or tongue of sand and gravel which, extending from near Strahan, has closed in upon the entrance of what was then a sound or fiord, and has made it what it now is, a lagoon, which the sea has no power to entirely close up by reason of the strong currents of the tides which, rushing in and out of the lagoon, keep the mouth always open.

Such speculations as to the mode in which nature has thus formed a closed lagoon out of a wide bay are not so fanciful as some people might think; hundreds of lagoons in other countries are proved to have been so formed; but the most remarkable instance I know of is to be seen in New Zealand. On the west coast of the South Island there is a constant drift of the material of the beaches, whether shingle or sand, towards the north, caused by the oblique set of the prevailing S.W. waves on the beach. At the west opening of Cook's Strait this coastal drift is deflected towards the east by the prevailing S.W., W., and N.W. winds and waves, and has formed the Farewell Spit, a tongue of sand over 20 miles long, and from two to five miles wide, which encloses Blind and Massacre bays. It has been observed that this spit is extending and deflecting towards the land, the only source from which it can grow being the sand swept up the West Coast and washed along the spit to its end, and in the course of thousands of years it will entirely enclose Massacre Bay, and make an immense lagoon of it.

Some thousands of years ago the bar and the entrance of the harbour was many miles inside of its present position, which is shown by the extensive sand banks inside the entrance, but still more convincingly by great beds of wind-drifted sea sand which lie on the hill sides of Cape Sorell peninsula, many miles inside the present entrance, and facing the shore of the harbour. The quartz hills of the peninsula are covered with a more or less thick bed of peat, which adheres to the smooth face of the quartzite, so that no sea sand is found on that side except such as has crossed the entrance from the Strahan side. Under the conditions of deep water and strong currents sand can cross over only from the east to the west side on the bar, where the waves and the breakers drive it across. If, therefore, thick beds of pure white sea sand are found lying on the hill sides some miles inside of the present bar, the inference is that the bar was near them in those days, and has been pushed out to its present position by the drifting of the sand along the northern beach. There is no other source from which this action could arise, because the sand brought down by the Gordon, King, and numerous creeks stops at their mouths, as it cannot cross the deep water of the harbour, where there are no currents on the bottom.

The above conclusions would appear to contradict what I said in my report to the Government of December, 1897, viz., that it appeared that if there were any coast drift on the sea beach it was to the northward; but there is no contradiction, because when there is a strong flood tide running into the harbour, the indraft is so great that it causes a powerful eddy of the sea water for nearly a mile and a half along the north beach, where the sea water is seen flowing along the beach into the harbour, and, of course, carrying the sand with it; but beyond the mile and a half the appearances are as if there was a drift towards the north.

This circulation of sand at the entrance is very extraordinary, and several times I looked with astonishment when a powerful flood tide was rushing into the harbour to see the whole of the water yellow with sand in such vast quantities that one was inclined to fear that the whole harbour would be presently filled up with it; but, then, after some days, the water ebbed out with even greater violence, and then the stream of sand flowing out to sea off all the sandbanks for miles up the harbour was equally astonishing. It would appear quite likely that the great sandbanks which obstruct the entrance are slowly growing, because one argues that the rough waves on the bar stir up the sand, which the flood tides carry into the harbour, where, meeting still water the sand settles to the bottom, and thus causes the slow growth of the sandbanks inside; also the sudden drop of the shallow water into 50ft. and 60ft. depths inside the lagoon generally indicates either growth or movement of the banks by scours. But, however this may be, a close inspection of the old chart of 1819 does not disclose any change in position or depths of the sandbanks nor in the position or depth of the sea bar.

The water of Macquarie Harbour is salt, but the colour of it is dark brown, caused by the peaty water brought down by the rivers; this water stains the rocks black, and even in the open sea at Pilot Bay the rocks are so stained, except when a heavy gale scours them white again. This brown water is evidently distasteful to fish, as there is not nearly so many in the harbour as one would expect; but Mr. Alexander Morton has a salmon trout which was caught near Strahan, and if these become plentiful it will be a great improvement to the harbour.

A striking peculiarity is the erratic and peculiar character of the tides. There is only one tide in 24 hours, and the average height at the Heads is 2ft. 6in., but this varies so much with wind and weather, that it is impossible to predict the tides. Very often the tide is seen to be what sailors call bulling, that is, the tide falls for an hour or two, and then rises again to near its first height, and finally falls to low water. For half of the year high water is at night, and for the other half in the day time. Sometimes for days there is scarcely any tide, and the water does not run in or out, then without apparent cause the tide will commence to rush into the harbour day and night with great force, until the water at Strahan and the Gordon has risen from 3ft. to sometimes 5ft., then it will start to ebb out with great velocity, sometimes ebbing for two or three days, with just a slight check at high water of the sea. Seafaring people say that when flood tide is pouring into the harbour bad weather is approaching, although at times it does so and no bad weather follows. It is true, however, that rough weather from the N.W. makes a strong inrush of the tide, causing the water to rise very high in the lagoon, and impounding the fresh water poured into it by the rivers, and as soon as the gale veers to the W. and S.W. the impounded water ebbs out with astonishing velocity and force, notwithstanding that the gale is unabated in strength. About the 26th of October, 1897, during a moderate gale at N.W. the flood tide poured into the harbour day and night for two or three days, till it filled up at Strahan 5ft. above ordinary level. The gale then increased to a heavy gale at W., and the harbour gave signs of ebbing; then it blew a very heavy gale at W.S.W. with a mountainous sea and tremendous breakers in the offing. Immediately the lagoon started to ebb in earnest, and on the evening of the 30th there was the most furious ebb tide I ever saw—the water roared in a cataract between Entrance Island and the Peninsula, and I do not think any steamer could have stemmed it. At 1 o'clock in the morning the ebb slackened, but at 8 a.m. it was still ebbing strongly. In the afternoon there was a repetition of the previous violent ebb, but not so strong; and next day the ebb was exhausted, although the S.W. gale had abated very little. This was a great gale, which lasted over a week; during its height I was astonished at the immense height of the breakers, and tried to fix the position of a line of heavy rollers with a sextant. When fine weather came I went in a steam launch to about the place where the breakers had been, and found there over 60ft. of water. Here I noticed what is often observed at both Greymouth and Westport—that the heavier the gale is apparently so much the smoother is the bar; the case being that in a strong gale the waves are all broken up in deeper water outside, and those which reach the bar are moderately small waves. At any rate, during the height of this gale the steamer Australia came in over the bar without any trouble, although it was a marvel to me how she ran through the lines of immense breakers outside the bar, and this part of her performance I did not see.

Returning to the curious action of the tide in Macquarie Harbour, it may be observed that this great tidal backwater acts like a sort of gauge, or barometer, to show up pulsations in the sea which could not otherwise be detected. Recent careful observations in the Lake of Geneva have shown that the surface of the lake rises and falls in a very mysterious manner, sometimes at one end and then at the other, sometimes in the middle and not at the sides. This has been supposed to be due at times to local winds, or to variations in the pressure of the air, even to part of the lake being covered with cloud and part not so covered, or to the passing of a distant steamer; but, in the absence of any of these supposed causes, the phenomenon remains unexplained. Now, if a lake acts like this, how much more may we suppose the sea to be liable to the same effects, which may help to explain the mysterious ebbing and flowing in Macquarie Harbour, often without apparent cause, when the harbour is seen to be ebbing out while the tide is rising, and flowing in when the tide is falling, or at times a powerful flood tide rushes in without any reason given from the sea tides, or from any apparent change in the weather.

Another interesting although well-known effect is seen in this harbour, called the throttling of the tides. In still weather, when no abnormal action is taking place, a rise of tides at the Heads of, say, 2ft. 6in. will raise the water at Strahan or the Gordon only about 1ft., so that the water in the lagoon neither rises so high nor falls so low as it does in the sea. This happens because the sea cannot get over the bar and the shallow parts near the entrance in time to fill up the harbour before the tide begins to fall, and, contrariwise, the water cannot get out quick enough before the tide at sea begins to rise. If the bar and the channel through the shoals were considerably deepened, the throttling of the tides woulp be greatly lessened, with the effect of causing still more sea water to pass in and out, and so increasing the scour; in Greymouth, New Zealand, after the completion of the breakwaters, and the bar had deepened from 6ft. or 8ft. to 22ft., it was found that the low water level at two miles from the entrance had fallen nearly 4ft., while the H.W. level remained the same. After noticing the strength of the currents which flow in and out of Macquarie Harbour, it is to be observed that there is absolutely no current one way or the other in the harbour: the body of water is so deep and large that however violently the tides, even when combined with great floods in the rivers, may be rushing out into the sea, the body of the water in the harbour is quite still, its function being confined to simply rising and falling in surface level.

The bar at Macquarie Harbour is

situated over 4,000ft. outside of Entrance Island; it is really a semicircular shoal of sand, extending from the north shore to the rocky peninsula on the south side, with a depth of about 8ft. 6in. in the line where steamers pass out, but the depth varies continually, and it has the great advantage that it is always deepest in bad weather; in onshore gales it is often 13ft. deep.

If Macquarie had a deep entrance, it would be one of the finest harbours in these colonies. Nature does not always make fine harbours where they are wanted; she leaves it for men to make them for themselves or go without, and where a harbour is badly wanted, men generally contrive to make one by some means or other. If it had not been for the discovery of the rich mineral country in this part of Tasmania, Macquarie Harbour might have been left to the swans and the pelicans; but the necessity for a deeper entrance has now become sufficiently urgent, and after suffering the pangs of fear and doubt the colony has at last made up its mind to take the work in hand. There does not appear to have been any grounds for doubt or anxiety as to the result of the contemplated works, as the effect has been proved on dozens of harbours which have carried out similar works, and although the newspapers cited as a warning some cases of dismal failure of harbour works in New Zealand, they were not harbours of this kind at all, and the success of them was at least doubtful from the beginning. All those that have failed were enclosed harbours built off an open beach, where the well-known coastal drift was disregarded, which has now overwhelmed one and gives serious trouble in two others.

Of course, if breakwaters are projected out to sea from a beach which constantly drifts in one direction, nothing can save such a harbour from being silted up, unless it has the motive power within itself to keep its entrance clear, or unless it is kept clear artificially by dredging or scouring. Thus the harbours of Calais and Dunkirk, where there is a constant drift of the beaches from west to east, have their entrances kept clear by sluicing the channel from artificial sluicing basins, and assisted by dredging; while the harbour of Timaru, in New Zealand, is kept open by a suction dredge.

But harbours which have the motive power within themselves do not require artificial assistance to keep their channels open to the sea if their natural current is controlled by suitable works, even although they may have to contend with the troublesome coastal drift; thus the harbours of Westport and Greymouth, though exposed to the full violence of the sea, and having besides to contend with the constant drift of the beaches towards the north, and with vast quantities of sand and shingle brought down by the rivers, maintain their channel out to sea at a regular depth of about 15ft. at L.W.S.T. or 24ft. at H.W., and have done so for the last 10 years without apparent change. As the tidal basins of these two harbours are very small, the run of the tides in and out twice every day is not strong enough to keep their channels clear, consequently when floods in the rivers fail, the channels gradually shoal up. But floods never fail for very long, and the first flood in the river restores the depth.

Now, in the case of Macquarie Harbour there is not only an enormous tidal basin of 72,000 acres, but the two rivers, Gordon and King, have a larger water shed than the Buller River in Westport, with the same rainfall of 100in., and quite as frequently flooded; in addition to these advantages there is no direct evidence of general drift in the sea beach, and the sand and debris of the rivers cannot reach the entrance because it cannot cross the deep water of the harbour, where, as I said above, there is no current; also it is to be observed that in Greymouth and Westport the rivers bring down shingle up to some the size of a man's head, which has to be swept out to sea to keep the channel clear; but the obstructions in the entrance of Macquarie harbour consist of the finest sand, so easily scoured that the ebb current is able to maintain a channel 84ft. deep between Entrance Island and the mainland, and 40ft. to 50ft. deep at other parts higher up.

There is nothing new in the plans I have submitted to effect the deepening of Macquarie Bar; it is the usual plan adopted all over the world for situations like this, the object sought being to contract the current so as to get depth in place of width, and in designing a work of this kind one has to be very careful so as to strike a proper mean between undue width and useless depth. In this case the width is fixed at 1,200ft. between the two breakwaters, which are to contract the existing width of about 7,600ft. Partly from experience, and partly from calculation, this width of 1,200ft. is reckoned to give a depth of about 25ft.; 1,200ft. by 25ft. is somewhat less than the existing waterway over the bar, but will really be a good deal more, because the velocity of water flowing through a channel is roughly as the square root of the depth.

While considering the depth one wishes to get at the entrance, it is of importance to avoid, if possible, throttling the tide in the lagoon, because the more tide-water that gets in and comes out again the more effective is the power to keep open a channel to the sea. I know a lagoon of about 9,000 acres which was provided with breakwaters at its entrance into the sea to keep open a channel through its bar, but the breakwaters were placed too close together, and the consequence was that I was in a steamer going eight knots trying to get out to sea, and not being able to stem the flood tide rushing in, we had to turn back and wait till it slackened; the other result was that the range of tide in the lagoon diminished by about 18in., which was a very serious loss of tidal water calculated over 9,000 acres.

In this case it is certain that 1,200ft. wide, if it attains a depth of 25ft., will pass more water into and out of Macquarie Harbour than at present does so, but that is provided the channel through the shoals above Bonnet Island are deepened correspondingly; it is hoped that this may be effected by a long training-wall extending upwards for three miles from Mount Wellington as shown on the plan; but if this north channel refuses to scour out to a sufficient width and depth it must be touched up with a sand pump dredge.

The style of breakwater to be constructed is the old-fashioned embankment of rubble stone, heavy rocks being placed on the sides exposed to the waves.

If rock of suitable size is to be had, no one would dream of building any other kind of wall, because a rubble mound is far cheaper and safer than one of concrete. Of course, if stone of sufficient size cannot be got, other means must be taken, such as to build the mound up to half-tide level and cap it with loose concrete blocks, of weight sufficient to resist the waves; but I have seen no reason to suppose that there will be any difficulty in getting enough rock of suitable weight.

There is one inconvenience in building a rubble mound on loose sand, which is, that the waves and currents plough out the sand in front and at the sides of the mound, causing the stone to sink down into the holes thus made. This, of course, consumes a great quantity of stone, and no one can tell exactly how much extra stone will be thus required, the only thing one knows is that the influence of the waves can only extend a certain depth down, according to the height of the wave, and beyond that the sand will be undisturbed, and the stone will sink no further. In America, chiefly, they try to save stone by paving the bases of the mound with a thick mattress of brush fascines; this has succeeded in some places, and has failed and been abandoned in others; but in this country the cost of making and laying such mattresses is probably greater than that of the stone you seek to save by their use. In Westport, they tried to save the great quantity of stone which was consumed in this so-called "settlement" by pushing staging ahead, and paving the bottom with small rubble, but it was very uncertain whether any good was effected by this method, so that it would appear that the only thing to be done is to grin and bear this annoying settlement of stone in the sand, with the comfort of knowing that when your foundations have sunk to their limit the edifice will stand for ever, in spite of the warning given in the Bible about building on sand.

One might naturally be tempted to launch out into the most glowing anticipations of all that will come about when the breakwaters are completed, and Macquarie bar deepened to allow great navies to enter into this grand harbour, but it does not become me at this time to dilate on these triumphant fancies. The apotheosis of the engineer comes in when his work is finished, and until then he holds his peace and devotes his care and thought to seeing that the work is carried out diligently and properly, so as to ensure a successful completion. Let me, however, conclude this with the grand lines from Pope, which I hope the people and Government of Tasmania will take to heart:—

"Bid Harbours open, public Ways extend,
Bid Temples, worthier of the God, ascend;
Bid the broad Arch the dang'rous Flood contain,
The mole projected break the roaring Main;
Back to his bounds their subject Sea command,
And roll obedient Rivers through the Land:
These Honours, Peace to happy Britain brings,
These are Imperial Works, and worthy Kings."

The paper was illustrated by over 40 specially-prepared lantern slides, supplied by Mr. J. W. Beattie, hon. photographer to the Tasmanian Government, and explained by Mr. Back.

Hon. C. H. Grant, M.E.C., thought that the Society and the public were to be congratulated on having such a very able and interesting paper supplied for this meeting, and by an engineer who had the highest reputation for harbour works of any in the Australias. Mr. Napier Bell had been professionally consulted by the Governments of all these colonies, and his advice was entitled to the most favourable consideration. He had not been content with receiving reports from other engineers as to the peculiarities of the tides and their surroundings at Macquarie Harbour, but had resided at Macquarie Heads for several weeks and made the most careful personal investigation into all the conditions before perfecting his plans. We are, therefore justified in having full confidence as to the result of their being carried out, and it is to be hoped that not alone the partial works at present provided for, but the whole scheme will be completed. The resources of the Western District justified the proposed expenditure. He (Mr. Grant) had seen similar works, but on a much more extensive scale, made universally successful in various parts of the world. The use of broken stone filling in place of cement blocks would enable the work to be completed in less time, and was attended with less risks. The peculiarities of the tides at the entrance to Macquarie Harbour, described in such a clear and interesting manner in the paper, were in some respects new to him, and different to what obtained in similar harbours. This was doubtless due to the extensive inside area, compared with the size of the entrance, and the large quantity of fresh water always flowing into the harbour owing to the abnormally large rainfall of the West Coast.

Hon. N. J. Brown, M.E.C. (Speaker of the House of Assembly), emphasised the obligation of the Society and the public to Mr. Bell for his paper. There were many points of scientific interest touched upon, but its practical character was of great importance, because it was calculated to increase confidence in the scheme. He could never understand the objections raised to making Macquarie Harbour accessible to steamers of deeper draught than those now engaged in the trade of the port, and sailing ships. If it was a mistake to do this, then the spending of so much money as has been spent in dredging the Tamar and the Mersey, and in improving the harbour of Burnie was a mistake. (Hear, hear.) The more easily communication by sea was made to this colony, by so much would the cost of production be decreased, and that decrease meant so much addition to the wealth of the whole colony. (Applause.) Our territory was small, and here, more than in the larger colonies, it was obvious that no portion of this island could be largely benefited without that benefit spreading over the whole of the community. He looked with confidence to the completion of this important work under the direction of such a skilled engineer as Mr. Napier Bell. (Applause.)

Captain Miles, M.H.A., warmly commended Mr. Bell and his paper. He claimed that the deepening of the bar would be of enormous benefit to the colony, because it would cheapen the carriage of fuel for treating low-grade ores, and so develop the West Coast mineral fields. (Applause.)

Mr. R. M. Johnston gave a geological description of the rocks occupying the basin of the Macquarie Harbour. He stated that in early tertiary times this great basin formed a fresh water lake, whose wasted sediments still remain forming a fringe on the northern side from Strahan to Kelly's Basin, composed of clays, sands, lignites, and beds of coarse shingles. The old lake, like that of the Derwent, was subsequently encroached upon by the advancing waters of the sea, whose action in again wasting the softer sediments of the old lake was accelerated by a long-continued slow subsidence of the land. This action continued until the present inland sea basin was formed. Mr. Johnston also drew attention to the erratic tidal rise and fall, and said it bore some correspondence to peculiar tidal waves observed for many years by Mr. Russell, Government Astronomer of New South Wales, in the harbours of Sydney, Newcastle, and elsewhere, the causes of which, for the most part, he ascribes to distant storms acting in conjunction with a particular direction of the wind.

After the exhibition of the views the meeting terminated with the usual votes of thanks.

MAY, 1899.

The monthly meeting of the Royal Society of Tasmania was held on Tuesday, May 16, at the Museum. The President, the Administrator of the Government (His Excellency Mr Justice Dodds, C.M.G., C.J.) presided.

THE PRESIDENT CONGRATULATED.

The Hon. C. H. Grant, M.L.C., on behalf of the Council of the Royal Society, heartily congratulated the Administrator upon the distinction which had been conferred on him, and which reflected honour upon the Society of which he had been so long a Fellow, and was now, as Acting-Governor, officially the President. He trusted the Administrator would live many years to enjoy his dignity as Chief Justice, upon which he shed honour and lustre. (Applause.)

The Hon. Adye Douglas, President of the Legislative Council, said they all congratulated the Administrator on the honour to which he had acceded, and he, as an old colonist, had a special pleasure in offering him his cordial felicitations. (Applause.)

His Excellency the Administrator of the Government, in returning thanks, said he had been taken by surprise by the kind utterances, for which he gratefully thanked them. They were rendered to him all the more pleasing as they came from two gentlemen with whom in years gone by he had been associated in Parliament—especially Mr. Douglas, at one time his colleague and chief, and whose character he respected now as then.

NEW MEMBERS.

The following members were elected:—Miss M. Davis, A.C.P., Hon. W. W. Perkins, M.L.C., Messrs. H. Nicholls, LL.B., W. Middleton, C.E., A. C. Parker, Eustace Maxwell, Dudley Allport, Chas. Harrold, A. E. Risby, and the Rev. W. H. Webster.

VISITORS.

The Secretary (Mr. Alex. Morton) introduced the following visitor:—Mr. H. M. Chrisp, engineer of the Great Western Railway.

ROCKS AT MOUNT READ.

The Secretary submitted the following paper on "Felsites and Associated Rocks of Mount Read," by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S. :—

Associated with the schists on the slopes of Mount Read and Mount Black are some obscure igneous rocks, usually silicious and often slightly schistose. These are what are called in the field by geologists "felstones" or "felsites." The term felsite carries different meanings in different countries. In Germany it is applied to the compact groundmass of quartz porphyries, which are the acid volcanics of pre-tertiary age. In England it designates the rock itself, not its groundmass merely. Unfortunately, the English use has come to include acid effusive rocks and acid intrusives under the same term. Thus elvan dykes are sometimes called felsites, and divitrified sheets of rhyolite are called by the same name. The authors explain their use of the names they apply to the Mount Read rocks. They confine the terms felsite and quartz felsite to divitrified acid lavas, and apply the term "quartz-keratophyre" to the same rocks when containing an alkali-felspar rich in soda. The Mount Read rocks, marked by great geological age and distorted and mineralogically reconstructed by intense dynamic metamorphism, are not easy to decipher; and their felsitic nature is often obscured by green colouration due to free development of chlorite. Occurring in the schist zone, they have been affected by the forces which produced the foliation of the schists, and often have a streaked, rolled-out flinty aspect. Their specific gravity ranges from 2·6 to 2·74. The rock is very prevalent on the north side of Mount Read, is met with at Rosebery and the Red Hills, and at other points in a line having a N. and S. direction for about 20 miles. It was probably geologically contemporaneous with the schists. Whenever the felsite appears in tunnels driven through the metalliferous phyllites or schists, ore ceases to be found. Being an intercalated sheet it cut off the ore. The ore bodies on Mount Read form lenticular masses in the argillitic schists, parallel with the plane of foliation. There is no reason to suppose that cavities exisited in these foliated beds in readiness for filling up with mineral. The parting planes of the schists were most likely the first channels for metal-bearing solutions, and the process of chemical replacement probably started from these channels, removing the country rock on either side and leaving ore in its place. The ore bodies come in and die out in these channels, and will probably be found to be quite as persistent in their repeated occurrence as the flexures to which the sedimentary rocks have been subjected. To obtain some knowledge of the true nature of the slates and schists, samples of each were chemically treated, with the result that argillite or argillaceous schist seems the most appropriate name for the least altered varieties. Other descriptions are phyllites or clay slates lustrous with mica; talc schists, silicious schists, micaceous schists, etc. The replacement process is plainly seen in a specimen of Red Hills felsite, where the igneous rock has been converted into hematite, leaving a few unaltered crystals of felspar to tell the tale, and the same process is probably responsible for all similar bodies of mineral in this belt of country. The schists in the vicinity of Mount Read occasionally retain less altered remnants of clay slate, but no fossils have yet been found in them. Judging from the succession, they are somewhat older than the Zeehan series, but great caution is necessary here, as the test of superposition is unreliable. The persistent easterly dip of the strata on the W. side of Mount Read points to overfolding on a large scale, which has produced an inverted succession of the beds. In any case the felsite is much older than any of our known granites. Suspecting the felsites to be soda felsites or keratophyres (in their altered sheared form often called "porphyroids"), the authors submitted specimens to Prof. Rosenbrush, one of the highest living authorities on petrographical geology, who has confirmed the reference, and remarks that they are members of the quartz-porphyry family, adding that their characters point not to quartz-porphyry in the narrower sense, but to quartz-keratophyre and keratophyre, forms which in Germany were originally called porphyroids and placer-porphyries. The authors give a list of minerals found in the schists, and describe the microscopical features of the keratophyres. The latter are summarised by the statement that they are rocks with a compact felsitic groundmass with porphyritic crystals of quartz, orthoclase and albite felspars, sometimes distributed sparingly, at other times crowded. In the typically porphyritic varieties are altered spherulites and signs of fluidal structures. In a word, they are ancient devitrified acid lavas. This long geographical line of felsites parallel with the West Coast range indicates that below that area in Silurian times there must have been a corresponding plutonic body of rock, which the vast period of post-Silurian denudation has not been sufficient to uncover.

MODERN LITERATURE.

Mr. W. H. Dawson read a paper on "Forecasts of the Future in Modern Literature." The paper was lengthy and of a metaphysical and economic character, dealing with the future social state of man. He contended that improved environment was demanded. There might be an abuse of it, but things would right themselves. Speaking of war, he said that probably war would be done away with by the invention of weapons of warfare which would make war impossible. He referred to the position of woman in the coming state, and said that if she were allowed to develop herself, she would assuredly find her right place.

Mr. R. M. Johnston praised Mr. Dawson's paper, and suggested it should be discussed on another occasion.

HARTZ MOUNTAINS AND PICTON.

Mr. J. W. Beattie read a most interesting paper, and Mr. Leonard Rodway gave an account of a recent visit made by them to the Hartz Mountains and the Picton district. The remarks were illustrated by a great number of splendid lantern slides prepared by Mr. Beattie.

Discussion on Mr. Beattie's paper was postponed on account of the lateness of the hour.

The Administrator of the Government cordially thanked the readers of the papers on behalf of those present.

JUNE, 1899.

The monthly evening meeting was held on Tuesday evening, June 20, Mr. T. Stephens, F.G.S., M.A., presiding.

CORRESPONDENCE.

The SECRETARY read the following letters:—From His Excellency the Administrator, Chief Justice Dodds, C.M.G., regretting that, owing to his absence from Hobart, he would be unable to preside at the meeting. From the Hon. Sir James Agnew, K.C.M.G., senior vice-president, and the Bishop of Tasmania, who also forwarded apologies.

ELECTION OF NEW MEMBERS.

The following gentlemen were unanimously elected Fellows of the Society:—Rev. S. Bucknell, Messrs. W. Aikenhead, M.H.A., and Alan Walker.

PAPERS.

The SECRETARY, in the absence of the authors (Messrs. W. H. Twelvetrees, F.G S., and W. F. Petterd, C.M.Z.S.), read a paper entitled "Nepheline and Melilite Rocks from the Shannon Tier":—

This paper is descriptive of some specimens of rocks from the Shannon district, received from the Mines Department, and from Mr. Geo. Allison, of Hunterston. They have been looked upon locally as indicative of tin and gold. From Mr. Allison's outlines of their occurrence, the geological features of the locality are briefly traced. At Hunterston the Shannon Tier forms a plateau of mesozoic dolorite rising 1,000ft. above the permo carboniferous country at its base. On the slope below the Tier are small, round, or conical hills of a dark grey basaltic rock, and on the flanks of these is a coarse zeolitic rock, locally called "tourmaline rocks." Gold is said to have occurred in this pseudo tourmaline rock, but on assay by the Government Analyst did not confirm this. The locality thus yields three varieties of eruptive rock, viz., the mesozoic dolorite, the tourmaline rock, and the basalt. The authors diagnose the so-called tourmaline rock as a nephelinite, and the basalt as melilite-basalt. This age, as far as can be hazarded at present, is probably permo-carboniferous for the nepheline and melilite rocks. The dolorite is considered to belong to the close of the mesozoic era. This latter rock is the typical ophitic dolorite, which occupies the summits of the Tiers, and of numerous mountains in every part of the island. It is a holocrystalline plagioclase-augite rock, structurally diabasic, and sometimes, where the augite is chloritised, merging into diabase. The well-formed felspar crystals are cemented together by the augite mineral, and these two elements have combined to form a non-vitreous massive rock of essentially the same constitution as gabbro and basalt; but as regards grain and structure, intermediate between the two. If one could follow this rock to its deep-seated roots in the earth's crust, where the pressure was greater, and the process of crystallisation correspondingly slower, we should probably find it existing there as coarsely crystalline gabbro. Admitting the intrusive nature of the rock, there are two theories of its occurrence. Seeing that its internal structure agrees closely with that of diabasic sills, has it spread laterally from fissures as an intrusive sheet? On this hypothesis the dolorite on the Tiers and the mountain tops would be merely a capping, and shafts sunk through it would pierce the stratified sediments below. The level contours of the sedimentary beds abutting on the faces or sides of the Tiers and simulating infra-position have suggested this explanation; but no actual trial has been made. The second hypothesis is that the dolorite represents the massive intra-telluric part of an immense body of eruptive rock, which as a whole never reached the surface, but everywhere thrust out lateral dykes, parts of which can still be traced in the coal measures. Either explanation is attended with difficulties. The nephelinite is a nepheline-augite rock. The long black prisms are not tourmaline, but augite. The interstices between the prisms are occupied by yellowish nepheline, which has often decomposed into snow-white radiated aggregates of the zeolite natrolite. The nepheline forms half of the entire rock. The microscopical characters of this rock are discussed, and the rock is correlated with the nepheline dolorite of the Katzenbückel in the Odenwald. The basaltic rock, associated with the nephelinite, contains no felspar in one variety of it. Its melilite is the most interesting element. The other constituents are olivine or augite. This basalt has no relation whatever with ordinary basalts. It has proceeded from a different magma, the theralitic magma as defined by Rosenbusch, who groups nephelinite, nepheline-basalt, and melilite basalt as an integral effusive formation the product of this magma. The authors of the paper have not detected nepheline in any of the other Tasmanian basalts. The crystals formerly attributed to nepheline in the tertiary olivine-basalts of Northern Tasmania are probably apatite. Viewed from a mining point these peculiar basaltic rocks of the Shannon do not offer anything particularly encouraging. As they are unique in Tasmania there is little use in comparing them with mineral-bearing rocks in other parts of the island. The few localities in the world where such rocks occur are not noteworthy for their mines. The rocks are altogether incongruous with the notion of tin ore occurring in them; and though gold is not intrinsically an impossible metal, yet payable gold is unrecorded from this family of stone.

Mr. W. A. McLeod, B.A., B.Sc., gave an interesting account of a fossil wood found in the tin deposits at Cox's Bight. Mr. McLeod, at the conclusion of his paper, was very highly complimented for the very able paper he had submitted to the society.

"Notes on Coral Reefs, with special reference to the Funafuti bore," by T. Stephens, M.A., F.G.S. It was decided to postpone Mr. Stephens's paper till next meeting.

DISCUSSION.

The Chairman spoke in very complimentary terms on the excellent work being done by Messrs. Twelvetrees and Petterd.

Mr. R. M. Johnston said he quite agreed with the remarks of the Chairman as to the excellent work done and being done by Messrs. Twelvetrees and Petterd in the geological work of Tasmania. The recent issue of papers by these authors which had been printed, illustrated with sections of the rocks, reflected the highest credit on the Government Printer (Mr. J. Vail). He (Mr. Johnston) could say that the plates now laid on the table were better than had ever appeared in the society's journals.

The Secretary said he could endorse what had fallen from the Chairman and Mr. Johnston, and would add his high appreciation of the kindly interest Mr. Vail, the Government Printer, was taking in assisting the society to get such excellent plates reproduced.

LIGHTNING FLASHES.

The Secretary said he had been furnished with some interesting photographs of lightning sketches that had been taken at West Devonport by Mr. Aikenhead, M.H.A. Mr. Aikenhead very kindly furnished the following interesting notes:—

"Malunnah, West Devonport, Tasmania, June 19, 1899. Alex. Morton, Esq., Secretary Royal Society, Tasmania, Hobart. My Dear Sir,—The photographs of the lightning flashes which I gave you last Thursday are prints from negatives taken by myself on the night of Friday, the 19th November, 1897, with a Vanneck hand camera from the balcony of my residence (Malunnah), West Devonport, which, being situate at the Mersey Heads, commands a clear and almost uninterrupted view of the sea, into which you will observe some of the vertical flashes descended. The thunderstorm was an unusually severe one, and the atmosphere surcharged with electricity, as evidenced by the frequency and extraordinary vividness of the lightning flashes, whose brilliancy momentarily rendered objects, even at a distance, as clearly discernible as in daylight. The intensity of the "triple" flash—of which I was so fortunate as to secure a counterfeit—was so great that for some moments I was completely dazzled. I may mention that the thunderstorm lasted fully an hour, and was at its height about 9 o'clock; and it was at this period the exposures were made with my camera.—Yours faithfully, Wm. Aikenhead."

JULY, 1899.

UNVEILING A PORTRAIT OF SIR JAMES AGNEW.

THE WEST COAST MINING FIELDS.

His Excellency the Administrator (Hon. J. S. Dodds, C.M.G., Chief Justice) presided on Monday evening, July 10, at the monthly meeting of the Royal Society of Tasmania, and at which there was a large attendance, including Mrs. Dodds, His Honor Mr. Justice Clark, Mrs. and Miss Clark, Hon. Alfred Dobson, Hon. Adye Douglas, P.L.C., Hon. C. H. Grant, M.L.C., Dr. and Mrs. Bright, and others.

Apologies were read by the Secretary (Mr. Alex. Morton) from the Senior Vice-President (Sir James Agnew, K.C.M.C.), the Bishop of Tasmania, and Colonel Legge, R.A.

His Excellency said a very pleasing duty devolved upon him. He had been requested to present to the Society a large platinotype photograph of Sir James Agnew, the senior vice-president. He was glad to be entrusted with the duty, because it gave him the opportunity of paying his tribute of respect to a gentleman who had done so much for the Society. (Applause.) He did not know that anything he could say to them about Sir James Agnew would be new. They all knew how long he had lived amongst them, how great and valuable had been his services, and what an estimable colonist he had been in every respect. (Applause.) Probably it was in connection with the work of the Society that they knew him best. When he reminded them how much Sir James had done, how long he had been connected with the Society, how liberal he had been in giving of his wealth to do what was necessary in furthering the objects of the Society, and the many other works he had encouraged, he would be only repeating household words. Sir James had been a member of the Society nearly 60 years. He was a member of the old society, which, as they knew, was founded by Sir John Franklin in 1841. And when the present Society was founded by Sir E. Wilmot, in 1843, Dr. Agnew continued his membership, and in 1851 he was elected a member of the Council, and at that date his arduous work for the Society commenced. When they looked back to the year 1851 and remembered they were now in 1899, and that during all those years Sir James's work had been untiring in every respect, they could form some idea of how much they owed him. (Applause.) In 1861, 10 years later, he accepted the position of honorary secretary, and from that time to 1893 continued to discharge his duties as such with unabated zeal and increasing interest. (Applause.) As regarded his public career, they were aware that for a certain time Sir James occupied the position of head of the Government of the colony, and for many years was a highly esteemed and respected member of the Legislature. During a short period of his (the speaker's) political career he had the honour of being associated with Sir James, and with another esteemed and respected colleague, the late Mr. Justice Giblin. They were together in the same Cabinet, and he could not imagine a more happy and harmonious Cabinet. At all events, he could not recall a more pleasurable time in connection with his public life than that. It would probably surprise a great many present to hear that in 1888 Sir James Agnew expended the large sum of £800 in importing salmon ova to stock the waters of this colony. (Applause.) This was, however, but one of the instances of the manner in which he had done good by stealth and how noble he had been in all his actions. During the long period of which he had spoken, Sir James had occupied the position of a most upright, honourable man in all relations of life, and had borne "without abuse the grand old name of gentleman." (Applause.)

The Union Jack was then slipped off the elegantly-framed portrait.

His Excellency, in doing this, said he might add that Sir James wore on his breast the decoration which his Queen had conferred upon him for a life well spent. (Warm applause.) He moved a vote of thanks to Mr. Stephens and Mr. Beattie, which was passed amid applause, and the proceedings terminated.

Hon. Adye Douglas, President of the Legislative Council, who was received with applause, said His Excellency had eloquently spoken of a certain period in the life of their noble friend; but he (the speaker) had had the pleasure of knowing him long before that period. They met as far back as nearly 60 years ago, in Victoria, on an excursion to Mount Abrupt, one of the Grampians. From that period to the present time they had been friends, and he (Mr. Douglas) had

always cherished the highest esteem for him. (Applause.) If there ever was an honest and good man in any community Sir James Agnew was one—(applause)—and he was an honest man—an "honest man" has been described as the noblest work of God—and an ornament to the colony. (Renewed applause.) His Queen had decorated him, but he had never made a parade of it. They could not do better than show their respect for such a man, and the only pity was that there were not more such men in the community. (Applause.)

Mr. R. M. Johnston, F.L.S., said he had been requested to say a few words from another point of view. He bore testimony to the aid and encouragement that Sir James Agnew had always given him and others in scientific studies. In his early studies as a naturalist 30 years ago, at Launceston, Sir James wrote to him most encouragingly. If he (Mr. Johnston) had done any good work for the Society it was to a very great extent due to the kind encouragement and friendship that Sir James had extended to him—(applause)—and Sir James had similarly encouraged others; he was himself one of the earliest observers in natural history in Tasmania. His attention had been called by their active secretary, Mr. A. Morton—who readily looked up everything of importance—to the minutes of the proceedings of the earlier days of the Society, which showed that Sir James in the year 1842 read a paper on the snakes of Tasmania. Upon looking it up he found that the paper was a most valuable contribution to science, and of no less importance to-day. The speaker referred to the encouragement Sir James Agnew had always given to art and art students in this colony, notably to Mr. W. C. Piguenit, who had now earned such an enviable reputation as an artist. Lastly, in speaking of the many valuable donations made by Sir James to the Library of the Royal Society, the speaker specially referred, amid applause, to the very valuable gift by Sir James to the Society of Gould's "Birds of Australia and Asia." (Applause.)

The portrait is the gift of Messrs. McGuffie & Co., of Elizabeth-street, to the Society, and is a striking likeness of Sir James in his court dress, wearing his K.C.M.G. honours, and is a platinotype photograph mounted and framed in rich gold.

CORAL REEFS.

Mr. T. Stephens, M.A., F.G.S., read an interesting paper on coral reefs, with special reference to the Funafuti bore.

After giving an account of the reef-building coral polyps, their organic range, and the building up of coral islands, the author described the mode in which the calcareous and silicious remains of myriads of minute denizens of the surface waters of the ocean accumulated, under favourable conditions, to such an extent as to considerably raise, in the course of ages, certain portions of the sea floor. Darwin's theory, which assigned subsidence of the land as the main cause of the growth of the coral reefs and islands rising from deep water, and the theory of Dr. Murray and others who regarded them as built up on banks which had been raised by oceanic sedimentation to within 25 fathoms of the surface, were explained by reference to coloured diagrams. Passages from one of Darwin's latest letters summarising the arguments in favour of the subsidence theory were quoted, and a brief account was given of the three expeditions organised to test the matter by boring, with a result that old coral reef had been found at a depth of about 160 fathoms below the level at which it must have been originally constructed.

THE WEST COAST MINING FIELDS.

Mr. J. W. Beattie (hon. photographer to the Tasmanian Government) read a paper entitled "Notes on the country from Kelly's Basin to Gormanston, *via* the North Mount Lyell Railway route." The paper was elaborately illustrated by over 70 lantern slides, principally from negatives taken by Mr. Beattie, and from others kindly loaned by Mr. A. E. Edleston, locomotive superintendent North Mount Lyell Railway, which showed the railway construction works up to date. The lecturer dealt with the beautiful scenery of Macquarie Harbour, mentioning the different points of interest from Strahan to Kelly's Basin, and contrasting the old days of the harbour with the present, views of Philip Island 1830, Settlement Island 1830, and Grummet Island 1830, being shown, with representations of the same localities as they appear now in 1899, Kelly's Basin, with the great works of the North Mount Lyell Copper Co., their wharves, railway, and brickworks, were graphically described and illustrated. The Darwin and Jukes mining fields, and their fine scenery, were described and shown, along the railway, their immense future importance being specially emphasised, and, judging from the frequent applause which greeted these views, and also of the scenery of the railway route right through, evident satisfaction was given. The lecturer, in concluding, considered that the North Lyell Railway would control nearly all the traffic of the Lyell field outside of the Mount Lyell Co. and Queenstown, and would also get the whole of the Jukes and Darwin country traffic, with that to the eastward, which has practically been unexplored, and when the company's smelters are erected at Thureau Hills (where a town rivalling Queenstown in size and importance would probably spring up) the traffic would be enormous. Both railways were considered most valuable from a tourist standpoint, the lecturer contending that they would open to the public our best type of West Coast scenery, hitherto closed except to the few, and that in the near future they would become recognised tourist routes of great popularity.

Mr. Beattie, at the close, was accorded hearty and prolonged applause.

EXHIBITS.

Mr. T. Stephens exhibited a specimen from a very large block of pumice washed up in Sydney harbour recently; and presented for distribution a parcel of walnuts from a species (*Hickoria pecan*) indigenous to the Central and Southern States of North America. The fruit is greatly prized in the United States, and the annual export of pecans from Texas alone is valued at not less than £10,000.

AUGUST, 1899.

HISTORICAL SECTION.

The second meeting of the Historical and Geographical Section in connection with the Royal Society of Tasmania took place on Tuesday evening, August 1, 1899, the President (the Right Rev. H. H. Montgomery, D.D.), presiding.

There were present a large number of members.

The HON. SECRETARY read apologies from Professor W. Jethro Brown, M.A., and Mr. A. Mault, regretting that, owing to prior engagements, they were unable to be present.

EXHIBITS.

The PRESIDENT drew attention to an interesting exhibit that he had received from Khartoum. The collection consisted of a complete outfit of a Baggara horseman, sent by Colonel Broadwood, commanding the Egyptian cavalry at Omdurman—the dress, cap, sword, and a large lance 12ft. in length.

The Secretary laid on the table some very interesting documents relating to the early days of Tasmania that the President had secured for the section.

PAPERS.

Mr. J. B. WALKER, F.R.G.S., vice-president of the section, read a most interesting paper entitled "The Cartography of the Terra Australis and New Holland." Mr. Walker said:—Homer represents the earth as a flat surface, somewhat of the form of an oval shield, surrounded by the great flowing salt river Oceanus, called by Milton "Ocean Stream." (See map to Gladstone's "Juventus Mundi.") The knowledge of the Ancients was almost wholly limited to the Mediterranean and its shores, with some vague information as to the Red Sea and Persian Gulf. Any ideas they had respecting the outer world were probably derived from the Phœnicians, the most adventurous mariners of those early ages. That they suspected the existence of a world beyond the great encircling river is shown by Plato's description in the "Timæus" of the island of Atlantis, beyond the Pillars of Hercules, and exceeding in size the whole of Africa and Asia. I quote from Jowett's translation: "In those days the Atlantic was navigable; and there was an island situated in front of the straits which you call the Columns of Hercules; the island was larger than Libya and Asia put together, and was the way to other islands, and from the islands you might pass to the whole of the opposite continent which surrounded the true ocean. . . . . Afterwards there occurred violent earthquakes and floods, and in a single day and night of rain, the island of Atlantis disappeared and was sunk beneath the sea. And that is the reason why the sea in those parts is impassable and impenetrable, because there is such a quantity of shallow mud in the way, and this was caused by the subsidence of the island."—Jowett's Plato. ii. 521. Of more interest with respect to the Southern Continent is a curious fragment from an old Greek writer of about the same period, c. 350 B.C., which has been preserved for us by Ælian, and which is quoted by Major in his "Early Voyages to Terra Australis," p. iii. This writer, one Theopompus, narrates a conversation between the god Silenus and King Midas of Phrygia. "Silenus told Midas of certain islands, named Europe, Asia, and Libya, which the Ocean Sea circumscribeth and compasseth round about, and that without this world there is a continent or parcel of dry land, which in greatness was infinite and unmeasurable; that it nourished and maintained, by the benefit of the green meadows and pasture plots, sundry big and mighty beasts; that the men which inhabit the same climate exceed the stature of us twice, and yet the length of their life is not equal to ours; that there be many and divers great cities, manifold orders and trades of living; that their laws statutes and ordinances are different, or rather clean contrary to ours." It must not be supposed that the Greek philosophers of the age of Plato and Theopompus still held Homer's opinion that the earth was a flat surface. The Greek intellect had early arrived at a true conception of the earth's form. Says Aristotle—"As to the figure of the earth it must necessarily be a sphere." He estimated its circumference at 400,000 stadia. He further remarks: "We may judge that those persons who connect the region in the neighbourhood of the Pillars of Hercules with that towards India, and who assert in this way that the sea is ONE, do not assert things very improbable." (Whewell, Hist. Ind. Sci. i., 161.) We have the works of several Greek geographers before the Christian era, of whom the best known is Strabo, who in 17 books gives a description of the whole known world. With the growth of the Roman dominion knowledge of the earth's surface was necessarily largely extended. We have the result in the celebrated geography of Ptolemy (130 A.D.) containing a very careful typographical account of the various countries. His work was illustrated by very tolerable maps, said to have been executed by Agathodemon. It is perhaps to be regretted that Ptolemy did not confine himself to known facts about the earth's surface. Unfortunately where knowledge was wanting he filled up with theory. Thus he abandoned the ancient idea of the all encircling ocean-stream, and ventured on an assumption making the Indian Ocean an inland sea like the Mediterranean, and extending Africa on the south and Asia on the east, as continents of immeasurable extent. Ptolemy was the last of the ancient geographers, and for more than a thousand years he and his theories held supreme sway in geographical matters. Some of these theories respecting the unknown parts of the world had a distinctly retarding effect on exploration, and were not disposed of until the great era of maritime discovery in the 14th century. During the Dark Middle Ages even Ptolemy was forgotten, and men's ideas of geography grew chaotic. The flame of learning was kept feebly alive in the great monasteries, but the monks despised science, and devoted their care wholly to theological works. They some times illustrated these works with a *mappamundi* (*mappa*, a towel; *mundi*, of the world, as their maps were usually drawn on linen). Such *mappae mundi* have been preserved in MSS. of Beatus' Commentary on the Apocalypse (776 A.D.). A facsimile of one of these, the original of which was drawn about the time of the Norman Conquest, will show what a fantastic jumble was made by these monkish cartographers, who grouped all the countries of the world haphazard round Jerusalem as a centre. The first advance in geographical knowledge came from the great religious movement which poured the hosts of Europe into the East during the period of the Crusades—1095 to 1270—in the time of Wm. Rufus and Coeur de Lion down to Edward I. Immediately following the Crusades came the era of land travel, when Marco Polo the Venetian, that prince of medieval travellers, made his way (1277, temp., Edward I.) to the Court of Kublai Khan in Pekin, and brought back to Europe marvellous tales of far Cathay (China), Zipangu (Japan), India, of distant Java, and the countries of the far East. Nearly a century later, in the reign of our Edward III., say 1350, when the mariner's compass came into use, and made distant voyages possible, the era of ocean discovery began. In this the Genoese captains led the way. These Genoese, disregarding the theories of geographers, began to construct sea-charts—or as they called them "portolani"—from their own observations, and solely with a view to practical use in their voyages. It was then that cartography first began to make substantial advances. From 1410 to 1460—in the time of King Henry V. down to the Wars of the Roses—the Portuguese, under Prince Henry the Navigator, courageously pushed their caravels out into the mysterious Atlantic called by the Arabian geographers the "Green Sea of Darkness," in which the voyager was believed to be swallowed up in impenetrable fogs. They dared to pass through the tropic seas which, in the popular imagination, were always boiling under the fierce rays of the vertical sun. So they crept down the coast of Africa, and made the first step to the discovery of the outer world. By the time of Prince Henry's death (1460, contemporary with the Wars of the Roses) a cartographer, like the Italian Fra Mauro, could construct a map (1457-59) containing a fairly recognisable representation of Europe, Asia, and Africa, surrounded by the ocean. Beyond this nothing was known. It remained for Columbus, in the closing years of the century—1492, temp Henry VII.—to lift the veil from the unknown and realise the ancient dream of a mythical Atlantis, by his discovery of America. In the earlier maps after Columbus we find the persistent influence of traditional ideas. America is represented as an island closely approaching China and India; whence the name West Indies. Magellan's voyage across the Pacific in 1521 (temp Henry VIII.), revolutionised men's ideas, and from that time we find the cartographers depicting the world more or less in accordance with our modern notions. Columbus had given to the world a real America for the fabled Atlantis. The problem of the Great Southland was longer in being solved. The ancient myth died hard, in fact we find traces of it lingering for 300 years more, down to near the close of last century. I do not propose to enter on the thorny paths of the controversy respecting the earliest indications of Australia, or to decide on the rival claims of different nations. The subject has been fully discussed by Major, Delmar Morgan, Collingridge, and others, and in their works full information can be found. Suffice it to say, that somewhere between 1514-42 (temp Henry VIII. and Luther's Reformation) the Portuguese, who had just discovered New Guinea, almost certainly, while cruising in the Eastern Archipelago, sighted some parts of the N.W. and possibly of the N.E. coasts of Australia, and we find vague and inaccurate indications of their discovery in maps about 1540. (The Royal Society has a fine reproduction of these maps). If to the Portuguese belongs the honour of having first sighted Australian shores, it is to the Dutch, and to the Dutch alone, that the credit is due of its actual discovery, *i.e.*, if by discovery we mean a definite knowledge of its position. The Dutch claims have been much debated, and it has been sometimes asserted that their maps were, for the most part, copied from the charts or descriptions of Portuguese and

Spanish navigators who had preceded them. Even Tasman's right to the discovery of Tasmania has been doubted, and he has been accused of appropriating Portuguese discoveries. But of late years the Dutch claims have been abundantly vindicated by the publication, not only of old maps, but of original journals of discovery ships, which have been carefully treasured up in the archives of the Dutch East India Co. It will, therefore, be sufficient for our purpose, disregarding all other maps, to take the works of the Dutch cartographers in order to show how the mythical *Terra Australis Incognita* was displaced, and the actual Southland—New Holland or Australia—was gradually evolved in its place. It was during the 70 years war with Spain, and on the eve of the rise of the Dutch Republic, the period so graphically described in the pages of Motley, that the Dutch first appeared as explorers of unknown countries. It was in "the spacious times of great Elizabeth," when Cecil and Walsingham seconded the efforts of Raleigh, Drake, Frobisher, and other great seamen to establish England's sea-power and lay the foundations of her empire. But Holland was first in the field, and at the first was more successful. Her ships were the most numerous and the best, her seamen more skilful, her scientific geographers more accomplished. At that time Holland was not only the commercial, but also the intellectual, centre of Europe. As a natural result of the extraordinary development of Dutch commercial enterprise there arose in Flanders, and also in Holland, a great school of cartographers, of which Antwerp and Amsterdam were successively the centres. The most celebrated of these map makers, indeed the only one whose name is at all familiar to English people, was the Flemish Gerhard Kremer, better known by his Latinised name of Gerald Mercator. In 1541 Mercator produced his great globe, and in 1569 his great world map. It is to Mercator and his friend Abraham Oertel (or Ortelius) that we owe the first modern Atlas, both the thing itself and the name. In 1570 (18 years before the Spanish Armada) Ortelius brought out, at Amsterdam, his first Atlas. It was called "*Theatrum Orbis Terrarum*, or "Spectacle of the countries of the globe," and contained 53 maps. It was not until near the end of the century, 1598, after the death of Mercator, that the latter's Atlas was published at Amsterdam by his son in conjunction with Hondius. The work of Ortelius (increased in later editions to 100 maps), and that of Mercator and Hondius, were the first examples of the modern atlas. The name was derived from the figure on the title-page of the giant Atlas supporting on his shoulders a celestial globe. The construction of a world map was by no means an easy task for these early cartographers to accomplish to their satisfaction. (1.) The countries that had been actually observed by competent navigators and travellers they could lay down with a fair approach to accuracy (2), but in the delineation of the more distant and less known countries they were confronted by the difficulty due to uncertainty of longitude, which there was no means of ascertaining with even approximate accuracy. (3.) Then the regions vaguely indicated by the inaccurate and often misleading descriptions of old travellers such as Marco Polo had to be fitted in somewhere and somehow. (4.) They were all more or less dominated by the fear of deserting the traditionary ideas about what was absolutely unknown. (5.) And, finally, they had a horror of blank spaces, and liked to fill up the map, if only with something conjectural, or if that was not practicable, with strange figures of land monsters, sea beasts, or (more innocently) of ships. The result is often a strange jumble of fact and fancy. The Ortelius world map of 1570, in the first edition of the atlas already mentioned, is a fair example of this blending of knowledge and wild conjecture. The unscientific character of the map is evident at a glance. There is no attempt to distinguish by dotted lines or otherwise, as is the practice of modern times, between the purely conjectural and the known. The Arctic and Antarctic regions, the N.W. Coast of North America (not explored until two centuries later), the interior of Africa, are all laid down in as absolute and definite lines as the shores of the Mediterranean. In the delineation of the *Terra Australis Incognita* we have a fine example of the method of the map-maker of the period. The one point of actual knowledge is the Strait of Magellan, and that side of the supposed Southland is. therefore, called "Magellanica Regio." New Guinea is shown as a large, round island, some 15deg. too far to the East, with a note that it is uncertain whether it is an island or part of the Southern Continent, which is accordingly extended so as nearly to touch it. The reported discovery by the Portuguese of this Southern Continent in another longitude is shown by a prolongation to the south of Java to about the latitude of the Cambridge Gulf, but some 15deg. too far to the west, separated from Java by a strait called Lantch idol Mare (a mis-spelling of the Malay Laut Kidol, meaning "South Sea.") This northern promontory bears the name "Beach" (on many maps called "Regio Aurifera"), and also the words "Luach" and "Maletur," with a statement that these extensive regions are known from the writings of Marco Polo and others. The actual fact being that the placing of the names is due to a misreading of M. Polo, who describes under somewhat similar names parts of Cambodia and the Malay Peninsula. Then we have the remainder of the Southern Ocean up to nearly lat. 40deg. S. filled up with a wholly imaginary continent called "Terra Australis Nondum Cognita," with imaginary capes and promontories, such as "Regio Psittacorum," the Land of Parrots, and so forth; while figures of strange and fearful monsters occupy the blank spaces of the ocean. Mr. Walker said that he had so far dealt with the mythical period of the cartography, but he hoped in a future paper to deal with the scientific period and show the gradual development of the coast line of New Holland.

Mr. T. Stephens, M.A., F.G.S., read the following interesting extract from a Port Phillip newspaper, the *Albion*, December 23, 1847: —. "That justice, which Australia Felix has year after year petitioned for and demanded, has at length been conceded to her. On the 1st day of January, 1849, a day which will ever be commemorated by a jubilee, the chains which have long bound her in slavery to a tyrannical Government will be snapped asunder by an edict of the British Parliament. . . . A Bill declaring the erection of this province into a free and independent colony was prepared and ready for introduction on the assembling of Parliament in August last. . . . The Colonial Minister, as if to sweeten the cup of liberty which he has prepared for us, and efface as much as possible all recollection of our bondage, has, by the Bill which provides for our manumission, bestowed upon this land the name of Victoria."

Mr. R. M. Johnston, F.L.S., gave a very interesting account of Macquarie Harbour meteorology and tides, 1825-6, being a summary of meteorological observations taken at Macquarie Harbour settlement, and of observations of the tides at Macquarie Harbour Heads during 12 months ending on January 31, 1826. Mr. Johnston said that these records were obtained from London by Mr. J. W. Beattie, being the original MS. records carefully prepared by Jas. Spence, Col. Assist. Surgeon.

Mr. Alex. Morton drew attention to an old interesting copper medallion that had been presented by the great navigator, Captain Cook, to one of the chiefs at the Society Islands. On the obverse side was the head of George III.; on the reverse are the two ships Adventure and Resolution, with the following inscription:—"Sailed from England March, 1772." This medal had been presented to the society by the Hon. Thos. Reibey, M.E.C. October 27, 1875, who stated that it had been obtained by his (Mr. Reibey's) grandfather, who commanded the brig Mercury, and traded through the islands in the early part of the present century.

The members at the close of the papers inspected the several interesting exhibits.

AUGUST, 1899.

The monthly evening meeting of the Royal Society of Tasmania was held on Monday, August 14, in the Art Gallery of the Tasmanian Museum. The acting president, His Excellency The Administrator (the Hon. J. S. Dodds, C.M.G., C.J.) presided.

The secretary (Mr. Alex. Morton), read the following apologies:—From the Hon. Sir James Agnew, K.C.M.G., M.D., senior vice-president, the Right Rev. H. H. Montgomery, D.D., vice-president; Hons. N. J. Brown, C. H. Grant, M.E.C.'s; Col. W. V. Legge, R.A.

ELECTION.

Mr. L. F. S. Hore, B.A., Oxon., was elected a Fellow of the Society.

THE LATE MR. JAMES BARNARD.

His Excellency said some little time back the Secretary, Mr. Alex. Morton, conceived the excellent idea of having the portraits of those who had done good work in connection with the Society hung on their walls. Last month the portrait of Sir James Agnew was presented, and on this occasion that of Mr. Barnard. Mr. James Barnard, like Sir James Agnew, was a very early member of the Society; he first became a member of the Tasmanian Society, which was started by Sir John Franklin. In an old minute book in the Royal Society's library the following notice occurs:—"Wednesday, 7th April, 1841. Present: Sir John Franklin; Messrs. Bedford, Kay; Drs. Lillie and Turnbull; Captains Ross and Crozier, R.N., H.M.S. Erebus and Terror. Upon the motion of Mr. Bedford, seconded by Sir John Franklin, James Barnard, of Hobart Town, was elected a member of the Society." On the formation of the Royal Society on October 14, 1843, the late Mr. Barnard was elected one of the first members of its Council, a position which he held to the time of his death, which occurred in the year 1897. In 1878 the late gentleman was elected one of the Vice-Presidents of the Society. During the year 1883 Mr. Barnard acted as hon. secretary during Sir James Agnew's visit to Europe. He took a very keen interest in the Society, the Museum, and Botanical Gardens, seldom ever missing any of the Council meetings. Mr. Barnard contributed a number of papers which have appeared in the Society's transactions, and by his will he left a sum for the purchase of works for the library. The portrait is a gift to the Society by the family of the late gentleman, and has been reproduced by Mr. J. W. Beattie, hon. photographer to the Government of Tasmania. (Applause.)

The Secretary read the following letter from the Hon. Sir James Agnew, K.C.M.G., M.D., senior Vice-President:—"Hobart, August 14. My dear Mr. Morton,—I am very sorry that I cannot be present at the meeting of the Royal Society this evening, as it would have given me extreme pleasure to take a more practical part than I can do in the ceremony which is to take place in honour of my old and valued friend, the late Mr. Barnard. Ever since the formation of our society Mr. Barnard proved himself to be a warm and consistent friend in zealously promoting its best interests, and the legacy which he so generously bequeathed to it shows that his practical regard for its welfare continued unabated to the last. I am heartily glad to join in recognising such services, and cannot but feel that no portrait can more fitly adorn our walls than that of the friend we have lost.—Very truly yours, J. W. Agnew."

CORRESPONDENCE.

The Secretary read a letter that had been received by the Hon. W. Crosby, M.L.C., Consul for the Netherlands at Hobart, stating that an Exhibition at Hague would be held in the months of July and August, 1900, and that His Excellency the Minister for Foreign Affairs at Hague would be glad to receive for exhibition anything relating to maritime matters previous to 1795.

PAPERS.

Mr. L. Rodway, Hon. Botanist to the Government of Tasmania, read an interesting paper entitled "Forestry for Tasmania." The author said the paper referred to the indifference to forestry in the past, culminating with the necessities of depression rendering it necessary, in the opinion of the Government, to reduce forest attention to a minimum. The recent appointment of so able a man as Mr. Penny has revived hope that not only our native forests will be conserved, but that some attention may be turned to the plantation of areas in places that are now suffering deforestation. The subject was treated under three heads:—Timber Production, Water Conservation, Influence on Climate. Native trees would not yield the best results if planted for timber. Owing to the slowness of the growth in most instances, and the quantity already in our forests, the enhanced value owing to increased care in growing would not repay the cost of attention. This, however, does not apply to the growth of wattle bark. Probably systematic planting of black wattle would pay handsomely in any district, and in many poor grazing districts would return a sum at the end of a few years that the owners of the land have little idea of. The class of trees required are such that would yield the best class of deal within a reasonable time. Such trees are found only amongst the fir or pine family. Last year about £18,000 worth of such wood was imported. The systematic growth of forests is largely practised in older countries of the world. In Germany recently 35,000,000 acres are so employed, returning £21,000,000 sterling, and employing over half a million persons. Tasmania is peculiarly suited for the growth of the best class of timber, and it is deplorable that the industry has not received the attention of our governing bodies. But the most important reason for encouraging tree-planting is not from the return of timber, but for the conservation of the water that is allowed to flow so ruthlessly to waste. A well timbered country retains the water from rains as a sponge would, allowing it to drain out very slowly, so that if we had reasonable forest areas on our watersheds, instead of a rush of rainwater to get off the land alternating flooded with dry creeks, the outpouring would be so slow that most of our creeks would more assume the character of a brook with a constant mean level. The rainfall of Tasmania is not so small as generally supposed, only the ubiquitous gum and extensive clearings constitute poor reservoirs. A forest, to be effective both for growth and water conservation, must maintain an unbroken and almost impenetrable canopy of foliage. Though climate is mostly due to cosmic causes, still local influences often go largely towards determining precipitation. Forests tend to equalise temperature, and masses of atmosphere heavily charged with moisture will, over a clear, dry, hot area become rarified, whereas over a cooler, damp district, rain must fall. But it is not only in the vexed question of rainfall that forests influence climate, it is also in their immediately local influences that they are of value. The rigours both of summer and winter would be greatly mollified, and many bleak portions of Tasmania rendered reproductive were judicious planting encouraged. If due encouragement had been given to this subject, say, even in the days of the sixties, we should now be not only producing all the softwood we require, but should be supplying the still larger market of Australia, and be in a position to do so for all time. Should we not in our own interest, as well as the interest of those to come after us, give this our earnest attention at once?

Messrs. W. H. Twelvetrees, F.G.S. (Government Geologist), and W. F. Petterd, C.M.Z.S., submitted an interesting paper, entitled, "On the Mesozoic Dolerite and Diabase in Tasmania." The writers stated that the subject of the paper is the familiar diabase or dolerite rock which plays such an important part in the geology and physical configuration of Tasmania. The geographical distribution of this eruptive rock in the island is briefly stated, and the striking fact referred to, that it is nearly invariably associated with permo-carboniferous and trias-jura sedimentary strata. The theory that the igneous rock is a sill concealing the sedimentary beds below it is mentioned, but conclusive evidence is said to be still wanting as to whether it is a denuded intrusive sheet, or a vast eruptive mass *in situ*. The thickest known sills are stated to fall short of the development of the massive rock which forms the upper part of Mount Wellington. The geological horizon of the rock is considered to be at the close of the trias-jura, or beginning of the tertiary, and the microscopical appearance of samples from all parts of the island support the inference that the rock all over the colony belong to one and the same geological age. It has never been found *in situ* in tertiary beds. In one instance microscopical fragments have been noticed included in tertiary olivine-basalt. This occurs near Bothwell, where the basalt has probably entangled in its flow loose pieces of the older rock. The essential minerals are plagioclase-felspar and augite. The accessory ones are olivine, apatite, elmenite, magnetite, pyrite, mica, and quartz. The secondary minerals which have been developed are chlorite, serpentine, actinalite, calcite, and scolecite. After a description of the microscopical characters of the rock, the authors state that locally the dolerite becomes converted into diabase by the chloritisation of the augite. The nearest European types with which the Tasmanian rock may be compared are the hunne-diabase and kinne-diabase in Sweden. It has been produced by the crystallisation of a magma, which was injected or intruded into strata lying below the surface. It did not crystallise rapidly, but under the pressure of superincumbent rocks now removed by denudation. There is nothing to show that the molten rock ever succeeded in establishing communication with the surface. If, however, it did, both the pipes by which it ascended, and the basaltic flows in which the ascent finally resulted, have been wasted, without leaving a trace behind. The entire absence of mesozoic basalts in the island suggests that these dolerites always were subterranean, and that the faces and cliffs now seen are subterranean sections, lifted for inspection by one or other of the earth movements which geological science so often reports. The authors discuss the name to be applied to the rock. In Europe and America it is known as diabase, in England mostly as dolerite. European geologists use the term dolerite for the coarse interior parts of thick lava sheets, and consider that rock a local, unimportant modification of basalt. But most English petrographers use the group name dolerite for all rocks intermediate between gabtro and basalt, and confine the term diabase to altered varieties of dolerite. If one or the other term becomes obsolete, it will be necessary to adopt the one which gains general recognition. The tertiary basalts of Circular Head, Table Cape, Lefroy, etc., often exhibit a slightly ophitic structure, and correspond with what goes under the name of dolerite in Germany. They may be distinguished from our mesozoic dolerite by their abundant olivine, glassy base, and greater freshness. The discovery of a little auriferous wash in the first and second basins of the South Esk, at Launceston, has led some to believe that the mesozoic dolerite might be gold-bearing; but the fact is, that the sand obtained carried, besides small flakes and water-worn pellets of gold, grains and crystals of quartz, zircon, sapphire, and ilmenite, all minerals of the granite and slate country in the upper reaches of the river, and must be referred to that source. No useful minerals have yet been found in this rock, and the lodes and reefs of our various mines are all of earlier date. The experience of our miners in this respect has been so uniform, that search for ore deposits in the dolerite is invariably regarded as useless.

LAVA V. SILL ORIGIN OF THE HIGHER COLOSSAL IGNEOUS MOUNTAIN CAPS.

Mr. R. M. Johnston, F.L.S., in his observations, placed a very high value upon the petrological investigations of our igneous rocks by Messrs. Twelvetrees and Petterd. He stated that prior to the time when these gentlemen commenced their splendid microscopic investigations—of which their latest contributions, read that evening, he referred to as "a rich mine of wide and valuable knowledge and logical deduction"—the local general geologists were not possessed of the necessary data to enable them to form satisfactory conclusions. He further stated that, in his opinion, conclusions as to the exact mode of origin of our massive igneous mountain caps—whether as sills or lavas—would be of little scientific value without a thorough survey of all our igneous rocks by such methods of careful systematic examination as are now being carried on by Messrs. Twelvetrees and Petterd. Mr. Johnston said he frankly accepted these gentlemen's conclusions regarding the conditions under which, what remains of, our massive igneous rocks of our tiers and mountain plateaux were cooled and crystallised, *i.e.* 1. The portions still unwasted by denudation were slowly cooled under an immense pressure of superincumbent rocks far below the level of the original surface. 2. The manner in which crystallisation has taken place corresponds exactly to that of true dykes, roots, and sills. He also pointed out that there were abundant examples of true igneous intercalated sills near Hobart, between Blackman's Bay and Adventure Bay: but he doubted whether the great massive igneous caps of Ben Lomond, Mount Wellington, and the Lake plateau were ever ejected or intruded as true sills; *i.e.*, were intercalated between the planes of bedding of other rocks, without any portion reaching the surface as a lava flow; although the unwasted portions now remaining, undoubtedly, show crystallisation identical to that of sill structure. He contended that it seemed to him incredible that a massive sill 2,000ft. to 3,000ft. thick could be thrust for vast distances between the planes of stratified bedding, say within 800ft. of the surface, without causing innumerable fissures and fractures through which some portions of the magma would be forced to the surface in the form of lava, ashes, etc. He also contended, if we assume a period of 2½ million years to have elapsed, that any massive lava flow, if exposed to surface waste or denudation at the normal rate of 1ft. in every 3,000 years, would be uniformly denuded to a depth of 833ft. from the original surface. He also pointed out that at a depth of 3,000ft. from the surface the pressure from a superincumbent mass of rock would be equal to the weight of 240 atmospheres. Taking these matters into consideration, he then asked:—1. Supposing that by gigantic fissure eruptions a tide of lava welled upwards to the surface, and in places attained in its flow a thickness of a thousand or more feet before cooling—What eventually would characterise the more rapidly cooling surface magma from the magma more slowly cooling at a depth of from 1,000ft. to 2,000ft. below the upper surface of the same flow? 2. As the radiation of heat from a cooling mass, from surface to base, would proceed in an inverse ratio to that of pressure—Would it not be possible for the characteristic crystallisation of *sill structure* to be produced without the agency of a "true intercalated sill?"

These suggestions, however, he merely advanced as speculations for the further consideration of the physicist and the petrologist.

The paper was illustrated with a fine series of photographs.

DISCUSSION.

Mr. Thos. Stephens, M.A., F.G.S., said the remarks of Messrs. Twelvetrees and Petterd on the main constituents of the Tasmanian "dolerite," with their accessories, and in the intersertal and ophitic structure of different varieties of the rock, were an admirable summary of results of detailed microscopic examinations which have already been laid before the Society, and will be very useful to all who are interested in this important branch of geological research. The authors have amply justified their use of the term "dolerite" rather than "diabase," which latter term some of us still prefer to use for the rocks in question, and their work is immensely valuable to all who study the geological history of Tasmania.

Mr. Stephens said the development and surroundings of the vast masses of dolerite, or diabase, in the central plateau must, of course, be studied in the field before any conclusions as to their origin can be accepted as final; and we must not begin by regarding them as "occupying the whole upland area of the Central Tiers." When referring to my own knowledge of the central plateau, I have preferred to speak of it in the following terms:—"The central plateau is not, as is generally supposed, a vast boss of ancient volcanic rocks, but rather a ring of massive dykes and caps of diabasic greenstone or dolerite, with intricate reticulations. These traverse all the rocks of pre-Tertiary age, and are interspersed with sheets of more recent basaltic lavas." I may also say that, at numerous points over the wide area of the plateau, there are outcrops of permo-carboniferous rocks, as well as some remains of the upper coal measures, which will have to be taken into account when the geological history of the whole area is being investigated. I think I may say that we all heartily congratulate Mr. Twelvetrees on his appointment to the post of Government Geologist. If I may judge from my own experience of official life, he will hardly find it possible to give much special attention, in the near future, to what is evidently to him a very favourite branch of scientific research; but his opportunities of geological observation will be largely extended, and it goes without saying that he will make good use of them.

Mr. Stephens said Mr. Johnston's paper comes in very opportunely in connection with the subject of that of Messrs. Twelvetrees and Petterd. Before dealing with the general question, he makes some remarks which are specially interesting to myself. In the true spirit of scientific inquiry, which rigidly subordinates theory to ascertained facts, he mentions that he has notified the opinions which he formerly held as to the relations of the igneous and sedimentary rocks between Blackman's Bay and Passage Point. I have always regretted that, on a point which is intimately connected with similar phenomena all over the island, I found myself quite at variance with one who has done more than any one else for the development of the geological history Tasmania, but this difference of opinion no longer exists. The remarks of Professor David, quoted by Mr. Johnston, to the effect that gigantic masses of igneous rock extensively developed along the coast lines of Southern Tasmania "are in reality sills, rather than old lava flow," are partly based on the evidence of certain sections which I showed him on his first visit to Tasmania; but I am inclined to think that by "old lava flows" he means such dyke cappings of vast thickness as might have been extensively denuded, leaving only the lower portions still of great thickness. These, having cooled slowly under the pressure of the upper layers, would, it might be inferred, exhibit the holo-crystalline structure so characteristic of true "sills." This is what Mr. Johnston himself seems to suggest, when speaking of the massive caps to which his paper refers, and it is one of the theories which must be seriously considered before we can come to any definite conclusion on the subject. In connection with the question of the part which denudation plays in determining the physical features of land surfaces, I may cite the instance of the grand canon at Flagstaff, in Arizona, which has been excavated by ordinary natural agencies to a depth of 6,370ft., with a width of 13 miles—a cavity which would hold the biggest mountain of Tasmania, and have plenty of room to spare.

At the conclusion of Mr. J. B. Walker's paper, "Early Cartography and the Terra Australis Myth," which was illustrated by some excellent prepared slides, Mr. R. M. Johnston showed a series of geological slides, illustrating intercalated "sill" flows of igneous rocks, and also massive flows of the same rocks as at Cape Pillar and Tasman Island.

The President moved a vote of thanks to the authors of the several papers. The slides used were prepared by Mr. J. W. Beattie, and the limelight lantern was worked by Mr. Nat Oldham.

SEPTEMBER, 1899.

The monthly evening meeting was held on September 18 in the Tasmanian Art Gallery, the acting president, His Excellency the Administrator (the Hon. J. S. Dodds, C.M.G., C.J.) presiding.

The SECRETARY read an apology from the senior vice-president (the Hon. Sir James Agnew, K.C.M.G.), regretting that, owing to ill-health, he was unable to attend, and also from Mr. A. G. Webster.

PAPERS.

Mr. THOS. STEPHENS, M.A., F.G.S., presented an interesting work, entitled "Theory of the Earth," by James Hutton, M.D., F.R.S.E. Vol. III. This book, recently published by the Geological Society of London, at the instance of, and under the able editorship of Sir Archibald Geikie, comprises chapters IV. to IX. of the concluding volume of Hutton's "Theory of the Earth," the first two volumes of which were published as far back as 1795, two years before his death. The MSS. from which it is printed were not then quite ready for publication, and appear to have passed from hand to hand until they finally came into the possession of the Geological Society. The first three chapters will probably never be recovered. Hutton has often been styled the father of modern geology. Of his description of the Island of Arran, in the present volume, Sir A. Geikie says:—"This striking essay is a masterpiece of acute observation and luminous generalisation. Had it been published in his life-time it would have placed him at once as high in the ranks of field-geologists as he admittedly stood among those of the speculative writers of his time. It seems but a tardy act of justice to his fame that the merit of this practical side of his life-work should be now at last fully established."

The BISHOP OF TASMANIA (Right Rev. H. H. Montgomery, D.D.) read an interesting paper entitled "Notes on the Habits of the Cape Barren Goose (*Cereopsis novæ hollandiæ*).

Mr. A. MORTON made some remarks on the subject matter of the Bishop's paper.

Messrs. W. A, MACLEOD, B.A., and O. E. White contributed two very interesting mineralogical papers entitled—

(1.) "On the occurences of a new species of garnet at Port Cygnet."—This paper describes a new species of garnet discovered in a dyke formation on the beach between Porf Cygnet and Lymington. As far as could be ascertained this dyke formation is contemporaneous with permo carboniferous sediments. A detailed investigation then follows of the rock itself, its macro and microscopic characters being given, and its relationship to the trachyte family established. The garnets of a brownish, yellow tint are abundantly scattered through the rock, and show well developed crystalline form. From analysis conducted by the authors, the garnet was found to contain about 12 per cent. magnesia, 12 per cent. lime, and 12 per cent. manganese oxide (lower.) These percentages are entirely new so far as published lists of analyses go, and to this new species the authors have proposed the name of *Johnstonite*, as a slight token of appreciation of the arduous and excellent work done by Mr. R. M. Johnston, F.L.S., in the geology of Tasmania.

(2.) Notes on a Fayalite basalt from One Tree Point.—This paper gives a petrotogical description of a peculiar rock, the geological occurrence of which is given by Mr. R. M. Johnston (systematic account of the geology of Tasmania, p. 149.) This rock outcrops as a lava flow beside the electric lighting station, and runs down to the beach as a thin flow The authors discuss the term "Basalt," its definition and application to this rock, and are of opinion that the present rock in texture is a basalt, and the ordinary ferro-magnesian minerals are replaced by the peculiar iron-olivine fayalite, whence the term *Fayalite basalt.* A complete analysis of the rock is given, also its specific gravity and microscopical characters. These points are followed by a careful review of the various microscopical characters of the rock as exhibited in their sections, and the paper concludes by some remarks on structural characteristics. Both papers are accompanied by coloured drawings showing the microscopical appearance of the respective rocks.

Mr. R. M. JOHNSTON offered some observations on the papers read.

TASMANIAN FORESTRY.

Following up the interesting paper read at the last meeting of the Society by Mr. L. Rodway, entitled "Forestry for Tasmania," Mr. E. C. NOWELL read an important paper "On the Conservation and Culture of Trees."

The writer, in the course of the remarks, said :—

For many years the tendency in this colony has been to substitute imported deals for our own hardwoods. The following table shows the quantities of timber in superficial feet imported in 1897 :—

	Sawn.			Timber in log.	Baltic Deals 3in. and 4in.
	Boards	3in. and over.	Under 3in.		
Victoria	393,170	62,427	19,486	3,671	25,847
N.S.W..	27,264	248,449	497	28,892	295,923
Germ'ny	2,245	—	—	—	—
Sweden.	416,220	—	23,967	—	494,183
America	893	14,784	—	—	—
N. Zeal'd	—	64,551	4,125	—	—
S. Aus..	—	2,505	—	—	—
	839,792	392,716	48,075	32,563	815,953

Totals.—Victoria, 504,601 ; New South Wales, 601,025 ; Germany, 2,245 ; Sweden, 934,370 ; America, 15,677 ; New Zealand, 68,676 ; South Australia, 2,505. Grand total, 2,129,099.

There does not appear to be any reason why this large demand for 2,000,000 superficial feet of soft timber, chiefly Baltic deals, should not be supplied in time from trees of our own growing. Mr. Rodway has suggested that some of our bush lands might be profitably employed in the cultivation of the black wattle for its bark ; and I submit for the further consideration of those concerned, whether tracts of land in the higher and moister parts of the colony—in the Lake Country, for instance—and the slopes of hills and mountains, would not be suitable for the growth of those trees from which the deals are produced. If these trees could be successfully cultivated in such localities, the land would be put to much better use than at present, more labour would be employed, the scenery would be more pleasing, and the climatic conditions would be improved. In the 23rd Annual Report of the Secretary of the Massechusetts Board of Agriculture (1875), Professor Sargent, Director of the Botanic Garden and Arboretum of Harvard University, has given an estimate of the profits of a plantation of European larch, which, in 50 years, including interest at 6 per cent. on interim profits (at 30 and 20 years), he reckons to be equal to about 13 per cent. per annum for the entire 50 years, after retaining the original capital invested. Whether similar profits could be made in this colony or not, is a matter for consideration ; but there can be no doubt whatever, that very substantial benefit would result from the establishment of such plantations.

A discussion followed, in which Messrs. R. M. Johnston, T. Stephens, A. Morton, and L. Rodway took part.

His Excellency the Administrator of the Government moved a vote of thanks to the gentlemen who had read papers, and said the Government ought to be approached, and urged to take some steps to extend the close season for the Cape Barren goose, or for a close season for a number of years. He believed the geese were destroyed more through ignorance than wantonness, and that if people knew how rare the goose was they would assist to preserve it.

OCTOBER, 1899.

The monthly evening meeting of the society was held on Monday evening, October 16th, the acting president, His Excellency the Administrator (the Hon. J. S. Dodds, C.M.G., C.J.) presiding.

APOLOGIES.

The SECRETARY (Mr. Alex. Morton) read apologies from the senior vice-president (the Hon. Sir James Agnew, K.C.M.G., M,D.), the Bishop of Tasmania, Right Rev. H. H. Montgomery, D.D., R. M. Johnston, F.L.S., vice-presidents; the Hons. N. J. Brown, C. H. Grant, Ms.E.C.; Messrs. A. G. Webster, and R. S. Bright, M.R.C.S.E.

PAPERS.

BOTANICAL NOTES.—BY L. RODWAY.

The writer said he should be sorry to let the current year close without recording original information that has been gleaned about Tasmanian plants meagre though it is. Amongst the flowering plants he obtained a specimen of Hakea rostrata F. v. M. from the neighbourhood of George's Bay. This plant has hitherto only been found in Victoria and South Australia. It is worthy of note that H. nodosce R. Br., which has a similar distribution on the Australian continent, is also only found in Tasmania at George's Bay. Hakea rostrata is very similar to the more common Tasmanian Hakea epiglottis Lab, which, however, is purely Tasmanian. Except to a man well acquainted with the genius H. rostrata would pass for H. epiglottis with rather large fruit. Atriplex cinerea var. semiglabrata. This form which he treated as a distinct variety, grows in swampy land at Muddy Plains, and thought it right to be considered a distinct variety to be somewhat shady. Only its appearance is so different and it grows in the immediate locality of the type form showing the difference to be due not merely to environment. This form differs from the type in being more slender, ascending to suberect, and the members generally more slender. But the most marked peculiarity is that on the upper surface of the leaves there is a complete absence of scales, this being glabrous, shining, and green. Cylindrocapsa Involuta Rein. — This common filamentous alga, which has not, that I am aware. yet been recorded from Tasmania, occurs in quantitp on the wet surface of rocks at Port Davey, forming quite a slimy coat. Among the fungi, Mr. Rodway said he would record first Barlæa Archeri Sacec, which he left out of the systematic list that he recently published, owing to the statement of Cooke in his "Handbook of Australian Fungi" that he had found Berkeley's specimen to be only a collapsed myxogaster. He would note also that Cooke's habitat, "On dead leaves of a succulent plant," is quite erroneous, as this fungus grows on the ground, and preferably burnt soil. Also the names of fungi new to Tasmania, and some new to science. The latter, which he had the honour to be associated with Geo. Massee, will be described in due course in the *Kew Bulletin.*

The following is a list of the plants referred to :—Hygrophorus ceraceus, Pries.; Polyporus nanus, Mass. et Rod.; Hydnum coralloides, Scop.; Hymenochæte fuliginosa, Cooke; Hymenogaster albicus, Mass. et Rod.; Rhizina atra, Mass et Rod.; Rhizina feruginea, Phil.; Humaria omphalodes, Mass.; Barlææ Archeri, Sacc.; Bulgariella pulla, Harst.; Hypocrea, lenta, Berk.; Pleospora liniperda, Phem.; Ustilago microspora, Mass. et Rod.; Uromyces caryophyllus, Schr.; Macrosporium atriplices, Mass. et Rod.

LIST OF THE DESCRIBED TASMANIAN COLEOPTERA, BY ARTHUR M. LEA (GOVERNMENT ENTOMOLOGIST).

The coleoptera of Tasmania have never been considered as a whole since the time of Erichson, and no list or catalogue of the species has ever been compiled. About 10,000 have now been recorded from Australia and Tasmania, of which scarcely 400 have been expressly described from Tasmania. A very imperfect knowledge of what species are confined to the island as species supposed only to occur there are constantly turning up in Victoria and New South Wales, and even sometimes in West Australia and Queensland. I have thought it advisable, therefore, to prepare a list of the species hitherto recorded from Tasmania, adding to the list such species as I personally know to occur, or which various friends have taken or received from there. No attempt has been made to compare the Tasmanian with the Australian fauna, as such a comparison could scarcely be of any use in the present state of our knowledge, and especially without a much better knowledge of the species occurring on Mount Kosciusko and other mountains of the Australian Alps, and which (noticeable also amongst the plants) show a very close affinity with Tasmania.

TASMANIAN ABORIGINES.

Mr. J. B. WALKER, F.R.G.S., read a most interesting paper entitled, "Tasmanian Abrogines, their Customs and Habits," illustrated with some specially prepared lantern slides.

DISCUSSION.

Mr. MORTON said at the British Association that met last year on September 8, Professor Tylor discussed the survival of palœolithic conditions in Tasmania and Australia with especial reference to the modern use of unground stone implements in West Australia, pointing out that the stone implements from Tasmania, the making and use of which bv the natives came under the observation of the colonists during the first half of the century, have a character which may be called quasi palœolithic. They were fragments or flakes of stone, in no case ground, but edged by chipping on one face only, and trimmed so as to afford a grasp to the hand, no haft of any kind being used. These instruments, Professor Tylor says, correspond to some extent with scrapers etc., belonging to the Drift and Cave periods in Europe, but their general rudeness, and the absence among them of symmetrical double-edged and pointed implements like the flint picks of Old World Paleolithic times, places (says Professor Tylor) the modern Tasmanians at a distinctly lower stage than the European of the Mammoth period. The stone implements found in Tasmania, indicate (says Tylor) a state of the Stone Age in past times, not essentially different from that found in actual existence before the disappearance of the native population. Professor Tylor is of opinion that these quasi-Paleolithic implements not having yet been dispossessed in the West Australian district by the ground stone hatchets, which were apparently introduced from the Torrens Straits region, would go to prove that the Neolithic Age was of no remote date, and that the vast area, including Australia as well as Tasmania, may have been till then peopled by tribes surviving at a level of the Stone Age, which had not yet risen to that of the remotely ancient European tribes of the drift gravels and limestone caves.

PHOTOGRAHS OF LIGHTNING FLASHES

Through the kindness of Mr. Aikenhead, M.H.A.. of Devonport, an enthusiastic photographer and a member of the society, Mr. Morton said he had been enabled to show five lantern slides of some lightning flashes taken by Mr. Aikenhead at his residence on Friday, the 19th November 1897. At the June meeting a short interesting letter from Mr. Aikenhead was read, giving a description of how he succeeded in taking photographs of the flashes. The subject of triple lightning flashes appears to be creating some interest in England. In the October number of *Nature*, 1898, page 579, Mr. C. E. Stromeyer, of Lancefield, West Didsbury, in writing to the editor of *Nature*, says:—"At the suggestion of Lord Kelvin, I send you the enclosed photograph of a triplet lightning flash which was taken during a recent thunderstorm at Whitby, and under the following conditions. The flash must have been about two miles distant (out at sea). The focus of the camera lens was 8in.; the aperture, f/64; the plate, Ilford Empress. The camera was not stationary, but was purposely oscillated by the hand. It was intended that its axis should describe a circular cone, but from the photograph the path appears to have been rather elliptical. Each revolution occupied about 1/80min. Mr. Stromeyer then gives a description of the three flashes, which is also figured in this number of *Nature*, and suggests that in view of the importance of obtaining more definite information about lightning he would suggest that in the presence of a thunderstorm photographs should be taken, and concludes an interesting letter with a description of the camera to be used. Mr. Morton said the letter by Mr. Aikenhead, read at the June meeting, accompanied with photographs, he had forwarded to the editor of *Nature*, who he hoped might consider them of sufficient scientific importance to reproduce in that journal.

BURMESE NATIVES.

Some interesting lantern slides, kindly loaned by Mr. Aikenhead, illustrating the natives of Burmah, houses, etc., were exhibited.

VOTE OF THANKS.

HIS EXCELLENCY, at the conclusion, moved a hearty vote of thanks to the authors of the various papers. Mr. Nat Oldham officiated at the lantern, the views being greatly appreciated.

HISTORICAL SECTION.

The first meeting of the newly-formed Historical and Geographical Section was held on Friday, June 29th, 1899, at the Royal Society's rooms. The President (the Right Rev. H. H. Montgomery, D.D.), presided.

The HON. SECRETARY (Mr. Alex. Morton) stated that the following Fellows of the Royal Society had sent in their names as members of the section:—The Hon. Adye Douglas, M.E.C. (President of the Legislative Council), Messrs. J. R. McClymont, M.A., and W. H. Dawson.

PAPERS.

The PRESIDENT read the following interesting paper, entitled,

A SURVEY OF TWO EARLY JOURNEYS WESTWARD—MR. W. S. SHARLAND IN 1832, AND SIR JOHN FRANKLIN IN 1842.

In 1832 the country up to Lake Echo seemed to have been known, but beyond it, westward, no white man appears to have ventured. I have asserted this as a fact, but it is in order to elicit a contradiction, if possible. Had anyone penetrated west of Lake Echo in these regions before 1832? I proceed to give the details of Mr. Sharland's first trip so far west. When descending a tier, after leaving Lake Echo, Mr. Sharland states that he saw the Frenchman's Cap southward. It is clear, I think, that he saw Wyld's Craig, which has so often been mistaken by its shape for a mountain that no one sees till he has ascended Arrowsmith in that latitude, or, of course, from Olympus and the Cuvier Valley. Sharland then discovered the Nive, but called it the Derwent—having just passed through the Marlborough Plains, which were then a forest. But five years afterwards, in 1837, a severe frost is supposed to have killed all the trees over an area of 20,000 acres. In 1842 nothing was visible here, according to Mr. Burn, but dead timber. Sharland, after crossing the Nive, named Mount Charles and Darcy's Bluff; and from a spur of Mount Charles he made his great discovery, Lake St. Clair, being three miles from it, but went no nearer to it, thinking nothing would be gained thereby. Having mistaken the Nive for the Derwent, it is natural that he should now have mistaken the Derwent for the Gordon. In this vicinity he saw native huts, but no natives. Their huts and the results of their fires extend right over Arrowsmith down to the Loddon; and, I suppose, as far as Macquarie Harbour in that case, making this their usual track. If this is established, then, the present Linda track more or less justifies itself as being the most feasible passage to the inhabited West Coast regions at the present day. Passing on—did Sharland name King William? William IV. came to the throne in 1830, and it is to be supposed that the grand mountain so near the edge of our central plateau on its western side was named after the reigning King. All travellers westward make for the same spot in descending from this great central plateau. And all speak with admiration of the magnificent view from Arrowsmith of the Western country. This guardian of the plateau was first called Fatigue Hill by Calder. Then later it was named by Strzlecki Arrowsmith. All who descended westward from Arrowsmith into Wombat Glen, 1,400ft., before the track was made, speak with respect of the effort needed. Sharland, I suppose, was the first who accomplished the feat. Wombat Glen is the name given to the spot by Sir John Franklin. Sharland then crossed the Franklin with difficulty, but called it the King, and advanced to what was afterwards called Painter's Plains. The name was given because on the bark of an old native hut two drawings in charcoal were discovered, one of an emu, the other of a savage killing a kangaroo with a spear. It is not to be supposed that these were executed by a native, but by some runaway from Macquarie Harbour proceeding eastward. This is all the more probable because Sharland found in 1832 the bones of a man in the Loddon Plains close by. He called the Loddon "the Adelaide." Mr. Calder gave the river its present name, not knowing that Mr. Sharland had already named it. Then in due course he ascended the Frenchman's Cap from the north, from which quarter it is a rounded hump, which is cut perpendicularly down in the southern face into a 2,000ft. precipice. He almost reached the top, and saw the ocean south of Macquarie Harbour, and mentions a peak about 25 miles south—calling it the Peak of Teneriffe. This must be Goodwin's Peak on the present map, and he speaks of it as the line-mark the convicts made for in their attempted escapes. He also says that it probably led to their destruction, and that no one could hope to escape eastward on that latitude. The valleys and hills run north and south, and are most difficult in their character. He also makes the reflection that even if a runaway had reached the Loddon Plains more northwards, he would see before him the tremendous mass of Arrowsmith and the King William Ranges, and seek to avoid it, whereas it is the only feasible way to the inhabited regions. I suppose there can be no doubt that Sharland was the first to ascend the Frenchman's Cap. Let us now pass over 10 years. In 1842 Sir John and

Lady Franklin made their celebrated journey to Macquarie Harbour, and it is remarkable that there is no account of it in any of the papers of the Royal Society, but a full report in six consecutive papers is to be found in the *United Service Journal* for 1843, written by Mr. Burn, one of the party. The expedition consisted of the Governor and Lady Franklin, Mr. Calder, Dr. Milligan, Lieut. Bagot, Corporals O'Boyle and Stewart, Mr. Burn, and a party of servants. They should have started in January, but were delayed on account of the suspension of the Colonial Secretary, and the actual journey did not commence from the Ouse till March 29, 1842. It was, of course, very late, and when they reached Arrowsmith the weather broke, with the result that in place of a week, they were 22 days on the way. Lady Franklin was at first carried in a kind of palanquin by two men, two others relieving them from time to time. But of course long ere the end of the journey it was quite impossible to use such a conveyance, and Lady Franklin walked. Then food, too, was of the coarsest. At one time upon the Franklin they were reduced to 3oz. of salt pork apiece; all through they seem to have had nothing but salt pork, damper, and tea. It is unnecessary to dwell upon the first part of the journey, which was over the usual route, from the Ouse through the Marlborough Plains, crossing the Nive near the confluence of the Nivelle, then the Clarence, and finally the Derwent, about a mile below Lake St. Clair, and then along the north face of King William, which mountain they ascended, and left on it an inscription on a gum tree. Thence down the western side, the view being described by them as being the finest in Tasmania, overlooking the western ranges. They now turned south-west in order, under Mr. Calder's guidance, to escape what they considered to be the King River, but which we know to be the Franklin. In so turning down the left bank of this stream they suddenly came to another, to Mr. Calder's great surprise, since he had never met with it before. It has in consequence been called the Surprise River. In due time they came to Painter's Plains, where Mr. Burn saw the two drawings spoken of above on the native huts. This was eight years after Macquarie Harbour had ceased to be a convict station. Passing on they crossed the Loddon into Loddon Plains, experiencing dreadful weather. After they left Arrowsmith, having camped, we suppose, somewhere near the present Iron Store, it seemed to have rained more or less incessantly for 18 days, until they reached the Gordon. Here on the edge of the Loddon Plains they had to wait for some days on account of the weather, with little shelter. A creek was within five yards of their camp, and only 3ft. below them. They called the spot Detention Corner, being just N.E. of the Frenchman's Cap. Provisions were running short. Eleven rivers, swollen into floods, including one to be crossed four times, were behind them. The Franklin, the biggest of all, was not only behind them, but before them also, as was the Acheron. Calder went back to Lake St. Clair from here, and returned in 54 hours, having walked 48 miles with swags of 80lb. with his party, but seven of them stopped on the Loddon worn out. As the Breeze, on the Gordon, would sail away by orders on April 18, it was determined on April 7 that Calder and Burn and two men should go forward and try to reach the ship and bring assistance from that end. They passed south-east of the Cap, making for Calder's Pass, and camped under Christmas Rock, a spot where Calder had spent Christmas Day in 1840. Pressing on, they crossed the Acherons by a natural arch of stone (does it exist still, I wonder?) and reached White Hill Plains, due south of the Deception Range, traversed the Black Forest, and stood beside the Franklin, now grown into a mighty stream, which was draining the southern slopes of the Eldon Range, both sides of the Frenchman's Cap, and eastward till it received the waters from Arrowsmith, Mount Gell, and Hugell, and even Lake Dixon to all appearance. The valley they were now in was full of Huon pine, and, indeed, the party were full of praise of the West Coast foliage, which began quite suddenly as soon as they had descended Arrowsmith, coming westward from that point into forests of brighter colour and richer growth. It was impossible to cross the Franklin in roaring flood and without a boat; nor was it weather in which to visit a river eight miles south of where they camped, which they named the Jane, after the lady who so bravely accompanied them. On April 15 the Governor and his party arrived on the Franklin. We suppose they all walked, and, indeed, Lady Franklin had given up her palanquin to Stewart in the Loddon Plains, the man having been taken ill. Here, in the midst of rain, and unable to move backwards or forwards, the party spent the Governor's birthday, April 16 (a Saturday), when, in addition to 3oz. of salt pork, the party each had a piece of cake. It was at least appropriate that His Excellency should have one birthday beside the Franklin River. They were kept here for eight days, although two men crossed the Franklin and brought succour from the Breeze, the men covering 30 miles in 8 hours. Meanwhile Calder had done splendidly. He again returned to Lake St. Clair, fording all he rivers both ways, bringing food, and also the mails, from Hobart—104 miles in five days, with swags of 70lb. The whole party crossed the Franklin on April 20, and here one of the servants lost his eyes through a sapling which had sprung back. The poor fellow had to be led the rest of the way, as it was impossible to carry him. After they had crossed the Franklin they saw a peak, like St. Michael's Mount they said, bearing S.E. It would appear to be Goodwin's Peak; and the Prince of Wales Range bore due east, very grand in appearance. In front, as they proceeded they named a range "the Elliott Range," after a former aide-de-camp of the Governor's. On Saturday, April 22, they reached the Breeze, anchored in Expectation Reach, some miles up the Gordon. Thus ended a most remarkable journey, considering that a lady was of the party and that the weather could hardly have been more unfavourable. The latter part of it, too, was through a country even to this day not well known. Too much praise can hardly be accorded to Mr. Calder, and it is no wonder that he became dead lame on his return journey. I conclude with a few practical suggestions. 1. It would be well if the members of this section would supply us with records of the first journeys through our island in any direction. The N.E. of the island would be as interesting a topic as the west and south-west. There is still time, I think, to secure accounts of most of these first attempts. 2. Would it not be well if this section were to bring out a map showing the unexplored, and nearly unexplored, portions of the island? It might give a direction to the energies of our romantic spirits if it were clearly brought home to them what parts of the island needed special attention. There are tourists also who would really like to be discoverers. It is likely they do not realise how little known large tracts of our island are, and that certain parts are unknown, and that such regions lie amongst our best scenery. For example, draw a line due south of Arrowsmith, and another due south of the Frenchman's Cap. Hardly anything, if anything, I am told, is known of the regions so enclosed north of the Gordon. 3. Would it not be a stimulus and a real help to geography if we attempted to mark on such a map the name of the first person who had ascended each high mountain, pushing back the dates if an earlier rival appeared? A good many mountains would remain to be attached by the present generation. This section might invite the attention of climbers to the peaks not yet won, and ask them for their first experiences. I suggest these points to you because it will bring us into touch with many who otherwise might not think of joining the Royal Society. We want the assistance of thews and sinews in our geographical work as well as students. I would suggest that the map which I advocate should be hung either in the tourists' room, or, more conspicuously still, somewhere in the hall, as a chivalrous challenge to the enterprising, with a notice that our Curator would be only too glad to give them further information. All records of trips taken in consequence of our advice and suggestions ought to be our property, and ought to be published—if they are published—under our auspices. I am sure the Tourists' Association would gladly co-operate, and indeed a holiday might be worse spent in the month of February than in following the steps of Sir John Franklin, not to the North Pole, but from the Ouse to Expectation Reach across our own island.

Discussion.

Mr. J. B. Walker drew attention to several of the explorers who had visited the West Coast; also gave a list of important papers relating to early Tasmania, formerly the property of the late J. Reid Scott, a list of which was published in some English catalogues. He, Mr. Walker, considered it a great pity these papers had ever left the colony.

Mr. T. Stephens referred to an old chart or map of Tasmania, drawn by Mr. Hogan, which has since been superseded by the present map, and also to the track gone over by the late Mr. Sharland and others.

Mr. R. M. Johnston said the members were greatly indebted to the President for his interesting paper, and spoke of the great work done in exploring by the late J. Reid Scott and Mr. Chas. Gould.

Mr. Mault said one of the earliest maps of Tasmania he had ever seen had marked on it Mount King William, and three of the summits were marked Nos. 1, 2, and 3. In a Hobart almanac by Bent was given an account of an expedition by the V.D.L. Co.

Colonel Legge also referred to the great pleasure he had in listening to the President's paper, and referred to the three peaks near Lake Dixon, and drew attention to some excellent photographs of Mount King William taken by Mr. J. W. Beattie. Colonel Legge said a good deal might be done in finding out the proper names of the different parts of the colony that were given to them in the early days, and also mentioned that good work might be done in working out the physical characters of the mountains and lakes of the colony.

Mr. Mault said, in reply to Colonel Legge, that soundings had been taken of Lakes Sorell and Crescent, as also the contour of these lakes, and pointed out that the deepest part of these lakes were 17ft. to 14ft.

Mr. J. B. Walker drew attention to some old charts in his possession, and promised to furnish the section with a paper at the next meeting dealing with old charts relating to Tasmania.

Mr. J. W. Beattie spoke of the country round about Mount King William which he had visited.

Mr. Mault moved a hearty vote of thanks to the President for his excellent paper, as also to Mr. E. A. Counsel, Surveyor-General, for the loan of a map of Tasmania.

The meeting then closed.

SIR JAMES AGNEW.

Yesterday (October 2nd, 1899) being the anniversary of the 84th birthday of the Hon. Sir James Agnew, K.C.M.G., a large number called at the hon. gentleman's house, conveying their hearty congratulations and good wishes. In the afternoon a meeting of the Council of the Royal Society of Tasmania, of which Sir James is the senior vice-president and also chairman of the trustees of the Tasmanian Museum and Botanical Gardens, was held, Sir James presiding. The following members were present :—Council of the Royal Society and Trustees of the Museum and Gardens, His Excellency the Administrator (the Hon. J. S. Dodds, C.M.G., C.J.), acting-President; Hons. Adye Douglas (President of the Legislative Council), C. H. Grant, M.L.C.; Messrs. A. G. Webster, Russell Young, Thos. Stephens, M.A., F.G.S., R. M. Johnston, F.L.S., F.S.S., Bernard Shaw, J. B. Walker, F.R.G.S., and the Secretary and Curator, Mr. A. Morton. Apologies were received from the following members :—The Hon. N. J. Brown, M.E.C., Speaker of the House of Assembly; the Bishop of Tasmania, the Right Rev. H. H. Montgomery, D.D.; Col. W. V. Legge, R.A., Commandant of the Tasmanian forces ; and R. S. Bright, M.R.C.S.E.

His Excellency said before the business of the meeting he had been asked to say a few words : Dear Sir James,—On this the anniversary of your 84th birthday, the Royal Society of Tasmania desires to pay you a tribute of respect, and I, as its *ex officio* President, have been requested to offer for your acceptance a photograph of the executive officers, including yourself. Appended to it are the signatures of the gentlemen composing the group, and it is hoped that you will regard it as a token appreciative of the esteem in which you are held by those with whom you have been so long associated. It is peculiarly fitting that the Royal Society should thus endeavour to show its appreciation of all your patriotic and unselfish efforts to advance the work which it has in hand, because in the long list of distinguished men who have ungrudgingly laboured for the society there is none to whom it is under such deep obligation as yourself. One of its earliest members, one of its most efficient and painstaking officers, the one who has most largely contributed to its funds, you stand out pre-eminently as the man who deserves its gratitude. But whilst I am expressing these sentiments on behalf of the Royal Society, I think that I may say also that very many of the people of this colony entertain the highest esteem and regard for you. Both in public and private life you have commanded the respect and deserved the approbation of all classes of the community. You have been foremost always amongst those who were desirous to work in the best interests of the country in which you have made your home. You have by personal exertion, sound advice, and generous donation, assisted to advance science, and encourage art. Many acts of kindness and charity are recorded in grateful hearts as the result of your large benevolence ; and several splendid contributions of money for public purposes testify to your unselfish character and great patriotism. Your life is an object lesson of the influence which a good man can exercise for the benefit of his fellows. You have stimulated others by your conduct, and you have set an example of unimpeachable integrity. May I now offer our congratulations upon the fact that, notwithstanding the ripe old age to which you have been permitted to attain, time has still left your intellect alert and vigorous, and that you are yet able to continue to exercise an influence for good. And of this I may assure you, that when it shall please God to end your labours, you will be laid to your rest amidst general sorrowing, and that you will be remembered as one who has endeavoured simply and conscientiously to do his duty in every walk of life. (Applause.)

The Hon. Sir JAMES AGNEW feelingly responded, and said he would value the gift very highly.

The Hon. ADYE DOUGLAS said he would like to add a few words to what had already fallen from His Excellency the Administrator. He might say he was the first to meet Sir James in the year 1840 in Victoria when they were both young men. He could say that all through Sir James Agnew's career he was always looked upon as a fine old English gentleman. (Applause.)

The health of "His Excellency" was proposed by Sir JAMES AGNEW, who said he felt very grateful to the Administrator in being present—one whom the colony might well be proud of, being one of their own, and rising to the highest position in the land. (Cheers).

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1902 MEETING.

A deputation consisting of the Trustees of the Museum and Members of the Council of the Royal Society waited upon the Ministry on Thursday, November 2, 1899, and asked the Government to place a sum of £500 on the estimates for the purpose of defraying expenses in connection with the annual meeting of the Australasian Association for the Advancement of Science which it was proposed to hold at Hobart in 1902. It was also requested that all the necessary printing in connection with the meeting should be done at the Government Printing Office.

The Hon. N. J. BROWN, M.E.C., Speaker of the House of Assembly, explained that in 1892 the then Government had complied with a similar request. He said that the fact of the annual meeting of the society being held at Hobart exercised a very advantageous effect, not only from a scientific standpoint, but also from a commercial aspect. It was, of course, a long way to look ahead to the annual meeting of 1902, but immediate action was necessary, inasmuch as a meeting was to be held at Melbourne in January next year, and the delegates who would attend at Melbourne wished to know definitely what support the association was likely to receive at Hobart. A general wish had been expressed that the meeting should be held at Hobart.

Several other members of the Council of the Royal Society supported the reasons advanced by Mr. Brown.

The PREMIER (Hon. N. E. Lewis) expressed pleasure at hearing the views advanced by the deputation. He admitted that the Royal Society was very valuable from an educational point of view, not only in scientific matters, but also in commercial matters. He did not think that the deputation would expect an immediate answer. The request would receive favourable consideration, and a reply would be given at an early date.

The joint deputation then submitted to the Ministry the following printed statement setting forth the claim of the Trustees of the Tasmanian Museum and Art Gallery to have their right to land adjoining the present Museum placed beyond dispute. The Trustees of the Museum and Art Gallery claimed through their predecessor the Royal Society, that the whole of the site extending to Davey-street should be permanently vested in them for the benefit of the public.

STATEMENT EXPLAINING THE CLAIM OF THE TRUSTEES OF THE TASMANIAN MUSEUM AND ART GALLERY TO HAVE THEIR EQUITABLE RIGHT TO LAND ADJOINING THE PRESENT MUSEUM PLACED BEYOND DISPUTE.

A memorial from the Council and Fellows of the Royal Society and Citizens of Hobart to His Excellency the Governor, dated the 22nd day of June, 1857, sets forth the facts connected with the founding of the Museum in the year 1848, explains the gradual growth of the institution, and the necessity for providing more space than that which was available in the building then held on lease by the Royal Society. The memorial goes on to state—"That upon an application made some time since to your Excellency's Government by the Council of the Royal Society for a site and a grant of money in aid of a Building Fund for a Tasmanian Museum, your Excellency's acquiescence was signified and a request conveyed by your Executive Ministers to the Council of the Society to prepare and submit plans, etc., of a suitable building. That plans, sections, and an elevation, etc., of a spacious building with commodious internal arrangements for a Museum, and accommodation for a Public Library, were accordingly prepared and submitted, and that no exception has been taken to the same since they have been in the possession and under the consideration of your Excellency's responsible advisers.

"That the ground originally proposed as a site for the Museum at the angle formed by Macquarie and Murray streets has been otherwise applied, and in lieu thereof a piece of land near the site of the old Government House, in every way suitable, promised for that purpose.

"That a subscription has been commenced for raising part of the fund required for the erection of the Museum, and it is confidently hoped that £2,000 and upwards will be thus obtained, the expense of erecting the building, including space for a Free Library, being estimated at £7,000."

The ground herein described, as originally proposed as a site for the Museum, at the angle formed by Macquarie and Murray streets, is that on which the Derwent and Tamar Offices and the Savings Bank now stands.

It will be noticed that the original design was to have a Free Library attached to or adjoining the Museum. The records of the Royal Society show that on the 3rd of August, 1857, the Secretary wrote to the then Treasurer of the colony, the Hon. F. M. Innes, inquiring whether, in accordance with a letter which had been received from the Colonial Secretary, the ground that had been specified by the Government as a site for the proposed Tasmanian Museum (namely the ground at the angle of Murray and Macquarie streets above-mentioned) had been defined and its boundaries marked off on the maps of the colony, and requesting that, if this had not been done, such instructions might be given as would ensure its execution at an early date, so that the Society might be in a position to take immediate steps for raising funds to aid in the erection of the buildings. To this letter a reply was received, dated 5th September, 1857, which stated that "the sale of the allotment in question has been decided upon, but that the claims of the Royal Society will not be overlooked when the land attached to the present Government House is available."

In a subsequent letter to the Colonial Secretary, dated 30th November, 1857, the Secretary of the Society again urged the immediate necessity for making provision "for the erection of a building suitable for a Museum, or so much of a building as may suffice for the present requirements of the Institution and the country, *bearing in mind that ample space must be left around for extension hereafter, such Institutions being in their nature cumulative and expansive beyond any limit we can assign to them.*"

The Report of the Society for the year 1858 sets out that the overcrowded condition of the Museum had at length drawn from the Government a practical recognition of its urgent claims for assistance, the Legislature having granted a sum of £3,000 in aid of a building fund, conditionally upon £1,500 being raised by private subscription. It is further reported that a subscription list had been commenced some time before, but that it was suspended in consequence of some doubts having arisen as to the possibility of obtaining from the Crown an appropriate site for the building, but the site so long promised having been gazetted on the 22nd of January of that year, and as it might be presumed that it was practically granted, the canvassing for subscriptions had been resumed, and the sum of £1,500 was shortly afterwards raised. (This was subsequently increased to £2,000.) The site last referred to is that now occupied by Franklin Square, and is marked on the Official Chart as "granted for a Museum," and gazetted on 22nd January, 1859. This site had a frontage of 140 feet on Macquarie-street and a similar length of frontage on Davey-street, with a depth of 265 feet, the whole area being 3 roods 16 perches.

The report for the year 1860 relates that, resting in all confidence on the good faith of the Government as to the granting of the site for the Museum, the sum of £1,600 had been raised by private subscription in accordance with the conditions of the Parliamentary Grant, but that the Government had intimated to the Council its inability to make a grant of the land which had been gazetted as a site, and expressed an intention of otherwise providing accommodation for the Museum. It was further reported that the proposal of Ministers was to give wholly inadequate and unsuitable accommodation in connection with a new range of buildings for departmental purposes which it was intended to erect at the back of the new Supreme Courthouse in Macquarie street. This proposal was accompanied by very onerous and, in fact, impossible conditions. It is to be noted in passing that the action of the Government in the matter was a distinct breach of faith with those who had subscribed so largely, relying upon the arrangement as to the site being loyally adhered to. In the following year it is reported that the Council had succeeded in obtaining a good site for the new Museum, and that designs had been furnished for the building. In the year 1862 the portion of the building, which was evidently only designed as a part of a more extensive building, was completed, and the Museum was established in its new quarters at the angle of Macquarie and Argyle streets.

No record has yet been discovered as to the exact area granted at this site, but from all that can be gathered it was clearly the intention to grant the land extending from Macquarie-street to Davey-street, and it is important to remember that even this area would be one-third less than that originally granted (now Franklin Square). The portion now left uncoloured on the accompanying plan was originally more or less covered by the waters of the harbour at high tide, and it was gradually reclaimed and came to be used as a convenient place for depositing stacks of timber. No steps seem to have been taken by the Society to secure their occupation of it. Attention having been called to the fact that the occupant had no authority to use the land for this purpose, some sort of annual lease or licence was issued by the Lands Office, apparently without any notice to, or knowledge of, the Royal Society, which body by an Act of Parliament in the year 1885 handed over to the Trustees of the Museum all their right, title, and interest in the land and buildings (with the exception of one room retained for the meetings of the Royal Society), on the condition that the institution should be a public one, to which admission was to be free of charge. It is therefore the Trustees of the Museum and Art Gallery who now claim, through their predecessors, the Royal Society, that the whole of the site extending to Davey-street should now be permanently vested in them for the benefit of the public.

The Minister of Lands (Hon. E. Mulcahy) said that the Ministry sympathised with the trustees, and did not wish to see any injustice done. He understood that some difficulty had been experienced in the matter of choosing a site for a Customs-house; one portion of the commercial community wanted it on the site of the Mariner's Church, but there were many reasons against that proposal. The tendency of the business was in the direction of the north-east end of the harbour, and the most suitable spot for shipping and commercial interests was where the Government proposed to have it, near the Museum. The Government could make use of the ground without infringing the rights of the Museum, and if the Government proposal was carried out the trustees of the Museum would actually get more land than they would receive under other circumstances. The Government could provide the necessary accommodation at the proposed site by utilising a portion of the street without infringing upon the footpath in any way; but the Marine Board or Corporation would require to be approached before this could be done.

DEATH OF MR. J. B. WALKER, F.R.G.S.

Widespread regret was expressed in the city on Saturday at the sad intelligence that Mr. James Backhouse Walker, F.R.G.S., of the firm of Walker and Wolfhagen, solicitors, and Vice-Chancellor of the University of Tasmania, had died from pneumonia, supervening on influenza. Mr. Walker had been out of health for some days previous to Monday in last week, when he was seized with influenza, and for the first two or three days was laid up with the usual symptoms. Then pneumonia set in, but of such a mild kind that up to Friday evening he had but little fever, and up to midnight on Friday he appeared to be going on well. He then told his nurse he was so much more comfortable that he could go to sleep, and he laid down and dozed, but during sleep the heart's action collapsed, and he could not be revived afterwards, death supervening at 10 o'clock Saturday morning, November 4, 1899.

The deceased was the eldest son of the late Mr. George Washington Walker, and was born in Hobart in 1841. He received his education at the High School, Hobart, and the Friends' School, York, England. He was admitted as a barrister in Tasmania in 1876, and was one of the original members of the Council of the University of Tasmania. In 1888 he was elected a member of the Council of the Royal Society of Tasmania, and was a constant contributor to the society's journal. Mr. Walker was recognised as the leading authority on the history of early Tasmania. At the meeting of the Fellows of the Royal Society held last month he read a most interesting paper on the aborigines of Tasmania. Few have taken a keener interest in higher education in the colony. He was also an active member as one of the trustees of the Tasmanian Library, and possessed one of the finest libraries of works relating to Australia and Tasmania. He was also much interested in the prosperity of the Workingmen's Club in the early stages of its career, and did good service in promoting thrift among its members. He was also for many years a zealous worker in the Davey-street Sunday-school, and his unobtrusive charity was well known throughout the city, though, like a true man, he liked best to do good deeds by stealth. The Council of the Law Society found him always a consistent supporter. In these, and in many other ways, he was a prominent and useful citizen, and will be much missed

The funeral on Monday was a thoroughly representative one, showing the high esteem the deceased was held in by all classes of the community. At 9 a.m. carriages containing friends of the late gentleman assembled at his residence, corner of Antill and Davey streets. At 9.30 the *cortège* left his house in the following order :—The hearse ; carriages containing relatives, and his old and esteemed friend, the Rev. Geo. Clarke, Chancellor of the University ; carriage of His Excellency the Administrator (Hon. J. S. Dodds, C.M.G., C.J.) ; carriage with the Premier (the Hon. N. E. Lewis, M.E.C.) ; two carriages of the members of the Council of the Royal Society, containing Messrs. Thos. Stephens, M.A., F.G.S., R. M. Johnston, F.L.S., vice-presidents, and the Hons. N. J. Brown, Speaker of the House of Assembly, C. H. Grant, M.E.C., Messrs. A. G. Webster, Bernard Shaw, Colonel W. V. Legge, R.A., members of the Council, Alex. Morton, secretary, and Mr. J. W. Beattie, vice-president of the Historical Section ; carriages with the representatives of the University, Professors Williams, Brown, MaCaulay, the Registrar (Colonel Cruickshank), and several of the members of the University ; carriage with the President of the Legislative Council (the Hon. Adye Douglas, M.E.C.), Mr. E. C. Nowell, Clerk of the Executive Council, and Mr. T. R. Atkinson, Usher of the Black Rod. The legal department was represented by His Honor Mr. Justice A. I. Clark, and nearly all the members of the legal profession. Carriages containing the trustees and librarian of the Public Library, of which Mr. Walker was a trustee. Altogether there were about 50 vehicles in the procession. Arriving at the grave the ceremony for the interment of the dead was carried out by the members of the Society of Friends in a very impressive manner. The funeral arrangements were entrusted to Messrs. A. Clark & Son, of Collins-street. The Bishop of Tasmania (Right Rev. H. H. Montgomery, D.D.), who is in the North-Western districts, forwarded the following telegram to the secretary of the Royal Society :—"Deloraine, November 6, 10.25 a.m. Deeply regret Walker's death. Irreparable loss to higher interests in the colony. If not too late ask the Dean to represent me at the funeral."

James B Walker

ARE ALL THE COLOSSAL IGNEOUS CAPS OF THE TASMANIAN TIERS AND OF THE LOFTY MOUNTAIN PLATEAUX TRUE SILLS?

By R. M. Johnston, F.L.S., F.S.S.

Professor T. W. Edgeworth David, B.A., F.G.S., one of Australia's most distinguished geologists, has kindly sent me a copy of an interesting paper read by him before the Royal Society of New South Wales in the year 1896, regarding the occurrence of "Sill Structure" in the eruptive rocks of that colony.

It has additional interest for Tasmanian geologists, inasmuch as it raises the question at the head of this paper, viz.—"Are all the Colossal Igneous Caps of the Tasmanian Tiers, and of the Lofty Mountain Plateaux—such as Ben Lomond, Mount Wellington, and the Great Plateaux of the Lake Country—True Sills?"

Igneous Sheets or Sills.

Sir Archibald Geikie gives a very graphic description of the nature and characteristic structure of an Igneous Sill as follows:—(Text Book of Geology, pp. 573—576.)

"Eruptive masses have been intruded between other rocks and now appear as more or less regularly defined beds. In many cases it will be found that these intrusions have taken the place between the planes of stratification, The ascending molten matter, after breaking across the rocks, or rather, after ascending through fissures either previously formed or opened at the time of the outburst, has at last found its path of least resistance, to lie along the bedding planes of the strata. Accordingly it has thrust itself between the beds, raising up the overlying mass and solidifying as a nearly or exactly parallel cake, sheet, or sill. It is evident that one of these intercalated sheets must present such points of resemblance to a subaerial stream of lava as to make it occasionally a somewhat difficult matter to determine its true character, more especially when, owing to extensive denudation or other cause, only a small portion of the rock can now be seen."

So far we have a very clear definition of the manner in which true igneous sills have been formed, and their mode of intrusion along the weaker planes and fissures of strata beneath the surface. In Tasmania there are abundant illustrations of clearly defined massive sills open to inspection, especially so, along the precipitous walls of the coast line between Blackman's Bay and Cape Frederick Henry.

About 14 years ago I drew the attention of the members of this Society (1) to one of these remarkable sills exposed on the coast line near Blackman's Bay, intercalated between the stratified beds of permo-carb. mudstones and limestones; and in my large work on "The Geology of Tasmania, I again described this sill or intercalated igneous sheet—illustrated by enlarged drawings of sections (2)—in the following words:—

"In various places along the coast line of the Lower Derwent many natural sections occur where the fossiliferous mudstones (apparently) unaltered at point of contact, repose quietly in horizontal beds which naturally fill up the uneven surface of the underlying older greenstone. A sketch of a very fine section is given showing 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 (3) 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 (basal sill), 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.* Fine sections showing the same relationship also occur for miles continuously between Passage Point and Adventure Bay."

It is not surprising, therefore, that some years later (1892) Professor David, Captain Hutton, and others, to whom I had per-

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(1) Proc. Roy. Soc. Tas., 1885, pp. 343 360, 410; *ibid*, 1886, pp. 18-26, illustrated by a number of plates and diagrams.

(2) Geology of Tas., p. 102. Plate showing position of intercalated sill.

(3) Two or three years ago in an address delivered by me to the Members of the Mining Institute of Australia, which met at Hobart, I stated that I had reason to alter my opinion in regard to the age of the older greenstone at this place, and now regard it also as an older sill thrust of colossal dimensions underlying the mudstone series at this point, but of later age.

sonally the honor of acting as field-guide at the time, were inclined to be of opinion "that the gigantic masses of *gabbro*" (*i.e.*, the *diabase* or *dolerite* of Professor Ulrich; Messrs. Twelvetrees, and Petterd, the writer, and others), which are so extensively developed along the estuary of the Derwent as well as along the South-east Coast, including Freycinet's Peninsula, *are in reality sills, rather than old lava flows as was formerly contended by some.*" The latter part of Professor David's remarks I have italicised, as it is rather misleading if it refers to the opinion entertained by myself and other local geologists who may have written about the massive diabasic rocks so largely developed throughout the central and eastern parts of Tasmania.

There never was, to my knowledge, any question at any time under discussion among local geologists as to whether our massive diabasic intrusions—forming the prominent features on our mountain caps, tiers, and along our Eastern shores—were originally erupted subaerially as *lavas*, or whether as colossal *sills* they were originally injected or intruded into strata lying below the surface; the superincumbent rocks which formerly enveloped their mass, have been long since swept away by subsequent denudation continued for ages until now. Up to the time at which Messrs. Twelvetrees and Petterd commenced their splendid microscopic investigations of our igneous rocks—of which their latest contribution read this evening is, in itself, a rich mine of wide and valuable knowledge and logical deduction—the local general geologists were not possessed of the necessary data to enable them to form conclusions that would be at all satisfactory in a question of this kind. Without a thorough survey of all our igneous rocks—by such methods of careful systematic microscopic examination as are, now, so ably being carried on by our own observers, Messrs. Twelvetrees and Petterd—I do not think any conclusions as to their exact mode of origin can be of much scientific value.

What, hitherto, specially attracted the attention of local observers and of the earlier geologists, Jukes, Selwyn, Milligan, and Gould, as regards the greenstone masses now capping permo-carb. and mesozoic rocks on the Great Lake Plateau, Ben Lomond, Mount Nicholas, Fingal Tier, Mount Wellington, and elsewhere was, "Were they superimposed massive caps, or were they massive greenstone cores against the flanks of which the permo-carb. mudstones and the mesozoic coal measures rested?" The economic importance of this question is very great; for if the massive greenstones on top of Ben Lomond, Mount Nicholas, are caps which may have been fed by roots from below, we might hope to follow our coal seams throughout the areas enveloped by these extensive masses. But if these colossal *caps* are themselves continuous through the permo-carb. and mesozoic rocks as vast co-extensive diabasic *cores*, then the limits within which we may follow the coal seams on their flanks will be correspondingly reduced. This, and this aspect of the case alone, had hitherto been the vexed question between some of our Tasmanian geologists, and not the newer aspect raised, viz., *lava versus sill*, structure and mode of origin.

Lava versus Sill Origin of the Higher Mountain Caps.

Nearly two-thirds of the whole area of Tasmania in its Midland and Eastern part is occupied continuously or ramified by masses of the diabasic greenstone rocks which were erupted towards the close of the mesozoic era. The great plateau of the Lake Country alone is almost continuously occupied by this rock for over one thousand square miles Its outer edge to the West, North, and East, forms precipitous tiers bordering the lower plains and generally reaches a height of from 3000 to 4000 feet, and, in some cases, rising to a height of over 5000 feet.

The general thickness of the more characteristic mountain caps of greenstone, as on Ben Lomond and Mount Wellington, even now, after ages of exposure to denudation, are from 1700 to nearly 3000 feet thick. If we assume, for purposes of illustration, a period of two and a half million years having elapsed since the close of the mesozoic era; and that our higher levels have been continuously exposed to denudation for the whole of that period—What would the extent of waste represent in the destruction of the masses of rock of whatever nature which were originally super-imposed upon them over their existing high level limits?; and—What are likely to have been the character of the rocks which have been wasted away from above them?

The usual estimate of the rate of denudation by atmospheric influences and gravitation is reckoned to be equal to a waste, on the average, of one foot of rock in 3000 years. In the space of $2\frac{1}{2}$ millions of years it follows that rock of a uniform depth of 833 feet has been swept away from the tops of all our higher greenstone tiers and mountain plateaux.

This is not at all an exaggerated estimate of the amount of rock-waste, whose mass originally covered the present greenstone masses. These greenstones at the points now exposed to waste, are proved by the valuable microscopic investigation of Messrs. Twelvetrees and Petterd, to be of such composition and crystalline texture (sill structure), as to have required the pressure of an immense superincumbent mass of rock; and great slowness in cooling; to induce that original character and successive forms of crystallisation which the gentlemen named have been able to determine as *sill structure.*

From such considerations we may follow with confidence the general conclusions arrived at by Messrs. Twelvetrees and Petterd.

Messrs. Twelvetrees and Petterd, whose prior investigations are recorded in the Proceedings of this Society and elsewhere, in their latest observations "On Mesozoic Dolerite and Diabase in Tasmania," have now, shown how extensive these investigations are. They have examined carefully numerous microscopical sections from all parts of Tasmania, and they modestly state that such observations are merely regarded by them as "stepping stones to more complete knowledge."

The general conclusion formed by them as regards the nature and mode of origin of our greenstone rocks *still remaining unwasted by denudation* are, that:—"They were never in the form of a lava overspreading the land in the presence of the atmosphere. They have been undeniably produced by the crystallisation of a magma which was injected or intruded into strata lying below the surface. They have not crystallised rapidly, but under the pressure of superincumbent rocks, which we seemed compelled to believe have been carried away by subsequent denudation. There is absolutely nothing to show that they ever succeeded in establishing communication with the surface. If, however, they did, both the pipes by which the magma ascended and the basaltic flows in which that ascent finally resulted, have been wasted without leaving a trace behind. The entire absence of mesozoic basalts in the island suggests that these dolerites always were subterranean, and that the faces and cliffs which we now see are subterranean sections lifted for our inspection by one or other of the earth movements, which geological science so often reports."

I quite accept the conclusions of Messrs. Twelvetrees and Petterd that the sections examined by them (which must in the case of the caps of the mountains, regarding subsequent denudation, be from levels from 1000 to 3000 feet below the original surface) (1) Were never in the form of a lava overspreading the land in the presence of the atmosphere; (2) That they have not crystallized rapidly while under the pressure of superincumbent rocks, which have subsequently been wasted by long continued denudation.

What thought occurs to me at this stage is—(1) Could a massive sill, 2000 to 3000 feet thick, be thrust for vast distances between the planes of stratified bedding—say within 800 feet of the surface—without causing innumerable fissures and fractures through which some portions of the magma would be forced to the surface in the form of lava, ashes, etc.? To me it seems incredible at present (2) Supposing also, that by gigantic fissure eruptions a tide of lava welled upwards to the surface, and in places attained in its flow a thickness of two thousand or more feet before cooling. What, eventually, would characterise the more rapidly cooling surface from the magma, more slowly cooling, at a depth of from 1000 to 2000 feet below the upper surface of the same flow? Would it not be possible for the slower cooled magma at great depths to show "*sill structure*" as regard crystallisation?

It must be remembered that at a depth of 3000 feet from the surface the pressure from a superincumbent mass would be equal to the weight of 240 atmospheres, *i.e.*, the pressure at the surface, and at a depth of 3000 feet respectively, would be as 1 is to 240. The rate of radiation of heat from a cooling mass, from surface to base, would, at the same time, proceed in an inverse ratio.

Geikie states that "In former geological ages extensive eruptions of lava, without the accompaniment of scoriæ, with hardly any fragmentary materials, and with, at the most, only flat, dome-shaped cones at the points of emission which have taken place over wide areas, from scattered rents along lines or systems of fissures. Vast sheets of lava have in this manner been poured out to a depth of many hundred feet, completely burying the previous surface of the land, and forming wide plains or plateaux. These truly "massive eruptions" have been held by Richthofen and others to represent the grand fundamental character of volcanism; ordinary volcanic cones being regarded merely as parasitic excresences on the subterranean lava reservoirs, very much in the relation of minor cinder cones to their parent volcano."

It may be inferred from these observations which are merely the outcome of speculative contemplation, that one may conceive of magma slowly cooling under the immense pressure of superincumbent rock and unexposed to the atmosphere without the agency of a true typical "*intercalated sill.*" Might not, also, similar crystalline structure to that of dyke root, or sill be produced in a similar way? It will be interesting to hear further from Messrs. Twelvetrees and Petterd with special reference to these speculative suggestions.

Forestry for Tasmania.

BY L. RODWAY, HON BOTANIST TO THE GOVERNMENT OF TASMANIA.

[Read August 14, 1899.]

Forestry has never received the attention its importance deserves from either our governing or our scientific bodies. I know that occasionally sundry learned Fellows of this Society have alluded to the subject, and also that our Governments for a few short years employed conservators, but except in one report of Mr Perrin I do not know of any attempt to seriously contemplate the subject. Certainly it has never taken its proper place as a matter of policy and public utility.

The policy of past Governments have been confined to a limited attempt to conserve the wealth of our virgin forests. There has been no grasp of what might have been done beyond this. Of the timber industry that could have been built up; of the enormous advantages of conserving the water that falls on the land in the form of rain and dew; of the changes in climate, much of which is certain, though much is problematical, they appear not to have troubled themselves. Even the mild protection of our native forests reached extinguishing point when the importunity of debt and a falling revenue tried the ability of our rulers. The office of Conservator was first curtailed and then abolished.

The return of prosperity and unavoidable enquiry brought to light the disastrous depredations that were taking place in our State forests. The Government have taken a step that will appeal to the sympathy of everyone having the interest of this subject at heart. They have appointed a Crown Lands Bailiff, and in doing so they have been fortunate in selecting from among their officers a man who is eminently fitted by nature and disposition for the position. I refer to Mr Compton Penny.

This evident recognition of the value of our timber wealth leads one to hope that when evidence can be produced to warrant it still further steps will be taken. It leads one to hope that the evidence adduced in other countries will be turned to account by us, and steps will be taken to at least encourage the plantation and growth of trees where they are badly needed.

I cannot hope, at least in this paper, to do more than superficially allude to the general benefits forestry may bring us. It would be completely out of place to go into details. The evidence of benefit is so clear, the experience of observers so conclusive, that what is required is direction to general principles. If general principles are recognised as being of urgent importance the technicalities of procedure will afford no difficulty.

I propose to roughly discuss the subject under its three principal heads:—

Timber production

Water conservation

Influence on climate.

The subject of timber production naturally falls into two sections—economical use of native forests and the planting of new areas. The first, though it has never received the attention it might, is suffering more from indifference than want of knowledge. We all have a pretty fair notion of what should be done. We know the return they should make to the State, and we know what should be done to prevent wanton destruction and reckless cutting. The economical use of our forests can be greatly improved, but I do not propose to waste your time in these details. Forest planting, on the other hand, would be something new to us. Exotic trees have been planted far and wide in Tasmania, and have almost invariably demonstrated their ability to thrive, but they have never been planted, as far as I know, for economical timber production.

Now we must recognise firstly that forests as they grow in a state of nature seldom produce the most economical timber supply. A straight lofty stem with no limbs except near the apex is the ideal timber tree, and this state is only to be attained by judicious planting and tending. With our native trees our forests are so abundant that it is doubtful if it would pay to compete with nature. Several of our fast-growing eucalypts would in the lifetime of an average man grow large enough to produce good timber, nd under proper treatment a tree would cut with less waste than is the case with unattended forest trees. Our wattles would gain a size that would yield valuable harvests of bark. But other trees, such as our Ironwood, Blackwood, Huon Pine, Leatherwood, Myrtle, etc, are of such very slow growth that it is quite out of the question to consider such a far off posterity that would reap them. However valuable these woods may be, economy would compel them to be rejected in favor of more rapidly growing plants. We can only hope to appeal to the sympathy of the people by suggesting the planting of a class of tree that will yield an almost immediate advantage with a harvest to be gathered at a no very distant date. The timber market clearly indicates the line to pursue. We have in a state of nature abundant heavy, tough, hard, durable material, and also an ample variety of beautiful woods in demand for cabinet and ornamental work; but the timber we want, the timber we have to import, is the soft but fairly strong, light-weighted woods that are so common in the Northern Hemisphere. These woods are the production of pines and firs, and cannot be dispensed with without considerable loss and inconvenience. Last year alone we imported £17,459 worth of this class of timber. This, to us, is a very considerable item, and must steadily be on the increase; not only will increasing population increase the demand, but the supply is becoming affected. In North America and Scandinavia, whence the principal supply comes, the forests are rapidly diminishing and prices are hardening. This must soon materially affect every industry where these soft woods are required. In America and Germany this question of the wood supply is occupying the gravest attention. Extensive departments exist, and every means is adopted to forward the economical planting and maintenance of forests. I see in the agricultural returns for 1892 the forest area of Germany was 34,343,743 acres, the annual return from which was about £21,000,000. The annual cost of maintenance was £4,150,000 and gave employment to 583,000 persons. If we are never to grow our own softwood, an equivalently large industry for us is wilfully allowed to be non-existent, which is negligent, wasteful and impolitic. Private enterprise and the enterprise of our forerunners in this worthy Society have introduced into Tasmania a great variety of deal-bearing trees, and these trees have almost invariably thrived well. You have only to look at the healthy fir trees dotted about the settled districts of the Island, but more especially at the noble collection in our Botanical Gardens to assure yourselves of the suitability of both climate and soil for the culture of fir trees. All fir trees do not yield the best timber, and the best timber trees would not succeed in any situation. Much experience and knowledge would be required. But that knowledge and experience is within our reach, and if economically applied must give satisfactory results. I will not here attempt to specify what species should be grown it would be premature and out of place.

The idea of true forest plantation for Tasmania, that is the formation of areas extending for many hundreds, perhaps thousand acres, is quite of the question. Such a sublime purpose, however to be commended, would not gain practical sympathy. Our efforts should be directed to point out the beneficial results that should accrue from the planting of copses, that is small areas, from a few, to say, one hundred acres. There are innumerable places quite unfit for agriculture, practically useless for pasture, yet eminently suitable for forests, places at the headwaters of creeks that would not only yield a good return for planting and upkeep, but, as I hope to show presently, would be invaluable as water conservors.

It is not economical to plant trees in a desultory manner. Trees must be planted with a knowledge of their requirements. Above all things too much space must not be allotted to each. This is for two purposes; to check the disposition to throw strong laternal branches and thus distorting, or, at least, preventing the development of a straight, tall stem and secondly to maintain an unbroken canopy of foliage through which the rays of sun cannot penetrate. This latter point is one of vital importance in forestry. To gain the best results the soil must be properly protected against loss of moisture by evaporation, not only for the purpose of conserving the water but also to best permit those processes of decay to take place that rapidly decompose the fallen leaves into humus or vegetable soil. Our Eucalypts and Acacias are peculiarly ill-suited for this very reason to produce the best forest results. The erect or pendant leaves remain edge on to the sun and afford a minimum of shade, consequently in a pretty dense Australian forest the sun still penetrates through to the soil drying it up, and the scanty foliage that does fall is seldom turned to humus at all. Certainly in many parts the soil is further protected by shrubs and herbs, but these are but a sorry recompense for a true canopy. In most parts in old countries it has been found best to intermix rapid growing fir trees with broad-leaved trees that shed their foliage every winter. This in a long series of years yields the best returns, but is hardly suitable for us for two reasons: We have abundance of native woods as useful as the woods produced by these trees; and the excessive time they require to come to maturity—often many generations. We require forests supplying a class of wood for which we have a great demand and that will yield a harvest within the shortest reasonable time. This is only to be attained by cultivating forests of pine trees. Such a forest would probably commence to return wood to the cultivator at 20 years.

From then for the next 40 years or more according to circumstances the forest would yield a constant supply. If, for example, our fathers about the outbreak of the gold diggings in Victoria had consistently planted forest areas with good species we should now not only be supplying our own wants to the extent of nearly £18,000 per annum, but would also be in a position to supply the whole of the much greater demand of Australia. There have been two objections raised to the policy of forest plantation in Tasmania. Some think though our climate generally would be favorable that the prolonged droughts might militate against the success. Experience shows this to be quite erroneous. Recently we went through one of the severest tests and the cultivated imported trees, though not always growing in the most suitable situations and never under the most favorable conditions, came well through it, so well that there would evidently be no fear of the severest drought doing real harm to forest plantations. But a much graver danger exists from bush fires and if copses were planted in and about bush land, doubtless the loss from this source would occasionally be great. But it is not in bush lands where there is the greatest demand for forests; they would yield their best results in the more cultivated parts. If a farmer planted a paddock of wheat in close proximity to scrub land he would know quite well the danger he was running from fire. But how many farmers in Tasmania when sowing grain tend to desist from a fear of this danger. Likewise where forests would be most useful interspersed in your widely-cleared and open area, would they be running a great risk of destruction? Hardly more so than a field of grain. But this subject of planting for timber production has all the one great objection. In these days when land is not entailed the cost of production comes out of the pocket of the immediate possessor. But who will reap the benefit? Even if one is pretty sure that this will fall to the lot of one's children the harvest is too remote. Though the care and attention of the young plantation is slight, still it is work without visible return. To calculate that the trees we plant with much care and expense to-day will return practically nothing for twenty years, is quite enough to depress the sympathy of any practical man. But fortunately the growth of forest areas is not productive of timber alone; indeed, the growth of timber may be left on one side as quite a secondary consideration. The principal interest to the people of Tasmania is that forest areas are big conservers of water. The rainfall of Tasmania is not as small as it is often supposed. Our rainfall is somewhere about that of the eastern counties of England. The trouble with us is that our rainfall is not used economically. We have a fall of rain falling mostly on hardened exposed surfaces, the bulk of it flows immediately off into the creeks, down the rivers, to the sea. If we have a very heavy downpour the flow off is so great the creeks swell, and that which would be a blessing and a godsend for months to come, could it be retained, bursts over the banks of our rivers destroying crops, stock, and buildings, rushes away from the land where it would have done good to mingle with the sea where it is not wanted. Then, as usual, the sun comes out, what water has not flown off rapidly becomes evaporated. Little or none soaks into the subsoil. The farmer a few weeks after is raising his voice that his creek has little water for his stock, and less for his crop. No, the principal reform we require on our land is to prevent this prodigal waste of nature's gifts; to naturally so protect the surface from excessive evaporation, and so retain the water in the spongy soil, roots, and detritus that the water which at present is sent into the sea and the air with the quickest possible despatch may be retained and retailed to us in a slow constant supply extending over months. How is it that in Europe, where the rainfall is no greater than with us, they have their brooks and streams carrying almost the same water all the year round, while in Tasmania we have only creeks that are three-parts dry eleven months out of the year? It is simply the difference in the natural reservoirs. There they have their woodlands with dense canopies of foliage through which the sun's rays cannot penetrate, into which the rain pours and is stored up as in a sponge; while here we have our light foliaged trees that give so little shade that the water gets out almost as freely as it gets in.

This is the main plea for forest culture in Tasmania. If small but natural water conserving areas were planted with trees whose foliage was suitable for soil protection, such areas would soon more than pay for themselves by the regulation of the water that would flow out from them. In a little time the advantage would be so apparent that forest planting would be undertaken as a matter of course, without longer requiring the stimulating and direct effort that Government would have to put forward at the outset. This is no imaginary picture, this is the experience that has been dearly purchased by many in the Northern Hemisphere. I could give you masses of instances from the bulletins of the United States, all pointing the same way; loss of water from forest denudation and the necessity of replanting I do not think you would have to go beyond any settled district in Tasmania for proofs. Indeed, I think a study of Mount Wellington an ample object lesson. Time does not permit me to dip into this part of the subject, as it deserves, more especially as I wish to refer to the influence of forests on climate. I am aware that the larger aspect of this does not come within our scope of practical enquiry. That forest protection and cultivation will have to come about for lesser reasons, and the larger result will be a fortunate corollary. The immediate plantation of huge forests for the purpose of modifying our climate would be rather Utopian, But we may be allowed to think of it. Within the scope of influence on climate are included two sets of phenomena, the general and the local. General climate is mostly cosmic. That is, the atmospheric dispositions are due to causes in no way referable to the influence on the immediate locality affected. But the question that interests us and has exercised the minds of many both now and in the past is, Are not these atmospheric conditions somewhat modified by the character of the area over which they spread?

The temperature of a forest and its immediate locality is, except in very cold weather, lower than that of open country, also except in damp weather the air in about or above forests carries a greater percentage of moisture. From this it is easily conceivable that condensation with rain will occur over a country pretty well wooded with true forests, while on the other hand expansion with no deposit of moisture will take place over open and therefore hot, dry places. That is to say though forest lands cannot affect cosmic causes, they are sufficient to turn the balance when conditions of condensation are approached, to cause rain to fall locally where otherwise it would be just missed. This influence on climate theoretically held, has been open to dispute; but careful observations at many stations in Europe are now showing a steady increase of rainfall in proportion as forests are encouraged.

But, however, these more general influences may yet be open to discussion, the immediately local effects of tree planting are undeniable. The farmer knows only too well the dessicating effect of hot dry winds parching up his fields and pastures; he knows as well the effect on his stock, and the conditions of his paddocks, in the heat of summer, and the bleak cold of early spring. Judicious tree planting has been found in other countries an effectual help in both cases.

Now, in conclusion, I would point out once again what would be the effect to Tasmania had a policy of tree planting been pursued by our forefathers. Firstly, our waters would have been conserved, and instead of periods of drought with no feed and little water, mixed with sudden floods, we should have natural reservoirs of retention, with consistent brooks, instead of empty creeks. Secondly, from the extension the forests would now have assumed instead of having vast evaporating fans, say like the Hamilton district for instance, where the clouds only too often come up from the west, expand into invisibility over head, to be condensed once again when they have passed away to the east, we should have had condensation instead with a fall of moisture, with all its concomitant benefits. And lastly, instead of now importing annually £18,000 worth of soft woods we should not only produce what we require, but be large exporters into the bargain.

Such being the case is it not a wise policy, is it not a duty to posterity, that if the thing can be done without a tax on our labors and resources, that we should do what we regret our ancestors have not done for us? I think there can be no question about it. Only how is it to be done? If a private individual made up his mind to plant a hundred acres with good trees he would find it too great a burden. The work would have to be initiated and partially conducted by the State. The State, up to a point, can produce the young trees without appreciable expense. The State has plenty of land available at New Town, Risdon, and elsewhere for all requirements. We have men already employed in similar work. Our Conservator (Mr Penny), our able manager of our Botanic Gardens (Mr Abbott) and his assistant (Mr Wardeman), who have ample ability for all that would be immediately required, and we have abundance of cheap labor. The young trees being produced in quantity it would remain for the Department to supply them at a low cost to reliable landholders, who would plant them under suitable supervision, And if this principle of State nurseries and supervision were economically carried out the department would be self-supporting, and in a few years the only wonder would be that the foresight of our public men had not adopted such a policy sooner.

SUPPLEMENTARY NOTE ON LIMURITE IN TASMANIA.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

In this paper the authors refer to their Note on the same rock presented to the Society last year, since when they have further examined it microscopically, and have studied its occurrence on the spot. They acknowledge their indebtedness to Mr. R. Williams, the Manager of the Colebrook, for many useful and interesting specimens. The mine is between Rosebery and Ringville, on the saddle of a hill about 1500 ft. above sea-level, and is remarkable for the quantity of pyrrhotite occurring in the rock, associated with copper pyrites in relatively small quantities. The authors do not regard the occurrence as a lode, but rather as a rock mass, in the form of an irregular dyke or intrusion. Generally, the country to the west is serpentine, and to the east slates; and the rock in question has been intruded along or near the line of contact, though at the top of the ridge it appears to have come up through the slates in several branches or bodies, leaving horses of metamorphic slate standing in its mass. Viewing the rock as a mass, it is composed of augite (altered largely to uralite and actinolite), axinite, calcite, datholite, danburite, with secondary chlorite and sphene. Essentially it is an ultra-basic rock (pyroxenite), which here and there receives the addition of other boric minerals and then becomes limurite, a composite rock, consisting practically of augite and axinite. How were the boric emanations introduced? Were they escapes from a neighbouring acid basin? That there was an acid reservoir not far off is shown by the tourmaline quartz porphyry at the Renison Bell Mine, and by the axinite quartz veins found on the West Coast Prospecting Association Section, and by the granite near the latter. A slide prepared from this vein-rock is referred to, and mention made of the association of tourmaline with axinite in other parts of the world. The authors arrive at the conclusion that the West Coast granite, or its elvan dykes, consolidated at the same time as the limurite dyke at the Colebrook. The action of boron vapours in the granite area to the west is shown by the tourmaline and axinite just alluded to, and if these vapours extended to the pyroxenic magma at the Colebrook, and were carried up with it, the origin of the limurite rock would be accounted for. Last year a Note on Datholite was submitted by Mr. W. F. Petterd, and now the authors state the results of a microscopical examination of this mineral. Another new mineral is added to the list of the components of this singular rock, viz., the boro-calcium silicate, danburite, and its microscopical characters are enumerated. A further mineral with characters suggestive of its being a precipitate from a boric solution is mentioned. It is somewhat similar to the decomposition product of boracite known as parasite, a hydrous magnesian borate. The authors consider that the limurite rock throws light on the question of the age of the granite on the West Coast, as the Colebrook intrusion appears to be younger than the serpentinous and gabbroid rocks to the west of the mine.

ON HAÜYNE-TRACHYTE AND ALLIED ROCKS IN THE DISTRICTS OF PORT CYGNET AND OYSTER COVE.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

The igneous rock at Port Cygnet, in Southern Tasmania, has been known for a long time by the name of felspar-porphyry. As the porphyritic crystals of felspar are rather strikingly displayed in the rock, specimens have now and again, through collectors, found their way to different parts of the Colony. Microscopical study of some of these samples made us aware that the handsome porphyries were soda-trachytes, and we classed them as such in our last year's sketch of the igneous petrology of Tasmania.* Since then we have found the felspathoid mineral haüyne or nosean in them, which confirms our previous determination, and a recent excursion to the locality has enabled us to recognise quite a group of these rocks, as well as to fix their geological age.

The country round Lovett and Lymington furnishes several sections which may be used by the geologist, but one of the most valuable of these is, perhaps, that which is afforded by the Livingstone mine. The mine shaft and buildings are on the crest of a hill, 600 feet above sea-level, about two miles N.E. of the township of Lovett. Just before reaching the crest the trachyte may be seen in the road-cutting underlying the sandstones and slaty arenaceous beds which form a large portion of the hill. On the saddle there are some fossiliferous beds of the Permo-Carboniferous System, charged with spirifera and fenestellidae, and a little higher the trachyte appears again. In one form here it has a slabby habit, due to its being largely composed of parallel layers of large tabular crystals of orthoclase felspar, some of which measure as much as two inches in length. The Livingstone mine shaft is close by, and appears to be sunk in banded trachyte and quartz. One hundred and fifty feet below this a tunnel has been driven for 360 feet, passing through

* Trans. Aust. Inst. Mining Engineers, 1898, Vol. V., p 108.

Permo-Carboniferous sedimentary beds, and intersecting several bands of trachyte in its course. First it cuts a 12 ft. layer; subsequently a 2 ft. band of the coarse porphyritic trachyte seen at surface (the miners' name for this is "magpie"), and near the end of the drive 12 to 15 feet of white trachyte rock is passed through, called "diorite" by the miners, and referred to under that name in the published reports of the company. It is important to note that these bands or lava sheets are conformable with the sedimentary strata, and we cannot entertain any doubt of their geological contemporaneity. In this hill, as in the entire region, considerable variety exists in the different flows of these trachytes. Some are coarse in texture, others are fine-grained and compact. Some of them have their counterparts on the Mount Mary Hill rising on the west side of Lovett. In particular the slabby trachyte, distinguished by its large tabular felspars ("magpie") is found again at the Mount Mary mine on the western side of the valley, only there it is much decomposed, and has an abundant development of epidote.

The Mount Mary trachytes may be seen cropping out in the quarry on the hillside in front of Harvey's Hotel at Lovett, where they have been used for road metalling and building purposes. At least two varieties are distinguishable in the quarry face—one a tough dense speckled rock, the other a smooth porphyritic, somewhat fissile, stone of a light bluish-grey hue, suggestive of a sodic lava. The compact type contains a fair amount of epidote. Passing up the hill to the west the rising ground above Mount Mary mine exposes outcrops of several varieties of trachytic rocks, which continue right through the hill to the Lymington-Wattle Grove Road. Opposite Martin's cottage on that road is a bold outcrop of a rather plutonic-looking grey hornblendic rock, at first sight much resembling syenite, but which on microscopical examination we found to be an undoubted trachyte, with beautifully zoned felspars.

There are good exposures of sections on the beach between Lovett and Lymington, where the beds are lying rather flat. On this beach we found additional evidence of the contemporaneity of the trachyte with the Permo-Carboniferous sediments. We discovered some fresh syenite (augite-syenite) along this line, and specimens of a similar rock and of an intrusive micaceous trachyte have since been given us by the Government Geologist (Mr. J. Harcourt Smith, B.A.), who collected them from the shore at low-water, just south of the Lovett regatta-ground. A very remarkable dioritic rock occurs on Mr. Patrick

Cranny's property at Lymington. It consists of hornblende + plagioclase felspar, with the hornblende greatly preponderating. We have placed this dark basaltic looking rock among the dioritic aplites called malchite.

That this petrographical province extends further north we have satisfied ourselves by the discovery of blocks of garnetiferous trachyte at the base of the Sugar-loaf Hill, behind Mrs. Cleary's cottage on the road to Cradoc. It is there also associated with Permo-Carboniferous fossiliferous marine beds. It is well known, moreover, that it extends to Oyster Cove in a N.E. direction.

The word "felspar-porphyry" was applied to the Port Cygnet rocks as a field term, indicating a porphyritic texture. It meant simply that the uniformity of the micro-crystalline ground-mass is interrupted by a profusion of larger crystals which were formed during the intratelluric period of the history of the rock. The term is only admissible as a temporary expedient for the designation of such rocks prior to definitive examination. It can be discontinued now that the trachytic nature of these rocks is beyond doubt.

It may be useful to trace the lines along which our enquiry has travelled, and show how they lead up to the results now submitted.

As a rule, when the colors are white, yellow, grey, we may take it that a lava does not belong to the basic series of rocks. It will be a member either of the acid series, containing over 66 per cent. silica, or of the intermediate series with 55 per cent. to 66 per cent. As a whole, the Port Cygnet rocks are remarkable for the small quantity of their free silica. They are essentially quartzless rocks. Of course they contain silica in combination, but only sufficient to bring up the SiO_2 per cent. to the limit for intermediate rocks, those lying between the acid granites and rhyolites and the basic gabbros, dolerites, and basalts. The silica per cent. corresponds with the specific gravity, which averages 2·5 to 2·6. These facts help us in locating the rock in a definite division. Now, in this division the andesites and diorites are characterised by plagioclase felspars, while in the trachytes and syenites orthoclase is dominant. In the Port Cygnet rocks orthoclase unquestionably predominates. Trachyte is the volcanic form, syenite the plutonic.

Haüy first gave the name of trachyte (τραχίς = rough) to volcanic rocks feeling rough to the touch. In these rocks there is generally very little glass, the ground-mass being more or less crystalline. When they contain plagioclastic felspar it is an acid variety. When this felspar increases in quantity, and grows more basic, we are led to the andesites; and it is not always easy to understand the meaning of the term trachyte as used by some authors, who extend it in the direction of the andesites till it becomes useless for the purpose of classification. In this connection we cannot do better than bear in mind Rosenbusch's definition of trachyte as implying the dominant presence of a potash felspar and the absence of quartz among the porphyritic constituents. He says:—

"The trachytes are neo-volcanic effusive rocks which may be designated equivalents of the syenitic plutonic rocks and of the palæo-volcanic quartzless porphyries in all their modifications."*

The only modification which we would venture to make in this admirable description would be to include palaeo-volcanic rocks in the trachyte group. Some carboniferous trachytes have been found in Britain, but these have been ranked by the illustrious author just named among "orthophyres" or "quartzless porphyries having completely the habit of trachytes." We cannot see, apart from the question of age, that anything would be gained by calling the Port Cygnet lavas, orthophyres. Many of the felspars are brilliant to the eye and pellucid in thin section. On the other hand, some of them have lost their glassy appearance and acquired a yellowish opaque aspect, sometimes, however, retaining a vitreous interior, to which the peripheral decomposition has not extended. We seem here to have intermediate stages between glassy sanidine and opaque orthoclase. No doubt, the mineralogist would deny the term sanidine to these opaque crystals and call them orthoclase. Of course, those who postulate sanidine as an essential constituent of trachyte will have to call some of these rocks trachytic orthophyres, and reserve trachyte as the name for the varieties with glassy orthoclase. But this seems to us a needless multiplication of classes, and we anticipate that the sanidine variety of orthoclase will not always be regarded as an essential ingredient of trachyte, nor will the name trachyte be confined to rocks of Tertiary age solely.

Assuming, then, that we are now dealing with the trachytic group, we take a further step and define these volcanic rocks as soda trachytes. This is shown by the presence of one or more of the soda minerals, haüyne, analcime, aegirine, aegirine-augite, cataphoritic hornblende, and the green pleochroic augite rich in the acmite molecule ($Na\ Fe\ Si_2\ O_6$). Such trachytes are very closely

* Mik. Phys. d. massigen Gesteine, 1896. p. 738.

allied to phonolites, and become phonolite by the addition of either of the felspathoids, leucite or nepheline. The roughness of ordinary trachytes is characteristically absent, and the disposition of felspar crystals in layers is a marked feature, imparting a certain degree of fissility to the rock. The rock has evidently possessed in its molten state exceptional viscosity, which has impeded free flow and caused crowding of the porphyritic elements. This, again, is not unknown among phonolitic trachytes and phonolites.* The presence of haüyne is considered by some authors sufficient to remove a rock from the trachytes to the phonolytes, and they would call some of the Port Cygnet rocks phonolytes. It is interesting to note that, as nosean (haüyne) in the first British phonolite (Wolf Rock, Cornwall) was discovered by Mr. Allport, in 1871, by means of the microscope, the same instrument has led to the discovery of haüyne and phonolitic trachytes at Port Cygnet.

Though the eruptive rocks of this province are evidently products of one and the same magma, yet different flows at different times show varieties of mineral composition in all probability characteristic of each eruption, in addition to which there are structural differences dependent upon the physical conditions of consolidation. We are able, more or less plainly, to arrange the numerous varieties provisionally, as follows :—

SODA TRACHYTE GROUP.

Effusives—

Haüyne Trachyte, with porphyritic haüyne.
Aegirine Trachyte, with aegirine needles and aegirine-augite.
Melanite Trachyte, with abundant melanite-garnet.
Trachyte, with green sodic augite.

These comprise various types, described in detail further on.

SODA APLITE GROUP.

Intrusives—

Sanidine-augite-haüyne Aplite.
Sanidine-augite-biotite Aplite.
Malchite or dyke-Diorite, (an aberrant member).

SODA SYENITE GROUP.

Plutonics—

Alkali-augite-Syenite, with micro-perthite and analcime.
Alkali-augite-Syenite, with elaeolite, (Little Oyster Cove).

* "We find that acid lavas are very decidedly less mobile than basic ones, and so flow less readily and to smaller distances; and, further, that certain intermediate lavas, rich in alumina and potash, are remarkably viscous, as is illustrated by the peculiar dome-like forms assumed by some trachytic and phonolitic eruptions." Daubrée "believes that some trachytic domes must have been erupted in a nearly solid, not even pasty, condition." Nat. Hist. of Igneous Rocks. A. Harker, Sc. Prog. Vol. VII. pp. 204–6.

The minerals which we have detected in these rocks may be enumerated as follows :—

	Trachyte.	Aplite.	Syenite.
Essential—	Orthoclase (Sanidine) Oligoclase Augite Hornblende	Orthoclase (Sanidine) Augite Biotite	Orthoclase Microperthite Albite Elaeolite Augite Hornblende
Accessory—	Haüyne Aegirine Melanite-Garnet Biotite Apatite Sphene Zircon Magnetite	Haüyne Apatite Sphene Zircon	Melanite-Garnet Biotite Apatite Sphene Zircon
Secondary—	Analcime Epidote Quartz Natrolite Actinolite Muscovite Pyrites Limonite Chlorite Clinochlore	Natrolite Opal Quartz	Analcime

Alkali Syenite (Augite Syenite).

Sp. gr. 2·6.

Found *in sitû* on beach south of Regatta Ground, Port Cygnet. No massive exposure, but lying at the water-level.

Macroscopic characters.

Medium grain ; brownish grey, syenitic looking ; has an elaeolitic appearance, with greasy feel. With porphyritic tendency by reason of a few large glistening felspars (nearly $\frac{1}{2}''$ long) scattered sparingly. No rhomb-shaped sections of felspars seen. Numerous small brilliant dark garnets appear as specks, which can be well recognised with the pocket-lens ; many of these seem enclosed in the felspars. The rock resists decay well, as shown by the thinness of the weathered crust, decomposition not extending far into the interior of the stone.

Microscopic characters.

Structure, normal hypidiomorphic-granular (granitic), with an occasional leaning to the trachytic type by an idiomorphic columnar felspar here and there. It is essentially a potash-felspar rock, but there is very little proper orthoclase in it, for the orthoclase is intergrown perthitically or rather micro-perthitically with striped felspar, often showing very fine striae indeed, giving the extinction angles of oligoclase or oligoclase-albite. These twinning-lines are generally short, not continuous, and are sometimes interrupted by similar sets at right-angles. Here and there in the slide is water-clear albite, pellucid as quartz; but apart from this, and an exceptionally clear crystal or two of orthoclase, the felspars are turbid.

Some analcime in the felspars points to the former presence of elaeolite, and its existence may be suspected, though we cannot optically demonstrate it.

An important feature is the garnet, which is very plentiful, in brown irregular grains and ill-formed crystals, having a corroded appearance. These are characteristically intergrown or associated with augite, biotite, and apatite, and in their neighbourhood is often seen a yellowish transparent flaky or zeolitic-looking mineral, with low refractive index, and giving in polarised light the appearance of a soda decomposition product. The abundance of garnet warns us that the rock is allied to the elaeolite-syenites.

There is some grass-green augite (malacolite) in granular irregular forms. It has slight pleochroism, and where vertical sections could be found they gave extinction angles of 33° and 34°. The mineral is often bleached in the interior. Besides being specially intergrown with garnet, it is associated occasionally with dark green hornblende. This hornblende is intensely absorptive. Its pleochroism is $\mathfrak{a}$ = yellowish-green, $\mathfrak{c}$ = very dark green. The $\mathfrak{b}$ direction could not be ascertained. A little light brown idiomorphic mica gave $\mathfrak{a}$ = light greenish-yellow, $\mathfrak{b}$ = dark dirty green. Zircon, present in all syenites, occurs in small quantity, likewise a little sphene in elongated wedges. Very little quartz can be definitely recognised.

This syenite cannot be considered quite identical with any of those syenites, rich in alkali, which Rosenbusch has erected into types under the names (after J. F. Williams) Pulaskite, Albany, and (after Brögger) Laurvikite types: but it is evidently related to these and to their allies, the elaeolite-syenites. The syenites which are known in other parts of Tasmania have quite other relationships, being more closely connected with the granite family.

Augite Syenite.

Found *in sitû* on beach between Regatta Ground and Lymington.

Macroscopic characters.

Fine-grained, with numerous lustrous faces of felspars, and specked with green augite. Some of the felspars are idiomorphic. Colour of the rock light grey.

Microscopic characters.

Structure, hypidiomorphic-granular, many of the felspars strongly idiomorphic parallel to 001 and 010. A few of these much larger than the rest, with numerous enclosures of sphene and small felspar crystals. Zoning of felspars quite a feature. Many of the orthoclase felspars are glassy, and have a sanidine habit. There is a good deal of albite-twinned felspar and microperthitic intergrowth of albite-oligoclase with orthoclase, some of the twinning being extremely fine, and cross-twinning is well shown. The extinction angles yielded by different crystals seem to be those of both albite and oligoclase.

A pale green augite (malacolite) is frequent. Its pleochroism is very slight. Its extinction angle in the prism zone is as high as 44°. Wedge-shaped crystals and grains of sphene plentiful. A little idiomorphic apatite and interstitial quartz. We have not noticed any garnet in this syenite.

Haüyne Aplite.

Sp. gr. 2·75.

Found at Port Cygnet, but the precise locality is unknown.

Macroscopical characters.

A medium-grained dark grey rock, consisting largely of small columnar and tabular sanidine crystals, some of which exceed the rest in size. A parallel arrangement of felspars occurs, but is inconstant, the crystals lying mostly in all azimuths. With a hand-magnifier granular augite seems plentiful, and crystals of yellow sphene are seen here and there. Small grey and white spots represent nosean, but this mineral can only be identified microscopically.

Microscopical characters.

The rock is seen to be essentially composed of sanidine, augite, and nosean, with the minerals sphene, apatite, and zircon as accessories. The sanidine is clear, and mostly in columnar forms, with Carlsbad twinning. Some of these prisms have been dynamically bent. They carry abundant inclusions of haüyne (nosean) decomposed to zeolitic matter of a light yellow colour, giving mottled grey and white interference appearances under crossed nicols. Augite is in prismatic elongated forms, and is a green pleochroic variety with extinction angle of 40°, though as the colour becomes yellowish the angle seems to decrease. $\mathfrak{a}$ = light green, $\mathfrak{c}$ = dark green. Bleaching is common. Grains and rods of augite border crystals of apatite. Large decomposed haüyne crystals are abundant as divergent and fan-shaped zeolites of a pale yellow colour in plain light. Allotriomorphic orthoclase felspar forms a cement uniting the above elements, and this gives the aplitic character to the rock. Yellow crystals of sphene in prismatic and acute rhombic sections are plentiful. Zircon is less common ; magnetite in grains.

Soda Aplite, a Sanidine-Augite-Mica Dyke Rock.

Sp. gr. 2·85.

Locality—On the beach at Port Cygnet, south of the Regatta Ground.

Macroscopical characters.

A hard granular dark glistening rock resembling a minette (mica-trap). Numerous little brilliant faces of dark mica visible. The felspar looks granular and sugary. The green augite is too minute for satisfactory identification.

Mineral constituents.

Sanidine, augite, biotite, apatite, soda decomposition products and pyrite.

Microscopical characters.

The first thing which strikes one on looking at a slide is the panidiomorphic structure of the rock, reminding one at once of aplite. At the same time the prisms of augite and plates of mica follow linear directions like the minerals of a foliated rock.

The felspar is granular and imperfectly prismatic, with its boundaries abridged by neighbouring prisms. Carlsbad twinning is frequent. Where elongated sections are available with some approach to a prismatic character, the extinction is straight. The crystals are pellucid and contain numerous microliths, rods, ovoid and circular grains, perfectly transparent, colourless, and without any definite action on polarised light. Some are light green ; these are augite. The inclusions, which are of large size, are a constant feature.

The augite seems to be diopside, of a dirty green colour, with an occasional disposition to bleach. It is in ill-formed prisms, without perfect terminations. Its extinction angle is about 40°, and it often has perceptible pleochroism. Augite grains, too, are numerous, and large nests or agglomerations of granular augite occur.

The third constituent in order of frequency is a yellowish-brown biotite with strong basal cleavages, showing in sections perpendicular thereto. Rays vibrating parallel to 𝔞 undergo least absorption, 𝔠 being opaque-brown, and 𝔞 yellowish-brown. There is a little apatite in stout short prisms and large irregular grains. Some decomposition material similar to the yellow products after haüyne is present. The rock contains neither quartz nor hornblende, and is altogether an unusual one. We do not know of any similar occurrence with which it can be compared. It appears to belong to the group of aplitic dyke rocks (Rosenbusch), but the absence of aegirine and the abundance of a high-angled augite shut it out from the tinguaitic set. Still, we feel tolerably certain that its place is in the soda-trachyte series, and among the dyke rocks in that series.

Haüyne-Trachyte.

Sp. gr. 2·55.

Occurs near the shaft on hill at Livingstone Mine, near Lovett.

Macroscopical characters.

A bluish-grey porphyritic rock with crowded layers of glistening tabular sanidine felspars. The smaller porphyritic elements are hornblende, augite, brilliant dark garnets, and numerous soft white sections of haüyne. This is the only rock which we have found with comparatively fresh or unaltered haüyne (nosean).

Microscopical characters.

The felspars are clear in section. The fragments in the slides are generally too imperfect for reference to particular zones. The orthoclase is much intergrown with oligoclase : there are fragmentary sections of Carlsbad twins with albite twinning on one half, sometimes with a cross striation. Partial twinning frequent in orthoclase crystals, but sometimes very faintly visible. Some felspars seem to have been enlarged by a subsequent addition of material, which surrounds the original crystals as a fringe. This must have taken place prior to the final consolidation of the rock.

Garnet.—This is plentiful. When it occurs in such rocks it is usually referred to the variety of calcium-iron garnet known as melanite. It is in forms of the trapezohedron and dodecahedron, and sometimes zoned. In thin section the colour is yellowish to reddish brown. Its sections are margined brown, and traversed by irregular iron-marked fissures. It is quite common to find it intergrown with and enclosing crystals of hornblende and augite.

Haüyne (Nosean).—This mineral is abundant, and gives sections approximating to faces of the cube (100), dodecahedron (110), and trapezohedron (211). Hexagonal sections are common ; no trigonal ones. Rounded grains very frequent, and crystals with a mutilated and corroded appearance. The mineral is sometimes colourless, but generally characterised by a soft slate-grey tint in the peripheral parts, shading off towards the interior. The colour is deepest at the border. Dark striae are often seen proceeding from the faces inwards, sometimes in sets at intersecting angles. There is none of the blue tint which is seen in some haüynes. The interiors are full of granular microlites ; nearly all are undergoing decomposition into natrolite or other soda products represented by divergent scaly aggregates. Crystals of haüyne are often enclosed in the large felspars.

Nosean and haüyne are classed together by Rosenbusch under the group name haüyne. They are both silicates of alumina and soda, but in the haüyne there is the addition of lime. Dana* gives the percentage composition of the two minerals as under :—

	Silica.	Sulphur trioxide.	Alumina.	Lime.	Soda.
Haüyne...	32	14·2	27·2	10·0	16·6 = 100
Nosean ...	31·7	14·1	26·9	—	27·3 = 100

Haüyne often has a blue tint. Where this tint is absent and no lime separates out during decomposition, it is impossible to distinguish the two optically. These facts have to be borne in mind when considering authors' references to either of these two minerals.

Hornblende.—This is a somewhat peculiar variety. It has the black colour of arfvedsonite to the eye, and is deep green, sometimes nearly opaque in thin section. If the section is at all thick it is opaque. The pleochroism is strong. $\mathfrak{a}$ = yellowish green ; $\mathfrak{b}$ = very dark green, sometimes opaque ; $\mathfrak{c}$ = very dark green, sometimes opaque. This absorption scheme $\mathfrak{c} \geqq \mathfrak{b} > \mathfrak{a}$ agrees with

* System of Mineralogy, 1898, pp. 431–2.

that of common green hornblende, and not with that of arfvedsonite, which is $\mathfrak{a} > \mathfrak{b} > \mathfrak{c}$. But the startling opacity suggests something out of the common, and in some sections the absorption varies to $\mathfrak{b} > \mathfrak{c} > \mathfrak{a}$, which characterises the black alkali-iron hornblende of certain phonolitic trachytes and linguaites which Brögger has called cataphorite. It seems to us possible that the hornblende is of a cataphoritic nature, though its extinction angle is rather low for that species. $\mathfrak{c} : c = 14°$ to $17°$, whereas in cataphorite it varies from 23° to 60°.

A bright green slightly pleochroic augite occurs in prisms and grains. $\mathfrak{c} : c = 34°$ or thereabouts. Apatite in grains. The groundmass consists of small sanidine prisms in fluxional arrangement, interspersed with small grains of augite. The whole is rather obscured by decomposition.

Tertiary haüyne-trachytes occur in France (Auvergne); haüyne-phonolites in Germany, Portugal, the Canaries, Colorado; the nosean-phonolite of the Wolf Rock, Cornwall, is the nearest related rock in Britain.

Haüyne-Trachyte.

Found on the crest of the Livingstone Hill, and in the mine tunnel 150 feet below. Also in the trench at Mount Mary Mine, west of Lovett.

Macroscopical characters.

A soft light grey rock, easily recognised by its large tabular orthoclase felspars lying thickly in parallel layers, causing the rock to split more easily in that direction. These felspars are mostly between $\frac{3}{4}''$ and $1\frac{1}{2}''$ in length, and from $\frac{1}{8}''$ to $\frac{1}{4}''$ thick, and can be often chipped out from the matrix, making good specimens for the cabinet. They are tabular ∥ 010, and the cleavage parallel to this plane is perfect. The crystals are opaque externally, light yellow, but occasionally the interior is glassy, sanidine-like. Mr. Frank Rutley has aptly described them to us as having a biscuit-like appearance. The miners call this rock "magpie." The only other pronounced macroscopical element is limonite in hexagonal and other sections after some cubic mineral, probably garnet. The same rock occurs at the Mount Mary Mine, where it is more decomposed, and contains much epidote.

Microscopical characters.

The orthoclase is often intergrown with a striped felspar. It encloses numerous hexagonal and other sections of haüyne, replaced by liebenerite (?). The rock is full of porphyritic pseudomorphs of liebenerite (?) aggregates after haüyne in rectangular and rounded sections.

Sharply defined sections of a cubic mineral decomposed to limonite are plentiful. The determination of the original mineral is difficult, as we have not much beyond the forms to guide us.

Dana says*—"Garnets containing ferrous iron often become rusty and disintegrated through the oxidation of the iron, and sometimes are altered more or less completely to limonite, magnetite, or hematite." In one of our sections we detected a crystal of melanite-garnet undergoing this change, but we have not been able to discover any further instances of partial change. Haüyne also suffers a somewhat similar change, and the choice here appears to be between the two minerals, haüyne and garnet, with probabilities stronger in favour of the latter.

The groundmass is rather obscure, but appears to consist of prisms of straight extinction felspar. Iron ore in minute grains.

Haüyne-Trachyte.

This is another trachyte from the top of the Livingstone Hill. It is a grey rock, with the faint bluish tinge, which in the Port Cygnet trachytes we have found associated with the presence of haüyne. Groundmass compact lava-like, with numerous porphyritic crystals of dull white orthoclase $\frac{1}{4}''$ to $\frac{1}{2}''$ in length. These crystals are tabular in habit. The other visible porphyritic constituent is the limonite to which we have alluded above as being probably pseudomorphous after melanite-garnet. This is in hexagonal and other familiar sections of the isometric system.

Mineral constituents.

Orthoclase: secondary limonite, muscovite, iron oxide.

Microscopical characters.

The large orthoclase crystals are turbid, and enclose occasional sections of nosean, now replaced by micaceous aggregates in confused flakes, polarising in the vivid colours of the second order. These remind one of the secondary muscovite (liebenerite) in liebenerite-porphyry. Mingled with them is a mineral giving soft grey interference tints, and this may be natrolite. The same aggregates are frequent throughout the rock, filling up the interiors of the porphyritic haüyne (nosean) crystals which

* System of Mineralogy, 1898, p. 446.

have preserved their characteristic contours. The groundmass is much decomposed, but seems to consist essentially of small sanidines. Numerous black needles obscured by ferrite may represent acmite or aegirine.

Aegirine-Trachyte.

Sp. gr. 2·61.

There are two or three varieties of trachyte, with needles of the soda-pyroxene aegirine entering largely into the composition of the groundmass. The most striking of these is a greenish rock, markedly porphyritic and fissile by reason of parallel layers of tabular sanidine crystals, found on the beach at Port Cygnet south of the Regatta Ground. The only other porphyritic mineral is augite. The plates of sanidine lie preponderatingly in one direction in layers, giving rise to divisional planes, along which the rock cleaves more easily than in a direction perpendicular thereto.

Microscopical characters.

Inclusions of minute needles of augite (or aegirine) are frequently arranged in zonal form round the periphery of the sanidines, and the margins of the large felspars often melt imperceptibly into the groundmass, the magma of which has apparently corroded them. A crop of microlites is usual along these imperfect edges. The sanidines are clear, and enclose crystals and fragments of augite, besides indefinable microlites and glass inclusions.

Augite.—Sections in the zone of 001 and 100 are common.

The colour of these porphyritic pyroxenes is a rather deep green; they are distinctly pleochroic. The extinction angles are very variable, and the character of extinction is undulose, probably in consequence of mixtures of normal and soda pyroxene. The extinction of the central portion of a crystal will be 38°, while that of the margin will be straight or nearly so. Sometimes a crystal is found extinguishing at about 5° or 6° in one direction, with a pale yellowish fringe extinguishing at the same angle in the opposite direction. Inserting the quartz wedge with its axis of least elasticity covering the elasticity axis of the pyroxene nearest to the vertical crystallographic axis of the latter, we notice that the colour falls till it is replaced by darkness. In petrographical language, compensation has set in. By this we know that the axis of elasticity in the two crystals (the quartz and the augite) are dissimilar. As the direction in question is that of least elasticity in the quartz, it follows that it is that of greatest elasticity in the pyroxene. This is an important optical test for distinguishing soda pyroxene from normal augite. The groundmass is a remarkable feature of the rock. Small laths of sanidine, often with fluxional arrangement, form a ground-work, with which are entangled pale green rods and needles of the soda-pyroxene aegirine. These are slightly pleochroic, and might be mistaken for augite, but that they uniformly extinguish nearly parallel to their long axis, which direction of extinction the quartz wedge shows to be that of the $\mathfrak{a}$ axis of optical elasticity. The rods are sometimes acicular at one or both extremities, sometimes curved. They occasionally attach themselves end on like a fringe to the borders of crystals of augite. They call to mind the aegirine needles in the aegirine- (formerly called acmite-) trachyte of the Kühlsbrunnen in the Siebengebirge.

In one of our slides is an equilateral hexagonal section of a small water clear mineral in the groundmass, greatly resembling a section of nepheline ; but it is not perfectly isotropic between crossed nicols, and we have failed to obtain a dark cross in convergent polarised light. It has peripheral and central inclusions of colourless to pale green pyroxenic microlites. It has no border such as is common in noseans. If it is nepheline, it would remove our rock from the trachyte to the phonolites ; for the present we must leave the determination doubtful. In the groundmass there is a good deal of isotropic zeolitic matter, apparently of the nature of analcime.

Another variety of the same rock is found on Mount Mary, just above the mine. There it is a compact green rock, often laminated, strongly resembling a metamorphic rock. A few isolated scattered crystals of sanidine occur in it, together with an occasional small black garnet. Under the microscope we see that the green colour is due to the felted network of aegirine needles, and that the rock is essentially identical with the one just described, only with the porphyritic felspars reduced to a minimum. The garnet is the usual melanite variety, brown in thin section. This rock contains pyrites.

Aegirine Trachyte.

Sp. gr. 2·61.

Occurs on Mount Mary, just above the mine.

Mineral constituents.

Sanidine, augite, melanite, titanite, aegirine, biotite, apatite.

Macroscopical characters.

A compact greenish grey rock, with large isolated glistening tabular crystals of sanidine. Numerous small black garnets embedded in the rock, and dark augite prisms visible under hand-lens.

Microscopical characters.

The large sanidine crystals are clear and fresh-looking. Dodecahedral sections of brown-zoned garnet in simple and compound forms enclose prisms of augite. These large garnets are a feature in the rock slice. Green pleochroic augite in imperfect forms of the prism occurs in nests. The extinction angle is as high as 37°, and the mineral often encloses crystals of apatite. 𝔞 yellowish green, 𝔟 yellowish, 𝔠 green. Some sphene is present porphyritically. A little pale yellowish brown biotite is associated with the nests of augite crystals. It can be picked out in the slide by its strong pleochroism—𝔞 yellowish brown, 𝔠 opaque.

The groundmass consists of small lath-shaped sections of sanidine with fluxional arrangement and pale green pleochroic rods of aegirine extinguishing parallel to their length. Granules and small crystals of sphene are plentiful. There is some isotropic material of a zeolitic nature.

MELANITE-TRACHYTE.

Stones of this rock were found at the back of Widow Cleary's cottage on the road to Cradoc, about 2 miles N.W. of Lovett, at the foot of the green conical hill which rises there from the road. The hill exposes permo-carboniferous mudstones a few hundred feet up, with abundant marine fossils. This is the most northerly extension of the trachyte which we examined, but we could not find it *in sitû*.

Macroscopical characters.

Light brown in colour, granular in texture, studded with brilliant black crystals of melanite-garnet. This mineral is such a constant and abundant accessory that the rock may well be called a melanite-trachyte.

Mineral constituents.

Orthoclase, perthite, melanite, augite, apatite, biotite, sphene, analcime, chlorite, limonite (manganese ?).

Microscopical characters.

The most frequent porphyritic element is melanite-garnet, light and yellowish-brown, in thin section, in the usual forms, and strongly zoned in successive layers. The garnet crystals are habitually intergrown with, and enclose augite. The next most important phenocrysts are those of a green pleochroic augite, with an extinction angle not exceeding 33°. 𝔞 light green, 𝔠 deep green, often encloses apatite. There are occasional large porphyritic crystals of fresh orthoclase and perthite, with zonal tendencies. The holocrystalline groundmass comprises orthoclase laths and allotriomorphic felspar; sphene in crystals and grains; some normal biotite; chlorite in scales as a pseudomorph; a little analcime and limonite, with purplish iron oxide (manganiferous ?).

Trachyte.

Sp. gr. 2·7.

On Lymington Road, opposite Martin's cottage.

Macroscopical characters.

A bold exposure on the west bank of the road of a pearl-grey granitoid rock resembling a fine-grained syenite, but essentially trachytic in nature. The groundmass is of even granular texture, with a few larger crystals of glassy felspar, with 010 faces and idiomorphic outlines. Felspar makes up the bulk of the rock; prisms of hornblende numerous; augite is present also, but cannot be distinguished macroscopically from the hornblende. The rock weathers little, but, when affected, the felspars become yellow and opaque.

Mineral constituents.

Sanidine, oligoclase (albite ?), hornblende, augite, sphene, apatite, zircon, magnetite, quartz.

Microscopical characters.

Those of a typical trachyte, somewhat near andesite, the main feature being tabular phenocrysts of zoned felspar in a granular felspathic groundmass. The hornblende phenocrysts are numerous enough to be considered as essential constituents. The augite recedes in quantity to an accessory value. It is difficult to locate this rock in any special position in the trachyte group. The forms of felspar are similar to those prevailing in andesitic trachytes, and there is a good deal of oligoclase; but there is no development of glass, and the rock is not lava-like in appearance.

Felspars.—Isometric forms prevail. Carlsbad twins with 010 faces are frequent, and zonal structure is characteristically developed. In no other rock in Tasmania have we seen the concentric zonal markings so beautifully exhibited. Striped felspar is present in quantity, its extinction angles being those of oligoclase-andesine. We have not been able to measure an angle high enough for albite on an 010 section, but a strip of felspar, intergrown with a crystal of sanidine, gave an angle of 20°, and this may be albite. The felspars are uncommonly free from inclusions of the other minerals of the rock.

Hornblende.—Next to felspar, this is the most prominent constituent in dark green columnar forms. The olive-green color is often so deep as to make the mineral opaque, and occasions difficulty in reading off the extinction angle. The absorption scheme is $\mathfrak{b} \geqq \mathfrak{c} > \mathfrak{a}$, and the pleochroism $\mathfrak{a}$ yellowish-green, $\mathfrak{b}$ very dark green, $\mathfrak{c}$ dark green, sometimes opague. The extinction angle is unusually high, the values which we obtained being 20°, 21°, 25°, 26°, 28°, 30°, 31°, 32°. These agree very well with Professor Brögger's cataphoritic hornblende, though the absorption scale does not correspond; it is evidently a hornblende with cataphoritic tendencies.

Augite is not frequent; it occurs mostly in forms of the prism. Extinction angle 38°, very pale green, non-pleochroic: crystalline sphene, apatite and zircon are constant accessories. The groundmass is not fluxional, but crystalline-granular. In it are a few rounded blebs of quartz, aurrounded by a fringe of re-crystallised felspars, and containing some moving bubbles; magnetite grains in no great quantity, and no mica discernable.

Malchite.

Sp. gr. 2·79.

This rock was found on Mr. Cranny's property, adjoining Coad's farm, at Lymington. It occurs on the side of the hill, but its geological relations were not further examined. Locally it is called "basalt."

Macroscopical characters.

Those of diorite, granular in texture, dark green in colour, owing to the green hornblende which forms the bulk of the rock. It is iron-stained along short irregular cleavage planes.

Mineral constituents.

Hornblende, biotite, augite, plagioclase, apatite, sphene.

Microscopical characters.

Essentially dioritic. What is remarkable is the decided dominance of hornblende as a constituent of the rock. This mineral forms irregular hypidiomorphic plates, often reduced to a granular condition by dynamo-metamorphism. It is intergrown with biotite, which often accumulates in nests or aggregations of flakes. In the hornblende $c : \mathfrak{c} =$ about 14°. $\mathfrak{a}$ pale yellowish green, $\mathfrak{b}$ dark brown green, $\mathfrak{c}$ dark green. The biotite is the ordinary type. Some of the felspars are larger than the rest, and these are hypidiomorphic, while the smaller felspars of the pseudo-groundmass are allotriomorphic. Many felspars are simply twinned on the Carlsbad plan, others albite twinned. A good deal of the felspar appears to be labradorite. The other constituents are apatite, sphene, quartz, and pale augite in small quantities.

The predominance of hornblende and the allotriomorphic felspars may be looked upon as exceptional for diorite pure and simple. Our rock is certainly dioritic, but its structure is rather aplitic than plutonic, consequently belonging to the dyke series of diorites. It is somewhat schistose in thin section, though not so macroscopically. It seems allied to the plagioclase hornblende aplites described by Osann from the Odenwald, and called by him malchite. Of our slides of the malchitic rocks—orbite, luciite, and malchite—luciite most resembles ours, but we do not grasp the essential distinctions intended to be expressed by these divisions. The quartz in our variety is present in very small quantity.

It is not easy to understand the occurrence of a dioritic rock in this plexus of trachytes; and, in view of the fact that Professor Rosenbusch in his recent "Elements of Petrology" (p. 135) has stated that diorites not only have no chemical or mineralogical relationship with the alkali syenites, but have never been found integrally associated with them, we would reserve the present peculiar rock for the additional examination which it merits and requires.

DISTRICT OF LITTLE OYSTER COVE.

Alkali Syenite, with accessory Elaeolite.

This is represented by a piece of rock from Mr. Innes's property, a mile back from Oyster Cove. We have not been able to examine the occurrence *in situ*, and from the small quantity of material at our disposal we can only give a general account of the characters of the rock.

Macroscopically it is a very light-coloured stone, weathering easily, and resembling a coarse trachyte rather than a syenite. It may be compared with those elaeolitic syenites which have a tendency to trachytic structure.

Under the microscope this pseudo-trachytic appearance shows itself by the larger felspars (sometimes idiomorphic) being cemented or surrounded by a holocrystalline groundmass of smaller hypidiomorphic and allotriomorphic felspars. There is, however, great variation in the size of the latter. There is a remarkable absence of coloured constituents. A flake or two of biotite is the only ferro-magnesian mineral which we can detect. Sphene, zircon, and apatite are accessories.

Orthoclase felspar preponderates. It is fresh and often zonal. Oligoclase is freely intergrown with it. Some of it is streaky, like the orthoclase of the Norwegian elaeolite syenites, and has an undulose extinction. There is much residual felspar (albite) in its clearness resembling quartz.

In the rock are certain irregular and imperfect forms of elaeolite, a few basal sections being isotropic. This determination was confirmed by digesting the rock in HCl and obtaining a fair quantity of gelatinous silica.

There is not sufficient of the felspathoid to constitute the rock a true elaeolite syenite, besides which the pyroxene and hornblende so abundant in elaeolite syenites are here conspicuously absent. It is rather one of those alkali syenites which occasionally carry subordinate elaeolite.

TRACHYTE.

We have examined three varieties of trachyte rock from Little Oyster Cove. They all appear to belong to the igneous complex, which embraces both the Port Cygnet and Oyster Cove Districts. They carry identical minerals, viz :—sanidine and oligoclase, cataphoritic hornblendes, green augite, sphene, zircon, and apatite; and, from garnetiferous gold-bearing sand found in the neighbourhood, we know that melanite-garnet is also an ingregient. From the few specimens which we have seen, it is likely that, as in the Port Cygnet series, these also are rich in varieties.

On the whole they exhibit a tendency to vary in the direction of the andesites, the dominant porphyritic felspar being plagioclastic, and an increase of iron ore in the groundmass showing itself. The small felspars of the groundmass are often minutely granular or allotriomorphic, but where prismatic they show straight extinction, which may mean sanidine or oligoclase. The porphyritic felspars are large and scattered; zonal structure common. A large orthoclase crystal, giving a section parallel to the clinopinacoid, showed a characteristic extinction angle of 22°. The hornblende is green, basal sections brownish green; extinction angle about 14°, and the absorption that of cataphoritic hornblende, $\mathfrak{b} > \mathfrak{c} > \mathfrak{a}$.

The preceding form a complete series of a unique set of rocks so far as Tasmania is concerned. To the geologist they are important as being the youngest matrix of gold in the colony. The trachytes appear to have shed the gold which has been won on the alluvial field at Lymington and found in the gullies on Mt. Mary. They are in places veined with quartz, but it is not at all clear that the quartz itself is auriferous, and the veins have not the characteristics of true fissures. We have seen some sand collected from a creek about a mile back from Little Oyster Cove towards Port Cygnet, which contains flaky gold, more or less waterworn, with numerous melanite garnets, zircons, and small crystals of sphene. It is a sand which is evidently the detritus of the garnetiferous trachytes, and the occurrence in it of gold associated with the minerals just named supports the idea that the trachytes are the source of the gold throughout the whole province. There is nothing intrinsically inconsistent in the occurrence of gold in the quartz veins of trachytes. It is found in various parts of the world in much younger trachytes and andesites than these, though the gold-bearing reefs in the rest of Tasmania are of older date and traverse Silurian slates and sandstones. But, so far as we can see at present, there is no trustworthy evidence to show that the Port Cygnet quartz veins are auriferous, while, on the other hand, there is some reason for believing the trachytes themselves to contain sparingly disseminated gold, especially where they are silicified and brecciated. The miners are pursuing the right course in selecting these tuffaceous and siliceous zones for exploration. Unfortunately the mining work which is being carried on has not so far proved the existence of the precious metal in the matrix in anything like payable quantities. Whether the gold has been concentrated anywhere to a greater extent than in the parts hitherto exploited, remains for future search to decide. The pyrite in these rocks has so far proved non-auriferous.

Conclusion.

We have abstained from referring to several additional minor varieties of trachytic rock which we have collected, and which differ slightly from the foregoing, but their minute description in this connection would serve no practical purpose, and we doubt not the discovery of further types will reward the diligent collector. The results of our enquiry may be conveniently summarised as follows :—

1. All round the arm of the Huon, known as Port Cygnet, there is an extensive development of porphyritic rocks, which are phonolitic or soda-trachytes containing haüyne, aegirine, analcime, and cataphoritic hornblende. Some of these furnish the finest examples of orthoclase felspar crystals to be found in the island.
2. The trachytic area extends to Little Oyster Cove on the N.E., to the N. of Lovett as far as Sugar Loaf Hill, to the S. of Lovett as far as Lymington and the Huon, but requires further exploration beyond these limits.
3. The trachytes are lava sheets contemporaneous with Permo-Carboniferous sandstones and mudstones.
4. Associated with these trachytic lavas and their tuffs are allied plutonic and dyke rocks, also of a sodic nature; viz., alkali-syenite (containing elaeolite) and haüyne-aplite.
5. There is an interesting development of melanite-garnet in the trachytes and syenite. This garnet seems to run through the whole series, and is a constituent of the auriferous sands of the district.
6. The dark green rock of the locality described in the older literature as "metamorphic," and looking such to the naked eye, is shown by the microscope to be ægirine-trachyte, full of minute acicular crystals of the green soda pyroxene ægirine.
7. Gold has been found at Lovett, Lymington, and Little Oyster Cove, mostly alluvial, a minute quantity *in situ*. It is highly probable that the alluvial gold has been derived from the trachyte, disseminated therein in small quantities. The few quartz veins in the trachyte do not seem to have collected this gold to any special extent, though what gold has been found in the matrix has occurred in their neighbourhood. The quartz is so closely associated with, and banded with, trachyte that the assay results are inconclusive. Appearances are against these quartz veins being true lodes.
8. This highly interesting, though small, peculiar petrographical province is a purely local one, confined, so far as

we know, to this part of Tasmania. Its unexpected discovery may be placed to the credit of the young and expanding science of microscopical petrology.*

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* Since writing the above we have seen Prof. Rosenbusch's new work on the Elements of Petrology (Elemente der Gesteinslehre, 1898), in which he groups the trachytes and quartzless porphyries (orthophyres) in one family. He says, (pp. 265–6), "Orthophyres differ from trachytes only in their greater age and consequent inferior preservation, viz., in the more frequent red and brown color, diminished porosity of the ground-mass, dull aspect of the felspars and extreme decomposition of the colored constituents. Fresh orthophyres cannot be distinguished from trachytes." Referring to the sanidine in orthophyres, he adds, (p. 266) :—"In the quartzless porphyries sanidine has mostly, though by no means always, surrendered its glassy habit, and possesses the habit and often the red color of orthoclase."

EXPLANATION OF PLATES.

FIG. 1.—Section of trachyte showing zoned crystal of orthoclase. Mount Mary, S.W. Lovett. × nicols. × 16.

FIG. 2.—Section of melanite-trachyte with zoned crystal of melanite-garnet. Cleary's Hill, N.W. of Lovett. Plain light. × 16.

FIG. 3.—Section of haüyne-aplite or haüyne-trachyte dyke rock, with large Carlsbad twins of sanidine carrying included crystals of haüyne. Groundmass = crystals of green augite and haüyne with allotriomorphic orthoclase felspar. From Port Cygnet. × nicols. × 16.

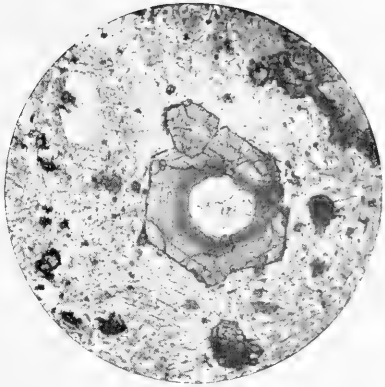
FIG. 4.—Section of trachyte from back road, two miles N.W. of Lymington. Porphyritic crystals = sanidine in Carlsbad twins and zoned, plagioclase, green hornblende and augite. × nicols. × 16.

FIG. 5.—Section of haüyne-trachyte from Livingstone Hill, N.E. of Lovett, showing large porphyritic sanidines. The dark hexagon on the left represents melanite-garnet; the smaller crystal below it is green augite. Surrounding these two crystals are small forms of haüyne. × nicols. × 16.

FIG. 6.—Section of green aegirine-trachyte from beach S. of Lovett. Porphyritic sanidine and augite. Groundmass = rods of pale green aegirine and prisms of sanidine with fluxion structure. Plain light. × 16.

FIGS. 7 AND 8.—Megascopic photographs of dull tabular orthoclase (decomposed sanidine) crystals in haüyne-trachyte on Livingsfone Hill, N.E. of Lovett. Natural size.

1.



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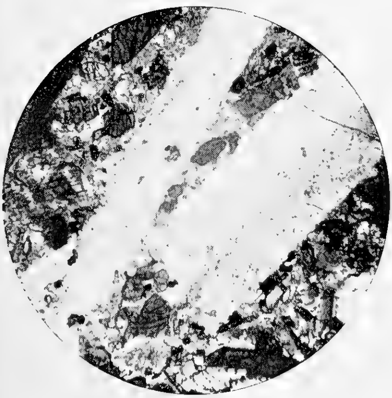

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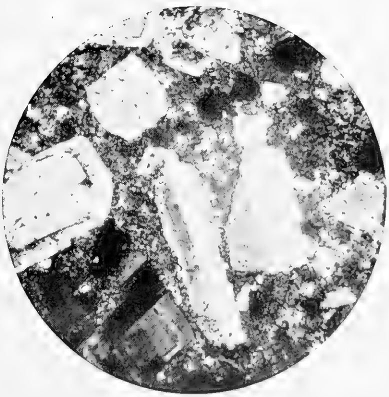
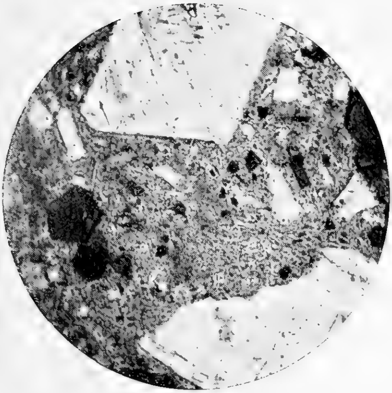


4.

TRACHYTE FROM PORT CYGNET.



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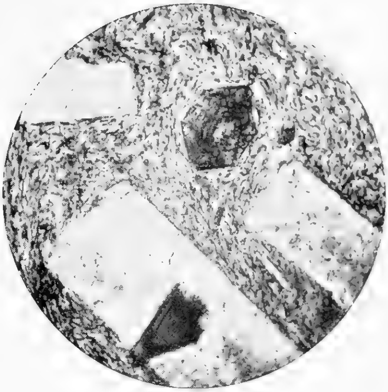

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8.

TRACHYTE FROM PORT CYGNET.

NOTE ON HUMERI OF TASMANIAN LABYRINTHODONTS.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

Last year we received from Dr. Hy. Woodward, Keeper of the Geological Collections in the British Museum (South Kensington) the *replica* of a cast in the British Museum Collection which had been obtained from Dr. Joseph Milligan, formerly of Hobart, and was labelled by Professor Owen "Humerus of labyrinthodont reptile from sandstone, probably carboniferous, Tasmania." Soon after informing Mr. Alex. Morton, Curator of the Tasmania Museum, of this circumstance, that gentleman brought to our notice and placed in our hands for examination a fossil bone (in two pieces), found in the sandstone quarry, near Government House, in the Domain, Hobart, and presented to the Museum, in 1856, by Mr. Kay, Director of Public Works. This bone, unnoticed for over forty years, is labelled "Humerus of a labyrinthodont reptile . . . . has been examined by Professor Owen," and on the reverse is written by one of the authorities at the British Museum, "Try Eosaurus of Marsh." Both the British and Tasmanian Museum specimens are left humeri, and unquestionably belong to the same genus, if not the same species.

Geological position.

The precise age of the sandstone beds in the Domain, at Hobart, is not yet beyond question, but the evidence available points to it being either Upper Permian or Lower Trias. The Cascade, Knocklofty, and other sandstones of presumably the same geological horizon have yielded Vertebraria Australis and fish remains referred by Mr. R. M. Johnston and Mr. Alex. Morton to the genus "Acrolepis."* According to these authors, similar sandstones in this part of Tasmania succeed the Upper Permo-Carboniferous marine strata with apparent conformability, and are classed by Mr. Johnston in his latest tabular scheme of Tasmanian formations as the lower sandstone

* Trans. Roy. Soc., Tasmania, 1889, p. 102 ; 1890, p. 152.

series of the Trias.* They are correlated by him approximately with the Hawkesbury beds and Narrabeen series of New South Wales, and the Burrum coal fields or Mr. R. L. Jack's Lower Trias-Jura of Queensland. We find a difficulty in naming more distant equivalents of these sandstones. The few fossils found in them and named above are consistent with an Upper Permian age. Acrolepis is a well-known Upper Carboniferous and Permian fish; but, so far, we must confess the materials do not exist for placing the beds with any degree of confidence on any distinct horizon in the Gondwana system of India or the Karoo strata of South Africa, though they evidently belonged to the ancient Gondwana land represented by those systems. In a letter received this year from Professor Amalitzky, he refers to his recent discovery of Pareiosaurus, Glossopteris with its rhizome vertebraria, Tæniopteris, &c. in the Upper Permian of the North Dwina, Russia; and we are not yet convinced that an Upper Permian age for the Hobart sandstones is definitely excluded. Be this as it may, the Upper Permian and Triassic stratified rocks all over the world—in England, Germany, Russia, United States, South Africa, and India—are known to include remains of labyrinthodont amphibia as well as the higher reptiles. Investigators are still engaged in working out the correlation of these widely-separated sedimentary formations, the exact horizon of which is not yet altogether settled. There is hardly any doubt that these sandstones, so similar in all the countries just mentioned, were laid down in fresh water, possibly in lakes, though we think more probably they belonged to large river systems.

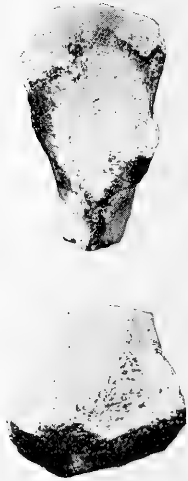
Description.

The British Museum bone is 66 mm. long, the Hobart one, 62 mm.: the breadth of the distal end in both specimens is 23 mm.; of the proximal end or head, 20 mm. The deltoid crest is developed into a strong bony process, which is prolonged as a ridge distad down the narrowest part of the shaft, where it subsides. The anconal depression at the distal end is sub-deltoidal, being a well-defined, shallow, trochlear groove, widening distad, and separating the extremity into the two condyles, ulnar and radial. The ends are broader across than they are thick, and are fairly expanded, though not so much as is generally the case in Anomodont and Dicynodont reptiles; neither does the bone shew the sigmoid shape of a lacertian humerus.

* Historical Sketch of the Geological Relations of Australia and Tasmania: Trans. Austr. Inst. Min. Engineers, 1895.

1.

2.



3.

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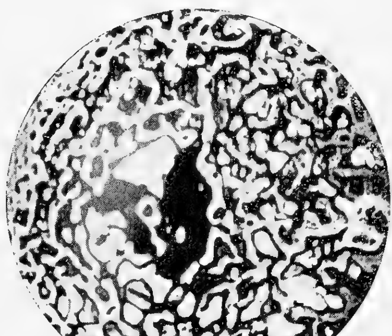

4.

LABYRINTHODONT HUMERI.

The articular surfaces of both ends are abraded, exposing uniformly cancellous structure of the osseous substance. A transverse section of the shaft shews a loose cancellous character all through : the cancelli are coarser towards the centre, but there is no medullary cavity as in the Onomodontia, Dinosauria, and other extinct reptilia, nor is there any differentiation into peripheral bony wall and spongy cancellated centre, as in some Permian reptiles. It is true, Prof. Owen refers to a femur of Rhombopholis scutulatus as being hollow,* but it is not certain that Rhombopholis was labyrinthodont.† Indeed, very few limb bones of labyrinthodont amphibia have been determined : a glance at the annexed list shews that the species and genera of the order have been always founded on vertebræ, jaws and other parts of the skull. Hence, in discoveries of isolated bones as those under review, caution is needed in drawing conclusions.

Under the microscope the larger cancelli are seen to be filled with opaque earthy material. They are sigmoid, elliptical, branched and otherwise irregular in shape, and often contain grains of quartz derived from the sandstone and confirming the authenticity of the specimen. The osseous substance surrounding the cancelli is sprinkled with ellipsoidal and fusiform cells only faintly and occasionally discernible in the slide. These are, doubtless, bone lacunæ, masked by the balsam of the mount.

The only conclusion which can be legitimately drawn from the form and structure of these humeri seems to be that they belonged to amphibian vertebrates. Although any more definite reference is impossible at present, it, nevertheless, appears to us desirable to place these remains on record, and thus render them available for comparison with future discoveries.

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* Owen. Palæontology, 1861, p. 215.

† On the remains of Labyrinthodonts from the sandstone of Warwick L. Miall. 2 J. Geol. Soc. 1874, p. 433.

EXPLANATION OF PLATE.

Fig. 1.—Humerus of labyrinthodont amphibian from Lower Mesozoic sandstone, Tasmania. British Museum cast. Anconal (back) aspect. Nat. size.

Fig. 2.—Ditto, ditto. Thenal (front) aspect. Ditto.

Fig. 3.—Humerus from Domain sandstone quarry. Hobart: Lower Mesozoic. Thenal (front) aspect. Nat. size.

Fig. 4.—Microscopical section of shaft of humerus, Nos. 2 and 3, showing cancellous structure of bone. × 10.

More or less well-known LABYRINTHODONT GENERA AND SPECIES, exclusive of the Salamandroid and Serpentine Forms of the Sub-Orders Microsauria, Aistopoda, and Branchiosauria.

GENERA.	LOCALITY.	HORIZON.	FOUNDED ON
Eosaurus acadianus (Marsh)	Coal Measures, Nova Scotia	Carboniferous	2 vertebral centra.
Anthracosaurus Russelli (Huxley)	Ditto, Lanarkshire	Ditto	Skull, ribs, and vertebra.
Loxomma	Gilmerton, near Edinburgh	Ditto	
Loxomma Allmani (Huxley)	Shropshire and Northumberland	Ditto	Skull, vertebrae, ribs, humerus.
Pholiderpeton	Gilmerton, near Edinburgh	Ditto	
Pteroplax	Coal Measures, Northumberland	Ditto	Skulls.
Macromerium scoticum (Lydekker)	Gilmerton, near Edinburgh	Ditto	Jaw.
Baphetes planiceps (Owen)	Picton Coal, Nova Scotia	Ditto	Part of skull.
Ichthyerpetum	Jarrow Colliery, Kilkenny	Ditto	
Dendrerpetum ?	Coal Measures, Nova Scotia	Ditto	
Pholidogaster	Edinburgh	Ditto	
Raniceps (Wyman) ?	Cannel Coal, Ohio, U.S.	Ditto	Skull, vertebrae, fore-limbs.
Actinodon latirostris (Jordan sp.)	Saarbrück	Permian	Skull.
Archegosaurus Decheni (Goldfuss)	Ditto	Ditto	Skull.
Euchirosaurus Rochei (Gaudry)	France	Ditto	Vertebrae.
Nyrania	Bohemia	Ditto	
Loxomma sp. (Fritsch)	Rothliegendes of Bohemia	Ditto	Jaw.
Macromerium Schwarzenbergi (Fritsch)	Bohemia	Ditto	Jaw.
Ditto bicolor (Ditto)	Ditto	Ditto	
Labyrinthodon Bucklandi (Lloyd)	Sandstone, near Kenilworth	Ditto	Skull.
Cochleosaurus (Fritsch)			
Chelyosaurus (Ditto)	Gas Coal, Bohemia	Ditto	
Gaudrya (Ditto)			

Dasyceps Bucklandi	Warwickshire	Ditto ?	
Platyops Rickardi (Twelvetrees)	Kargalinsk Sandstone, Russia	Ditto	Part of skull.
Brachyops laticeps (Owen)	Mangli, Upper Damudas, India	Ditto ?	
Gondwanosaurus bijoriensis (Lydekker)	Bijori, ditto	Ditto ?	Skeleton.
Eryops megacephalus (Cope)	Texas	Reputed Permian	Jaw.
Trimerorachis	Texas	Ditto	
Eryops Oweni (Lydekker)	Karoo, South Africa	Permian or Trias	Jaw.
Bothriceps Huxleyi	Karoo, South Africa	Trias ?	Skull.
Bothriceps australis (Huxley)	Australia	Unknown	Ditto.
Mastodonsaurus (v. Meyer)	Keuper sandstone, Würtemberg	Trias	Skull and vertebrae.
Capitosaurus robustus (v. Meyer)	Ditto, Stuttgart	Ditto	
Trematosaurus Braunii (v. Meyer)	Bunter sandstone, Bernbourg	Ditto	Skull.
Labyrinthodon leptognathus (Owen)	Keuper sandstone, Warwick	Ditto	Vertebræ, sternum, and part of skull.
Ditto pachygnathus (Owen)	Ditto	Ditto	Skulls, humerus, femur, ilium, phalanges.
Diadetognathus varvicensis (Miall)	Ditto	Ditto	Jaws.
Capitosaurus arenaceus (Münster)	Bunter sandstone, Germany	Ditto	
Metoposaurus diagnosticus (v. Meyer)	Near Stuttgart	Ditto	Skull.
Odontosaurus Voltzii (v. Meyer)	Bunter sandstone, Soultz-les-Bains	Ditto	Jaw.
Platyceps Wilkinsonii (Stephens)	Hawkesbury beds, Gosford, N.S.W.	Ditto	Skeleton.
Gonioglyptus longirostris Ditto Huxleyi Glyptognathus fragilis Pachygonia incurvata	Pánchets of India	Ditto	
Rhytidosteus capensis (Owen)	Beersheba, Orange Free State	Ditto ?	Part of skull.
Petrophryne granulata (Owen)	Cape of Good Hope	Ditto ?	Skull.
Rhinosaurus Jasikovii (Fischer)	Simbirsk, Russia	Jura ?	Skull.
Pachygonia incurvata	Maleri of India	Oolite ?	

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Loxomma Allmani (Huxley)	Shropshire and Northumberland	Ditto	Skull, vertebrae, ribs, humerus.
Pholiderpeton	Gilmerton, near Edinburgh	Ditto	
Pteroplax	Coal Measures, Northumberland	Ditto	Skulls.
Macromerium scoticum (Lydekker)	Gilmerton, near Edinburgh	Ditto	Jaw.
Baphetes planiceps (Owen)	Picton Coal, Nova Scotia	Ditto	Part of skull.
Ichthyerpetum	Jarrow Colliery, Kilkenny	Ditto	
Dendrerpetum ?	Coal Measures, Nova Scotia	Ditto	
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Euchirosaurus Rochei (Gaudry)	France	Ditto	Vertebrae.
Nyrania	Bohemia	Ditto	
Loxomma sp. (Fritsch)	Rothliegendes of Bohemia	Ditto	Jaw.
Macromerium Schwarzenbergi (Fritsch)	Bohemia	Ditto	Jaw.
Ditto bicolor (Ditto)	Ditto	Ditto	
Labyrinthodon Bucklandi (Lloyd)	Sandstone, near Kenilworth	Ditto	Skull.
Cochleosaurus (Fritsch) Chelyosaurus (Ditto) Gaudrya (Ditto) Sparodus (Ditto)	Gas Coal, Bohemia	Ditto	
Micropholis Stowii (Huxley)	Beaufort Beds, Karoo, S. Africa	Ditto	
Dasyceps Bucklandi	Warwickshire	Ditto ?	
Platyops Rickardi (Twelvetrees)	Kargalinsk Sandstone, Russia	Ditto	Part of skull.
Brachyops laticeps (Owen)	Mangli, Upper Damudas, India	Ditto ?	
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Rhinosaurus Jasikovii (Fischer)	Simbirsk, Russia	Jura ?	Skull.
Pachygonia incurvata	Maleri of India	Oolite ?	

ON THE FELSITES AND ASSOCIATED ROCKS OF MOUNT READ AND VICINITY.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

ASSOCIATED with the schists of Mount Read and district are some obscure igneous rocks, siliceous in nature, compact in grain, often slightly schistose, which are what the field geologist calls felsites or felstones. These terms, however convenient, need explanation, for in different countries they carry different meanings. In Germany the word felsite (or micro-felsite) is applied to the compact homogeneous-looking groundmass of quartz porphyries. These porphyries are the acid volcanics of pretertiary age. In England, on the other hand, felsite designates the rock, not its groundmass merely. If the petrographers of each country could throw over the historical significance of their terms and come to some international agreement as to rock nomenclature and the meaning to be attached to terms, much of the present deplorable confusion would disappear. At present the discordance is considerable. The following extracts serve to indicate the English usage :—

*Cole.**—Quartz-felsite=Eurite=" the fine-grained and compact forms of granite." " Felsite is so differently used by different writers that its reputation as a rock name is lost."

Hatch.†—Felsite=" the acid quartzo-felspathic lavas—the devitrified rhyolites and obsidians."

Rutley.‡—Felsite=" devitrified obsidians and pitchstones. Felsites are not exclusively devitrified rocks ; in some cases they occur as dykes and then approximate to the micro-granites or granophyres." Quartz-felsite=" apophyres of deep-seated granite masses (Elvan group)."

Harker.§—Felsites="acid intrusives. The name 'felsite,' or, if containing evident phenocrysts of quartz, 'quartz-felsite,' has been applied in this country not only to these rocks but also to many volcanic rocks (acid and intermediate), and their usage lacks precision and significance."

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* Aids in Practical Geology, 1893, p. 201.

† An Introduction to the Study of Petrology, 1891, p. 85.

‡ Granites and Greenstones, p. 15.

§ Petrology for Students, 1897, p. 100.

*Teall.**—Acid rocks="Felsite, Eurite petrosilex. These terms are practically synonymous. They have been applied to compact stony rocks, the mineralogical composition of which cannot be ascertained by examination with the naked eye or with a lens."

Jas. Geikie.†—Quartz-felsite=Quartz-porphyry. "In this rock we have a compact groundmass of felsitic matter, through which are scattered macroscopic or microscopic crystals or crystalline granules of quartz and orthoclase. . . . . . It seems probable that micro-felsitic matter is simply the result of devitrification of a glassy base."

Sir A. Geikie.‡—Felsite (felstone.) "Originally vitreous lavas like the rhyolites, but which have undergone complete devitrification, though frequently the perlitic, spherulitic, and flow structures."

Teall.§—Acid intrusives=felsophyre, granophyre, micro-granite. Acid volcanic=devitrified rhyolites, obsidians, and pitchstones.

These samples show that, what with acid intrusives, acid volcanics, elvans, devitrified obsidians and rhyolites, granophyres, micro-granites, quartz-felspathic lavas and the rest, the term has come to mean nothing more precise than a compact ancient acid rock. Hence some petrographers abandon its use altogether, and parcel out the rocks covered by it, some among the ancient rhyolites, the rest among micro-granites.

A different nomenclature is adopted in Germany. This family is included by Rosenbusch in Liparites and quartz porphyries. In his recent work‖ he says :—"The difference between liparite and quartz porphyry is one of age: quartz porphyries are pretertiary palæo-volcanics, liparites are neo-volcanic tertiary rocks, consequently young quartz porphyries." He defines them as effusive rocks of normal granitic magma, and divides them into two sections, viz., (*a*) microgranitic and granophyric quartz porphyries, (*b*) felsophyric and vitrophyric quartz porphyries. Under different names we see there are still two main groups, the microgranitic and the rhyolitic ; though, as they are both classed as effusive rocks, we cannot carry out any exact comparison with the English usage.

It is accordingly necessary to explain the sense in which we attach names to the Tasmanian rocks. While the particular name has a certain importance, it is equally important for us to understand the rocks to which it is applied. Seeing that quartz porphyry is so widely used

* British Petrography, p. 291.

† Outlines of Geology, 1888, p.p. 152-153.

‡ Text Book of Geology, 1893, p. 161.

§ British Petrography, p. 296.

‖ Elemente der Gesteinslehre, 1898, p. 239.

in England for compact granitic protrusions, we propose to confine the terms felsite and quartz felsite to devitrified acid lavas. The term quartz-keratophyre is applied to the same rocks when containing an alkali-felspar rich in soda. Keratophyre, the syenitic equivalent = soda felsite : quartz keratophyre = soda quartz felsite. This terminology can be correlated with Rosenbusch as follows :—

Here defined.	*Rosenbusch.*
Felsite.	Felsophyre felsite rock.
Quartz felsite.	Felsophyric quartz porphyry.
Keratophyre = Soda felsite.	Keratophyre.
Quartz-keratophyre = Soda-quartz-felsite.	Quartz-keratophyre.

The groundmass of felsites is characteristically felsitic. What felsitic matter really is has occasioned much discussion among petrologists, and a definite result can hardly be said to have been yet attained. The compact groundmass irresolvable by the naked eye or the hand lens is often resolved by the microscope into an intimate aggregate of minute crystalline-granular quartz and felspar, giving a confused speckled appearance between × nicols.

When the component individuals of the aggregate become more minute and indefinable, the groundmass is what Rosenbusch calls crypto-crystalline. This is the felsitic material. And, following the process of resolution still further, we arrive at the ultimate isotropic vitreous base. But more frequently further resolution discloses a minute aggregate of isotropic granular or flaky material which we assume to be a devitrification product, though this is mostly not susceptible of proof (miscro-felsite, Rosenbusch). From Vogelsang's researches it is probable that this micro-felsitic material is no longer a mechanical aggregate of quartz and felspar, but an independent silicate. (See the lucid exposition given by Rosenbusch, Mass. Gest., p. 668.)

Under such conditions it is not wonderful that the Mount Read rocks, masked by great geological age, and distorted and mineralogically reconstructed by intense dynamic metamorphism, should prove puzzling to the geologist. Their felsitic nature is often obscured by green colouration due to the free development of chlorite, which gives a very different appearance from that of the light coloured hälleflinta-like aspect of so many of the more typical felsites. It must be premised that the rocks not only occur in the Zone of the West Coast argillitic and phyllitic schists, but have themselves been affected by the forces which produced the foliation of the schists. Hence they have a more or less banded or schistose appearance, though, owing to their greater hardness compared with the slates, they are not foliated to anything like the same extent. The effect is often only shown by obscure banding or streaking, while elsewhere there is a more decided approach to schistosity. Sometimes a few reddish porphyritic felspars are discernible, but as a rule the rock has a streaked reddish and greenish flinty aspect, as if the original porphyritic crystals had been rolled out and their material diffused. The colour of different varieties, however, varies a good deal, ranging from yellowish white to reddish.

Specific Gravity.

Teall states the sp. gr. of felsites and liparites as ranging from 2·53 to 2·7. Our determinations of the Mount Read felsites, comprising numerous selected specimens, are :—

2·6, 2·62, 2·63, 2·65, 2·68, 2·7, 2·74.

The specific gravities of the Lenne-porphyries of Westphalia (Keratophyres and Quartz Keratophyres) given in O. Mügge's important paper may be usefully compared.

Quartz-keratophyre, 2·648, 2·654, 2·647.
Felso-keratophyre, 2·62 (non-schistose), 2·638, 2·74 (high sp. gr. due to chlorite), 2·65, 2·75.

Also those furnished by Rosenbusch :—

Keratophyre, 2·611, 2·677.
Quartz-keratophyre, 2·709, 2·647, 2·620, 2·64 2·634, 2·614, 2·632.

The specific gravity of the Tasmanian felsite is consequently quite in accord with what has been observed elsewhere.

Intrusive or Effusive.

The relations of the rocks to the argillitic metalliferous schists are far from being definitely established, and require close working out over an extended area. Owing to the densely timbered country and paucity of serious mining operations, this is a task of extreme difficulty. All that has been done hitherto has been to notice the fact of their occurrence here and there, especially where the country has been cleared a little for mining work. On the north side of Mount Read on the North Hercules, Barlen, and Consols sections, this rock is prevalent, sometimes as a greenish flinty schistose or fissile felsite, and towards the bottom of the track going down to the Ring River valley in abrupt massive cliffs of a green and reddish streaked compact siliceous felsite. It has here the appearance of an intrusive mass, but this may be with equal probability the exposure of a thick lava mass. A common characteristic of metamorphosed felsites and their tuffs in schist areas is the indefinable nature of the boundary line separating them from the schists. This seems to be the case in this region, and is a fact in support of their contemporaneity. We have seen the same felsite in the shaft at Mount Black Mine, and still further north on the Tasmanian Copper Company's property between Rosebery Township and the Pieman River. Further south, too, it occurs in the direction of Red Hills and Mount Darwin; and a very coarse granular chlorite-stained variety of the same series is found on the White Spur between Moore's Pimple and Mount Read. This zone therefore extends in a N. and S. direction for about twenty miles, while E. and W. its breadth is comparatively small. The zone of felsites seems to mark the upturned edges of sheets of lava roughly parallel with the axis of the present West Coast range. These lavas were probably geologically contemporaneous with the argillaceous sediments now converted into schists, and with them were folded, crumpled and rolled out into the schistose, banded conditions in which we now find all the rocks of this belt of country. At least this interpretation is the one which seems to us the most feasible in the present state of our knowledge of this difficult piece of country.

Their relations to the Ore Beds.

This fact confronts us: Whenever the felsite appears in tunnels driven through the metal-bearing phyllites or schists, ore is no longer found; the felsitic rock is barren. The occurrence of a band of this felsite in an adit is suggestive, at the first blush, of an intrusion; but the absence of sharply-defined walls is against the idea, and it can be explained quite satisfactorily on the supposition that it is an intercalated sheet. It cuts off the ore simply because the ore is not contained in a lode fissure, but has been deposited by a process of segregation, or has replaced the original rock by metasomatic substitution. The ore bodies on Mount Read form lenticular masses in the argillitic schists parallel with the plane of foliation, and disposed at irregular intervals in directions parallel to each other. The deposition took place probably subsequently to foliation, judging from the parallelisms with the enclosing schists. This is seen on a small scale in some of these mines, where the ore follows a minute arching and folding of the schist without dislocation. These lenticular masses have been looked upon as segregations of mineral along crevices or lines of weakness in the rock. It is rather difficult to imagine cavities of the required size existing in the rock in readiness for filling up with mineral; but there is nothing improbable in supposing the parting planes of the schists to be the first channels for the precipitation from solutions of their metallic contents. The process of replacement might then very well start from these channels and remove the country rock on either side, leaving ore in its place. The suggestion that the lenticular ore bodies represent old lake bottoms has not the testimony to support it which can be adduced in favor of the metasomatic hypothesis. The sulphides of the Rio Tinto Mine in Spain which have been appealed to are mostly bodies filling fissures which separate slates and intrusive quartz porphyry; and it is only iron ore lying in horizontal beds of miocene age with plant remains which can be referred to a sedimentary origin. Those conditions are not comparable with the mineral zones on Mounts Black and Read. Here the ore bodies follow the dips and foliation planes of the enclosing schists which on Mount Read dip easterly at a high angle with a strike from 10° to 20° W. of N. The lenticular forms of these bodies are suggestive of replacement having gone on *pari passu* with the operation of a solvent. They differ from true lodes in always being found conformable to the surrounding schist, and from both fissure and segregation veins in having no gangue or matrix different from the country rock. The foliation planes have apparently served as initial channels for the mineralised solutions which attacked and removed the schist on each side, and left their mineral contents *in sitû*. It is obvious that in such a process there would be a beginning: the attacking solution would attain a maximum of power and gradually decrease to a minimum. The result would be a lens-shaped body of mineral. The question presents itself, are such deposits as permanent as true lodes? But this is hardly the appropriate form for such a query. It would be more proper to ask, are these ore deposits as reliable as the *pitches* or *shoots* of ore in true lodes? We know very well that, though mineral veins or lodes go down to apparently quite inaccessible depths in the earth's crust, the courses of ore which they contain are inconstant and irregular. A metalliferous zone is followed by a barren one, or *vice versâ*. Therefore, to institute a just comparison, we must imagine the partings of the schist to correspond with a lode fissure, and the lenticular ore bodies with the ore shoots in a lode. The depths to which these foliation planes extend depends (1) upon the magnitude of the anticlinal or synclinal flexure to which the sedimentary rocks were subjected, and (2) upon the extent to which the secondary foliating agency affected them. This form of deposit has an advantage over most bodies, in that there has often been the opportunity for the formation of numerous ore bodies on parallel lines following parallel parting planes of the schist. The ore bodies come in and die out in these channels as ore courses do in a lode; and there is in reality no more nor any less reason for timidity or despondency in exploiting either. It will be noticed that on this supposition the ore was not deposited in the beds before they were crushed and foliated; consequently, by simple exclusion and without further argument, the hypothesis that the metals were precipitated on ancient lake bottoms which have since been raised and tilted, falls to the ground as far as the Mount Read ore bodies are concerned. To gain some knowledge of the true nature of the slates and schists, some of the unaltered slate (a dark greasy variety) from Mount Read was powdered and treated in the test tube, first with a cold saturated solution of citric acid, then heated, but no effervescence took place. Subsequent boiling in HCl. gave the same result. The non-metalliferous schist from the same locality was subjected to the same treatment. Some of this behaved in a similar manner; but another piece gave signs of the presence of a carbonate. The microscopical test showed calcite. Slides of the schist in the tunnels of the Hercules Mine sometimes show abundant calcite, occasionally in a granular condition, as if broken up by earth movements. That minor later movements have occurred is evidenced by the "greasy headings" in the mines. These are false walls, or parting planes, where the rock has been shifted by earth stress. Under the microscope the powdered schist reveals its derivation from the slate very plainly. Both consist of grains of alumina or aluminium silicate, with a little quartz. This schist is perhaps the most common on the Hercules group of sections on Mount Read. It is hardly a true schist, hardly even phyllite, which is a lustrous slate. Argillite, or argillaceous schist, would perhaps be the most suitable name. There are, however, other descriptions on the range. There are clay slates, glossy with mica; these are true phyllites. There are siliceous schists, which have resulted from the foliation of sandstones; and quartz schists, probably from quartzites: and talc schists, as on the Jupiter section, which must have had a different origin from the argillitic and quartz series. Talc schists are most likely to originate from pyroxenic rocks, but nothing is known yet of the relations of the Jupiter rocks. Micaceous schists occur, but not the true mica schists of the gneissose Archæan series. At Cutty Sark, near the Pieman River, there is a dark, compact, granular rock, of doubtful origin, which has been involved in the movements of the chain, and received an impress of schistosity. In fact, all through this zone of metamorphism and foliation, no matter what kinds of rock, they have been caught up in the process of schist formation, their original characters more or less obliterated, and a new stamp of rock structure impressed upon them. An exceptional occurrence in the schist zone is the Mount Black lode at Rosebery, which is a banded true fissure lode containing gold, wolframite, bornite, bismuthinite, chalcopyrite, iron and arsenical pyrite, and black tourmaline. The occurrence of wolframite and tourmaline is noteworthy. Just south of this, at the South Mount Black, is a dyke, black with tourmaline. The acid nature of this dyke and lode seems to indicate some connection with the movements of the granite magma in the West Coast area. This relationship naturally involves a much younger age than that of the surrounding schists and felsites. The tourmaline quartz-porphyry at South Renison Bell, the axinite at the Colebrook, and the Mount Black fluor and tourmaline rocks, probably all belong to one and the same eruptive phase.

The schists are repositories of numerous minerals and ores, which vary in the extent of impregnation to both extremes, inasmuch as these are more commonly simply represented by a few sparsely scattered minute crystals and flakes of pyrites, often of a cupriferous tendency, with occasional patches of galena and zinc sulphide. More rarely these metallic minerals are found in great quantity, sometimes wholly replacing the substance of the rocks, until they assume the character of a dense mass of sulphide ore of enormous extent. It is such masses of mineralised schist which are operated upon by the miners in the districts of Mount Reid and Rosebery. The change does not assume a general character, for often within a restricted area one or other of the copper, lead, zinc sulphides preponderates; but, as a rule, zinc is present. At the Tasmanian Copper and adjacent mines the ore is practically that of a zinc-copper nature; at the Hercules the zinc-lead impregnation is the most pronounced: while at the King River, the East Hercules, Red Hills, and others, the ore is almost zinc free; and at the Mount Read Mine almost all degrees of admixture may be obtained. A small quantity of associated gold and silver is very general, and in favourable localities for decomposition, where large masses of gossan have formed, the precious metals have been obtained in greater abundance, and have in one instance been worked by methods common to the alluvial gold-miner. In the workings of the Hercules and South Hercules mines, bunches of crystallised carbonate of manganese of great beauty are occasionally met with, and in the schists of the East Hercules the ores of bismuth have been detected, while in the vicinity of Lake Dora cobalt minerals occur; but the ores of these metals are not by any means abundant, and are, as at present known, simply curiosities of interest to the mineralogist, but of no practical value to the miner.

The following is a list of the more important minerals which have been detected:—

Arsenopyrite.	Cuprite.	Limonite.
Absolite.	Chalcocite.	Malachite.
Azurite.	Erythrite.	Psilomelane.
Barite.	Fluorite.	Pyrites.
Bornite.	Galenite.	Pyrolusite.
Bismuthinite.	Göethite.	Rhodochrosite.
Cerussite.	Gold.	Siderite.
Chalcopyrite.	Hematite.	Sphalerite (Blende).
Cobaltite.	Huascolite.	Stibnite.
Copper, native.	Jamiesonite.	Tetrahedrite.

The Mount Read felsite does not appear to have yielded sufficiently to the foliating force to provide planes along which solutions could travel freely, or was not so easily attacked by the latter; hence it contains no ore bodies. This is not, however, a universal rule. At the Red Hills an igneous rock, probably felsite, occurs, which has been more strongly foliated, and, in a specimen received from the Government Geologist (*see* Report on Lake Dora District, 1898, p. xxi.,) we noticed a decided illustration of the replacement process. A few felspar crystals remained unaltered, but the rest of the rock had been converted into hematite. But at the Mount Read mines the ore is confined to the argillitic schists. The question arises, whether the proximity of the igneous rock bears any casual relation to the ore in the schists—has the eruptive rock in any way stimulated ore deposition? An answer in the affirmative would have a practical effect on mining, as the discovery of felsite would indicate the proximity of ore. The case of the white melaphyre at Zeehan, which favourably affects the silver-lead lodes there, suggests the possibility of something similar ruling in the case of the Mount Read felsite. But the two cases are not parallel. At Zeehan the lodes in question traverse the eruptive rock; at Mount Read the ore bodies are outside it. And it is difficult to see how the latter would affect ore deposition in the schists, when, as appearances indicate, the ore was deposited subsequently to the foliation and metamorphism of both felsite and schist. It is true that ore is found never very far away from the felsite. A very natural way of accounting for this is that schists and felsite are geographically associated, and form together one mountain complex.

Age of the Felsite.

If our interpretation as set forth above be correct, the geological age of the schists and felsite is the same for both. There is no direct evidence of precise age yet available. The schists themselves in the vicinity of Mount Read are argillites and phyllites, and occasionally retain in places less altered remnants of slate, but no fossils have been found in them. The most recent determinative work done in this direction is R. Etheridge, jun.'s description of Mr. A. Montgomery's collection of Silurian fossils from the limestones of Zeehan and the Heazlewood. Mr. Etheridge says they "present both a lower and an upper Silurian facies, but with a preponderating tendency towards the latter." He thinks "it is not improbable that they represent a series of beds homotaxially equivalent to the lower portion of the upper Silurian." * Judging from the succession, the Mount Read and Mount Black schists are somewhat older than the Zeehan series, and are probably not younger than the lower Silurian. But great caution is necessary here, as the evidence is of a negative character. The test of superposition is unreliable, as the persistent easterly dip of the strata on the west slope of Mount Read points to overfolding on a large scale, which has produced an inverted succession of the beds. In any case, the felsite is much older than any of our known granite rocks.

Determination of the Felsite.

Anticipating for a moment the results of our microscopical examination, we may say that the predominance

* Description of a small collection of Tasmanian fossils.—R. Etheridge, jun.

of plagioclastic porphyritic felspars led us to suspect that the rock belonged to the sub-group of soda felsites or keratophyres (in their altered sheared form often called porphyroids). To avoid all chance of error, we sent samples of the rock to Professor Rosenbusch, who very kindly favoured us with his opinion, as follows :—" Undoubtedly we have here strongly dynamically altered forms of the acid eruptive rocks. The typical porphyritic structure, the nature of the phenocrysts, the still recognisable fluidal structure, the nearly entire absence of dark constituents, the occasional spherulitic forms still recognisable in their replacement products (quartz, albite), all point with certainty to members of the quartz porphyry family, and, with great probability, not to quartz porphyry in the narrower sense, but to quartz keratophyre and keratophyre. . . . . The rocks greatly resemble our German occurrences in Westphalia, the Fichtelgebirge and Thüringen, and especially the occurrences in Wales. These are the forms which in Germany were originally called porphyroids and flaserporphyries."

Microscopical characters of the Felsite.

As the aspect of the rocks differs in the field in different parts of the same mass, so their microscopical structure varies to an equal extent. Sometimes they are typically porphyritic, though the crystals are never very large ; or the porphyritic crystals are set so closely together as to resemble somewhat a plutonic rock-like granite ; or they are broken and mutilated, giving a fragmentary appearance to the rock. The mineral constitution, too, varies. There is a set in which quartz phenocrysts accompany those of felspars, and another series from which they are absent. Nevertheless, despite all these variations, the observer recognises that he is looking at one and the same group, the acid and the sub-acid eruptives.

The mineral constituents of one or other of the members of the group may be classed as under :—

Essential.	Accessory.	Secondary.
Orthoclase.	Magnetite.	Albite.
Oligoclase ?		Chlorite.
Albite.		Epidote.
Quartz.		Sericite.
		Calcite.
		Limonite.
		Sphene.
		Zoisite.

The changes are all rung on these minerals, the secondary ones replacing or obscuring the essential constituents in varying degrees.

In addition to orthoclase, a felspar of the albite or oligoclase-albite series appears as a porphyritic constituent, and is sometimes very abundant, becoming the prevailing felspar. This shows us that these are not the ordinary orthoclastic felsites.

The material upon which we have founded these preliminary microscopical studies comprises an extensive series of rocks collected from Mount Read, on the sections owned by the South Hercules, North Hercules, East Hercules, Crown Hercules, and Ring River Companies, from Tipperary Creek on the west side of Mount Read, from the White Spur between Dundas and Mount Hamilton, from the Tyndal Track and Creek south of Mount Read, from the Red Hills east of Mount Read, from Mount Black and the Tasmanian Copper Company's property north of Rosebery, &c. The following micro. details will be of interest to students :—

We note that in the porphyritic types on the North Hercules section the felspars have a habit of collecting in nests, and there is a good deal of water-clear secondary felspar surrounding the phenocrysts. The phenocrysts float in a matrix of this secondary felspar, with which calcite is sometimes associated. Carlsbad twins may be often seen bent by dynamical stress, and strongly seriticised. In the more granitic or crystalline forms, on this property, there is abundant quartz, which often has a fragmentary aspect, being in all sorts of irregular shapes. Hexahedral forms are rare. Some of the grains are embayed ; others are stretched, cracked, or broken. Strain shadows are frequent : minute fluid cavities present occasionally. Between the felspars there is a good deal of bright green chlorite. Sericitic streaks curve between the phenocrysts ; this may represent original flow structure. The rock on the White Spur is a counterpart of that of the North Hercules. The crystalline form is the dominant type. Fragmentary deformed quartz frequent. Schistose structure marked ; the lines of schistosity bend round the unyielding quartz grains, causing a streaky appearance, and probably marking former flow lines. The ordinary porphyritic form of rock also occurs on the White Spur.

In the keratophyre of Tipperary Creek the felspars are strongly sericitic, and the rock is veined with albite. This felspar veining occurs also in the same rock at Red Hills, in which there are rather peculiar nests of albite crystals. The keratophyre here is rich in bright green chlorite. On the Tyndal Creek there is a rather fresh keratophyre, with a good deal of chlorite. On the track to Mount Tyndal the felsite is much epidotised; some of the Carlsbad twins have one half replaced by epidote, and chlorite is developed abundantly. The felspars of the keratophyre in the Ring River adit have been replaced by aggregates of secondary albite and quartz; the crystals of felspar here have sectional fields very characteristic of keratophyres. There is a keratophyre on the Crown Hercules overlying the ore body, with slate on both sides. At the Mount Black mine the shaft is in keratophyre, identical with that of Mount Read. The porphyritic felspars are here, too, surrounded by secondary felspathic growth. Further north, on the Tasmanian Copper Company's property, there is a band of felsite in the lower adit 40 feet wide, in which the few felspars are broken up into aggregates of secondary albite. With reference to the groundmass of these rocks, Professor Rosenbusch writes to us :—"Nothing is left of the original groundmass; it has been converted into sericite, quartz, and albite. The newly-formed albite felspar can be distinguished quite easily from the older phenocrysts. The chlorite indicates original pyroxene rather than biotite."

Summarising the above, we have here the characteristics of felsite and quartz felsite, and especially of keratophyre and quartz-keratophyre. The rocks have a compact quartzo-felspathic (felsitic) groundmass, with quartz and orthoclase and albite phenocrysts, sometimes distributed sparingly, at other times so crowded as almost to lose the porphyritic stamp. In the typically porphyritic varieties are altered spherulites and signs of flow structure. In a word, these are ancient, now devitrified, lavas of the alkali-granite and alkali-syenite families. The quartz keratophyres are the granite volcanics; the keratophyres are of syenitic nature.

There are no plutonic masses in the neighbourhood with which we can connect this series of lavas. The syenite, which occurs in boulders north of Rosebery, has not been found *in sitû*; and the granite at Heemskirk is of younger date. There is some pegmatitic granite on Jolly's section at Lake Dora, which microscopically appears fresh and post-Silurian. The mass or dyke of syenite porphyry at Lynchford is evidently of great age. The mechanical deformation of its crystals indicates that it was subjected to the same earth movements as the slates; and there is consequently a likelihood of it being quite as old as the felsites. The long line of felsite, with its axial direction parallel with that of the West Coast range, shows that below that area, in Silurian times, there must have been a corresponding plutonic body of rock, which the vast period of post-Silurian denudation has not been sufficient to uncover.

Mr. W. F. Ward's Analysis of Quartz-keratophyre from the North Hercules Section, Mount Read.

Professor Rosenbusch suggested to us that a chemical analysis of this rock was highly desirable, in order to confirm the results of optical examination. This analysis has been made by Mr. W. F. Ward, Government Analyst, who states it as follows :—

Constituents.	Per cent.
Silica	75·73
Alumina	12·70
Oxide of iron	2·25
Lime	2·00
Magnesia	0·60
Potash	2·04
Soda	3·48
Loss at red heat	1·20
	100·00

From the above it will be seen that the reference to quartz-keratophyre is fully sustained. The percentage of silica shows it to be an acid eruptive, while the excess of soda over potash indicates the keratophyre group.

ON MESOZOIC DOLERITE AND DIABASE IN TASMANIA.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

The following Notes lay no claim to be an exhaustive description of our familiar "diabase" or "dolerite" rock, which plays such an important part in the geology and physical configuration of our Island. The present object is rather to place upon record some inferences drawn from the examination of numerous microscopical sections of specimens collected or received from all parts of Tasmania. It is by accumulating the results of observations that stepping stones are formed to more complete knowledge. A glance at Mr. R. M. Johnston's geological map of Tasmania, issued by the Lands Office, will show the share this rock takes in the structure of the Island. It occupies the whole upland area of the Central Tiers. On the northern face of the Tiers—the Western Tiers as they are here called—there is a tongue of the rock prolonged northwards past Mount Claude. At their north-west corner it forms or caps mountains, such as Cradle Mountain (the highest in Tasmania), Barn Bluff, Mount Pelion West. Eldon Bluff forms a narrow western extension. Mount Sedgwick is a western out-lier; Mount Dundas another. In that part of the island it is also found at Mount Heemskirk Falls, and on the Magnet Range, two miles north of the Magnet Mine. Mounts Gell and Hugel are also western out-liers. Its south-west boundary is Denison Range, with Mount Field West, Mount Mueller, and Mount Picton. Southerly we find it in the Hartz Mountains; the rock goes down to the south as far as the Rivers Huon and Esperance, and even further south it is found on the isolated peaks of La Perouse and Adamson's Peak, and a narrow fringe of it runs along the coast-line south of the Huon to South East Cape and South Cape. On Bruni Island it is present in a very massive form. It is found on Tasman's Peninsula, and in the whole of the south east of the Island it cuts up the sandstones and shales of the Permo-Carboniferous and Trias-Jura country. Mount Wellington and other heights near Hobart have summits composed of this rock. From the eastern side of the Central Tiers it is continued to the Eastern Tiers and the hilly ground from Swansea northwards to St. Mary's. Ben Lomond, the Mount Nicholas Range, Tower Hill, Mount Victoria, and Mount Saddleback are north-east out-liers fringed with Permo-Carboniferous and Jura-Trias. The northern extension passes under the sands and clays of the Launceston Tertiary basin, and re-appears along both sides of the River Tamar. It extends to Mounts Barrow and Arthur and Ben Nevis. There is an isolated patch of it at the mouth of the Mersey and at Port Sorell. On the East Coast it abuts on a fringe of granite on Maria Island, Schouten Island, and Freycinet's Peninsula.

A peculiar feature is the almost invariable association with it of Permo-Carboniferous and Trias-Jura beds. The whole periphery of the area forming the Central Tiers is fringed with a narrow zone of these beds, and the same holds good in the case of all the isolated peaks. How can this association be explained? It has been suggested that dolerite capping has protected underlying sediments, and that the latter do not merely hang on the flanks of the igneous table-land, but actually lie beneath the eruptive capping, as the lower formations would do in the case of a sill. The few boring trials which have been made in different parts of the Island lend no support to this suggestion. They have been made through the Permo-Carboniferous and Trias-Jura beds, and traversing these, have penetrated into the dolerite below. On the other hand, no trial has been made of boring through the dolerite at surface with a view of reaching the coal measures: as a matter of fact, we do not know whether the rock on the Tiers is a denuded intrusive sheet, concealing sedimentary rocks below it, or whether it is a vast eruptive mass *in sitû*. The thickness in other parts of the island makes it difficult to believe that it is an intrusive sill. The thickest sill we can find mentioned in geological literature is the sill of basic rock in the Shiant Isles, off Scotland, described by Sir Archibald Geikie* as showing a sea-wall 500 feet high. But even this surprising thickness falls below the development of the massive rock which occupies the upper part of Mount Wellington. At the same time numerous minor intrusions in the form of dykes penetrate the Permo-Carboniferous and Trias-Jura sedimentary beds, so that we have two rather clear types

* Quarterly Journal Geo. Soc., 1896, p. 375.

of occurrence. Mr. R. M. Johnston places the geological horizon of this rock at the close of the Trias-Jura system, and we have no doubt in this his opinion is approximately correct. The rock has never been found *in sitû* in any of our Tertiary beds, which, however, do contain included fragments of it. The microscopical appearances of specimens from widely distant parts of the island also support the inference that the rock all over the Colony belongs to one and the same geological age. In one instance we have noticed microscopical fragments of the dolerite (diabase) included in Tertiary olivine-basalt. This occurs near Bothwell, where the basalt probably has entangled in its flow loose pieces of the older rock.

Its mineralogical constitution is rather simple, as will be seen from the following list of constituents :—

Essential.	*Accessory.*	*Secondary.*
Plagioclase.	Olivine.	Chlorite.
Augite.	Apatite.	Serpentine.
	Ilmenite.	Actinolite.
	Magnetite.	Scolecite.
	Pyrite.	Calcite.
	Mica.	
	Quartz.	
	Oligoclase. (?)	

MICROSCOPICAL CHARACTERS.

Plagioclase-Felspar.—The sections are lath-shaped, in short or long laths, sometimes in tabular forms. Of course, it must be remembered that these sections only give us a view of one particular plane, and convey to the mind, merely inferentially, the image of the solid crystal. The felspars could not be called lath-shaped ; lath-shaped sections are all that is meant. Out of so many sections it is surprising to find how few are available for measurements of the extinction angle. For this purpose only such twins can be selected as give approximately symmetrical extinctions on opposite sides of the trace of composition plane. The twin forms are Carlsbad and Albite. We have seen none on the pericline type. If we take the haphazard sections of felspars in this rock, we shall find some giving low, some high, angles. The low-angled ones are probably those parallel to the base ; the high-angled ones parallel to 010, and the maxima of extinctions are given by the latter. The highest angle we have noticed is 42°, but, as a rule, angles of 30°, 32° are obtained. From this the felspar may be inferred to be labradorite and labradorite-anorthite.

Augite.—The augite crystallises after the felspars, sometimes enclosing them, sometimes wrapping them partially round or moulding itself on their ends. This gives rise to the structure called ophitic or diabasic. The structure has been surmised to have originated in rocks which consolidated under hydrostatic pressure, for instance, beneath the ocean; but this is purely hypothetical, and does not account for the same structure in the middle of thick subaerial lava flows. The augite is nearly colourless, or of an extremely light-brown tint; never the violet tinge which characterises the augites of Tasmanian Tertiary basalts. This colour character is occasionally rather useful in distinguishing the mesozoic from the Tertiary dolerites. Where the augites are fragmentary and small and the felspars much reduced in size, and the rock assumes an intersertal structure, as at Killafaddy, Tasman Peninsula and some other localities, doubt sometimes arises, on inspection of microscopical slices, as to whether we are looking at dolerite or basalt. In such cases the absence or rarity of olivine, which at most only occurs sporadically in the Mesozoic rock, is a useful guide. The Tertiary basalts of the island invariably contain a plentiful amount of olivine.

The augite has not been converted into diallage. Twin crystal sections, parallel to the clinopinacoid, exhibit fine oblique striæ, which must be parallel to the basal plane, and not the orthopinacoidal lamination of diallage. In sections parallel to the orthopinacoid the striæ are at right angles to the vertical axis.

Olivine.—This is not an abundant accessory. From most parts of the rock it is entirely absent. When it does occur, as at Killafaddy, Ross, Hobart, Bothwell, West Devonport, &c., it appears to be idiomorphic. It is then one of the early minerals in the rock, most likely second in point of time only to the apatite and iron ores. It appears preferentially in the finer grained varieties and those which show an approach to intersertal structure.

Apatite.—Occurs as slender needles in the felspars and in the unindividualised groundmass when this is present.

Ilmenite and Magnetite.—The iron ores in most diabases are ilmenite and titaniferous magnetite. Ilmenite cannot be recognised in our rock in any definable forms, though many of the shapeless grains may be that mineral. On the other hand the forms of magnetite can be discerned very well. In a section of the interesting rock at the Hobart Railway Station, which is of a porphyritic nature, a very fine magnetite cross is visible. This is an embryonic crystal with two axes at right angles to each other, neatly marked out by octahedral grains of magnetite growing end to end and forming a cross of singular symmetry and beauty. The iron ore is very plentiful in this variety, forming skeletal crystals everywhere. It is, as a rule, abundant in the varieties which possess any interstitial groundmass. In the holocrystalline descriptions it is present in larger grains or crystals, but in very small quantity, and from the ferriferous borders of many of the augites, it is reasonable to suppose that the iron in the rock has been largely utilised in that way.

Quartz.—This is an unexpected mineral in rocks of this class, but we have found it microscopically intergrown with felspar (granophyric intergrowth), in a piece of dolerite from the top of Mount Faulkner, kindly furnished by Mr. R. M. Johnston. Under such circumstances it must be an original constituent.

Mica.—A very little light brown biotite occurs in the Launceston dolerite at the Cataract Gorge, and at the place on the Elphin Road where the rock crops out opposite Mr. Thomas Corbett's grounds. The mineral is not associated with any chloritic products, and appears to be original.

Actinolite.—Needles of this mineral are to be found in the rock at the Railway Station, Hobart, and this is the only locality where we have observed it. It is rather strange that no hornblende is noticeable in any of our specimens, as it is not at all uncommon in the Swedish Hunne diabase, which structurally resembles many of the Tasmanian occurrences.

Chlorite.—This substance is now universally admitted to be only a secondary constituent of diabase, and to be of no value in classification. Rosenbusch traces it to the weathering of the augite mineral. Many Tasmanian dolerites are perfectly fresh, but others contain a green chloritic mineral between the felspars, and even in the felspars themselves. In some the augite has been entirely replaced by fibrous chlorite, and the rock would be called diabase by many English petrographers. Still this chloritised dolerite is not a separate geological unit, but forms part of the mass of the fresh rock, and has doubtless received its character from the purely local action of ordinary meteoric agencies. This fact suggests the old question of dolerite versus diabase. Dogmatism is inadmissible here. The consensus of petrographical opinion must be allowed to prevail.

Calcite.—This occurs in small quantities, *e.g.*, in the Organ-pipes of Mount Wellington.

Serpentine.—There is a little yellow serpentine in the olivine-dolerites, resulting from the decomposition of olivine.

Scolecite.—This zeolite is occasionally found coating the joint planes and faces of the rock at the Cataract quarry, Launceston, in white radial aggregates. It is a hydrous aluminium and calcium silicate, which has been reported from cavities and fissures of widely differing rocks, basalts, dolerite, granite. It is of no particular importance as a rock-forming mineral, but forms interesting specimens from the mineralogist's point of view. It is apparently a decomposition product originated by the access of meteoric waters.

Groundmass.—This occurs sparsely in most varieties between the angles of the felspars, and sometimes forms irregular patches in the rock. In the Hobart Railway Station rock it is in sufficient quantity to produce a porphyritic facies. It mostly forms an imperfectly individualised mass, comprising skeletal and embryonic felspars, magnetite grains, &c. Its character is well displayed in Mr. Teall's figure of sections of the High Green plagioclase augite dyke, Q.J., Geol. Soc., 1884, p. XIII., Fig. 2.

Some of the small felspars in the groundmass of the Hobart rock, and that of Ross, give straight extinctions, and may be oligoclase. The groundmass is holocrystalline felspathic, and has not a basaltic facies. It would appear to indicate that the rock did not consolidate subaerially, but, on the other hand, not very far below the surface. This felspathic groundmass is plentiful in some of the dolerite near Bothwell. The main mass of the rock between Bothwell and The Lakes, despite its general coarseness of grain, has a little of it, and it is not wholly absent from the coarse ophitic dolerite at the dam on St. Patrick's River. It is abundant in a fresh coarse dolerite near Mount Claude, which is also remarkable for containing allotriomorphic felspar. In some varieties the green chlorite has wandered into the groundmass, as at Mount Direction (south), where the rock cotains some olivine.

Besides the ophitic structure, we have another modification found chiefly in the finer grained varieties of this rock, namely, one in which an incompletely individualised or otherwise indistinct groundmass exists in the interstices of the small crystals of felspar, and round the granules or small fragments of augite which are distributed in those interstices. This is the intersertal structure of Rosenbusch. Both ophitic and intersertal structures are met with in basalts. Intersertal basalts are common all over the world : ophitic ones have been described by Judd, from the Western Isles of Scotland. Gabbros also are sometimes ophitic. It would be interesting to know whether the two modifications are characteristic of different geological occurrences ; if so, one would expect to find the ophitic structure prevailing in the larger masses of rock, and the intersertal in narrow dykes. The most can be said of the Tasmanian occurrences is that the intersertal structure is confined to the close-grained varieties.

Parts of this dolerite become converted into diabase by the chloritisation of the augite. Thus a diabase on the Blue Tier (Gould's Country) is a typical occurrence, the whole of the augite, which is ophitic, being changed into chlorite. Some of the occurrences of diabase in the island may possibly be older, but evidence of their age is not yet available. It may yet be shown that some of these altered dolerites are of Palæozoic age ; for instance, there is a dyke of diabase near the Hampshire Hills, and near the Bridge on the Arthur River, Heazlewood, is a porphyritic diabase, with ophitic chloritised augite, and a little light brown biotite. The diabase occurring at the Blue Tier may belong to the older series. On the Corinna Road, 8 miles from Waratah, is what appears to be a diabase with intersertal structure. The felspars in it are smaller than usual, and grains of augite occupy the interstices. Both calcite and chlorite are present ; possibly this is a melaphyre.

The European types with which the Tasmanian Mesozoic dolerite may be compared, micro-structurally, are the Hunne-diabase of Sweden, and the Kinne-diabase from the Kinne-kulle of that country. The latter rock, as exemplified by one of our slides, exactly corresponds with our typical coarse-grained dolerite. In Sweden it covers Silurian rocks in the form of a sheet. The Hunne-diabase of the Hunneberg, in the same country, and in the same geological position, contains a little bronzite, biotite, quartz, and hornblende, but in structure closely resembles some of our fine-grained varieties.

Many people look at our bold escarpments and rugged faces of "greenstone" and believe that some stupendous eruption ejected the mass from below and poured it over the land in an overwhelming flood. In view of the preceding remarks it is hardly necessary to say that these rocks were never in the form of a lava over-spreading the land in the presence of the atmosphere. They have been undeniably produced by the crystallisation of a magma which was injected or intruded into strata lying below the surface. They have not crystallised rapidly, but under the pressure of superincumbent rocks, which we seem compelled to believe have been carried away by subsequent denudation. There is absolutely nothing to show that they ever succeeded in establishing communication with the surface. If, however, they did, both the pipes by which the magma ascended, and the basaltic flows in which that ascent finally resulted, have been wasted, without leaving a trace behind. The entire absence of mesozoic basalts in the island suggests that these dolerites always were subterranean, and that the faces and cliffs which we now see are subterranean sections lifted for our inspection by one or other of the earth movements, which geological science so often reports.

The names by which this eruptive rock is known are not constant, and the discussion of them introduces us to controversial petrology. The rock is that which is called diabase in Europe and America, and dolerite by most English petrographers. It is a plagioclase-pyroxene rock, with the ophitic (and intersertal) structure which so eminently characterises diabase that it has given rise to the term "diabasic structure." The rocks related to it are, on one side, ophitic gabbros; on the other, intersertal basalts. In former days, if the rock was of pre-tertiary age, it was called "diabase": if more recent, "dolerite." European geologists, however, reserved the term "dolerite" for the coarse interior part of thick lava sheets. This term is not much used now-a-days by Continental petrographers, and the instances in which it is applicable are considered by them as local and unimportant. But the habit of attributing much importance to geological age as a factor in rock nomenclature has now died a natural death, even in Germany, and the only question at issue is that of convenience. Some general agreement is desirable as to whether the present group should be called dolerite or diabase. English petrographers (with the exception of Mr. Harker) use the group name dolerite, and keep diabase for altered varieties of the same rock. This usage was established by the late Mr. Allport, and has been followed by Judd, Teall, Hatch, Rutley. Mr. Harker alone retains "diabase" for massive sills, dykes, laccolites, &c., and applies dolerite to the less important intrusions of similar rocks. Rosenbusch states that diabase, when fresh, is undistinguishable from tholeites and dolerites: Professor Lacroix, in France, upholds the term diabase as the group name. Looking at the present practice of petrographers all over the world, we see that there is a preponderance of agreement in favour of the term "diabase." The future will show whether English petrologists will agree to surrender their somewhat isolated though thoroughly logical use of "dolerite," and fall into line with their colleagues in other countries. All that can be done at present is to observe the trend of petrological opinion, and if one or other of the terms becomes obsolete, it will be necessary to adopt the one which gains general recognition. Meantime we venture to adhere to the English practice, and call this rock dolerite in its fresh condition and diabase in its chloritised state.

The tertiary basalts of Circular Head, Table Cape, Lefroy, &c., often exhibit a coarse intersertal or slightly ophitic structure, and would correspond with what goes under the name of dolerite in Germany. In point of coarseness such basalts are dolerites. They may be distinguished from our mesozoic dolerite by their abundant olivine, glassy base, and greater freshness.

The discovery of a little auriferous wash in the first and second basins of the South Esk at Launceston has led a few people to believe that the mesozoic dolerite might be gold-bearing; but the fact is that the sand which was obtained contained, besides small flakes and water-worn pellets of gold, grains and crystals of quartz, zircon, sapphire, and ilmanite, all minerals of the granite and slate country in the upper reaches of the river, and must be referred to that source. No useful minerals have yet been found in this rock, and the lodes and reefs of our various mines are all of earlier date. The experience of our miners in this respect has been so uniform that search for ore deposits in the dolerite is invariably regarded as useless.

SUPPLEMENTARY NOTE ON LIMURITE IN TASMANIA.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

Since we contributed a notice* of the remarkable "limurite" rock occurring on the property of the Colebrook Prospecting Association, N.E. Dundas, and more recently discovered to extend in a more or less broken sequence as far north as the Southern bank of the Pieman River, mining operations have been carried on there continuously, and have invested the occurrence with additional interest from that point of view. Renewed examination of the rock under the microscope, as well as in the field, has resulted in further conclusions along the line of our previous enquiries, and these we now submit.

The mine has been made easily accessible from both Ringville and Rosebery, being situate between those townships. The rock occupies the saddle of a hill about 1500 feet above sea level, has approximately a strike of N.E.–S.W., and has been proved to be metalliferous for at least 100 yards in width. The contained metals are magnetic pyrites, arsenical iron pyrites, copper pyrites, and a small amount of bismuth oxide, the copper combined with small gold and silver contents, giving the occurrence its chief economic value. The published assays of the mixed stuff state the copper contents at from 1 % to 2 %. The Government Analyst is said to have also ascertained the presence of 1 % of nickel and cobalt in the pyrrhotite examined by him.

Geologically, the rock is a dyke or intrusive mass, apparently developed between slates on the eastern side and serpentine on the west. The intrusion has evidently taken place along or near this line of contact, though it would appear to have come up at the top of the ridge through the slates in several branches or bodies, as horses of hard metamorphic slate have been left standing in it, to the annoyance of the miners. A clean contact is formed, near which

* Proc. Roy. Soc., Tasmania, 1897, pp. 1-6.

the slate, a quartzo-felspathic variety, is micaceous, with chlorite and actinolite. Leaving the metals out of consideration, the dyke is composed of monoclinic pyroxene (largely altered to uralite and actinolite) axinite, calcite, datholite, danburite, with a little secondary quartz (?) chlorite and granular sphene, and a little talc in the rock occurring further north on the Clifton property. We are disposed to consider the presence of original hornblende not established. The axinite is in veins and massive patches, and is intergrown with datholite, danburite, and the other minerals of the rock mass. Professor A. Lacroix, in his memoir on the limurite of the Pyrenees, is of opinion that the rock does not belong to a definite petrographical type, as it is variable in structure, and its mineralogical composition differs in different parts of the same mass. This remark applies with unabated force to the Colebrook intrusion, so far as the dyke as a unit is concerned. Looking at it in this way, it is essentially a pyroxenite, which here and there receives the addition of axinite and other boric minerals. Where these minerals are developed the rock becomes locally limurite, a composite rock containing pyroxene and axinite. It is agreed that the axinite resulted from boric emanations, but how these were introduced is matter for speculation. Was the magmatic reservoir below an independent unit in course of differentiation into basic and acid layers at the time of intrusion ? Or was this spot on the confines of two reservoirs, and were the boric vapours, which were carried up in the pyroxenic material, escapes, so to speak, from the neighbouring acid basin ? Axinite veins are often found elsewhere injected into rocks already consolidated, but in this case it seems clear that the two elements crystallised synchronously. Even in those parts which are veined by axinite we do not think that the veining was later than the consolidation of the mass as a whole, nor that the rock as a whole had emerged from the phase to which both pyroxene and boron vapours alike belonged. One part of the intrusion may very well have advanced a little further in the crystallising process while other parts lagged behind ; and one result of this would be the somewhat heterogeneous character of the dyke as a whole, which, in fact, we observe.

That there was a granite reservoir not far off is shown by the tourmaline-quartz porphyry to the west at the South Renison Bell mine, between which and the Colebrook is another occurrence of axinite, in the form of axinite quartz veins, on the West Coast P.A. sections, close to the granite. A slide prepared from this vein rock shows axinite, quartz, and an abundance of leucoxene. It is noteworthy that the axinite is confined to the vein stuff, as in Cornwall, but there is no occurrence of limurite.

Boron vapours, existing in the magma, and evolved during crystallisation, undoubtedly play a part in producing both tourmaline and axinite. In Cornwall both tourmaline and axinite are found in the granite contact zone, while other rocks, sometimes basic igneous ones, have been acted upon by granite with the same results. In the Hartz axinite and tourmaline occur at the contact of granite and diabase, and this led Lossen to correlate these two minerals.* In view of these facts, it seems to us very likely that the Western granite or its elvans and the Colebrook pyroxinite consolidated contemporaneously. Plutonic solfataric processes, which were plainly in operation in the granite area, as shown by the tourmaline and axinite just referred to, may very well have liberated the boron vapours, which, travelling eastwards by easily imaginable channels, arrived at and were entangled in the moving mass which cooled as the axinitic pyroxenite at the Colebrook. The whole question of this occurrence of axinite possesses a special interest for all occupied with the problems connected with the origin of igneous rocks.

Microscopical inspection of the tourmaline-quartz-porphyry at the South Renison Bell mine discloses a groundmass existing as a Mosaic of quartz and tourmaline, which contains porphyritic crystals of quartz and nests of large tourmaline and quartz crystals. There is no doubt as to the tourmaline. Its colour is brownish yellow and blue, often in one and the same crystal, strongly dichroic O > E, axis of maximum elasticity ‖ C. The tourmaline often enwraps grains of quartz. The quartz contains vacuum bubbles in fluid inclusions in considerable quantity.

Last year a note on datholite as occurring in the Colebrook limurite was submitted by one of us to the society, (†) and we have since taken occasion to examine this mineral microscopically. In thin section it is colourless, but in polarised light the interference colours are high, comprising the tints of the second and third orders of Newton's scale. The double refraction is slightly under that of augite. In

* Massige Gesteine. H. Rosenbusch, 1896, p. 103.

† Notes on some recently discovered and other minerals occurring in Tasmania. W. F. Petterd, Proc. Roy. Soc. Tasm. 1897, p. 63.

the only direction in which the 001 imperfect cleavage lines appeared the extinction was straight. No pleochroism is perceptible. The mineral contains microscopical fluid inclusions with moving bubbles, some of which are easily visible with a half-inch objective, other bubbles are stationary.

Another new mineral, which may be added to the list of components of this singular rock, is the boro-calcium silicate danburite, famous for its crystallographic resemblance to topaz. It is disseminated through the stone and abundant on fissure planes in glistening irregular crystal aggregates, looking like quartz ; but with a hackly kind of fracture. It is colourless to pale yellow. Under the microscope the relief in Canada balsam is weak, a little less than that of quartz. It gives allotriomorphic interlocking granular sections like grains of a quartzite, and is of startling limpidity. Its interference colour is low, not above the yellow of the first order. Its only inclusions appear to be needles of actinolite.

On one of our slides we notice in the clear substance of the axinite some pale green sub-spheroidal and polygonal translucent crystals generally made up of rods or fibres somewhat curved, proceeding from the periphery to the interior. These remind one of the decomposition products of borocite called "parasite" by Volger (*), a hydrous magnesian borate. The wavy fibres are suggestive of some of the forms met with in precipitations from a saturated solution, and the phenomena seem to point to the existence of an excess of boric acid in the rock magma.

As the serpentinous and gabbroid rocks at and to the west of the Colebrook must be more ancient than the Colebrook dyke, and if our interpretation be correct, also older than the phrase of activity in the granite basin, it follows that we have here some light thrown upon the question of the age of the granite of the West Coast. We do not now formulate a theory of its age, but simply observe that the limurite rock will probably be found to constitute one of the factors to be reckoned with in settling that question.

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* Zirkel, Mik Besch, min und Gesteine 1873, p. 226.

NEPHELINE AND MELILITE ROCKS FROM SHANNON TIER.

By W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S.

We received recently from the Mines Department some specimens of rocks from the Shannon district, where they had been looked upon as indicating the possible occurrence of tin and gold. Mr. George Allison, of Hunterston, kindly supplemented these, and outlined for us their geological occurrence on that estate, and from his descriptions we are able to indicate broadly the features of the locality. The Shannon Tier forms there a high plateau of mesozoic dolerite which rises a thousand feet above the Permo-Carboniferous country at its base. On the slope below the Tier are small rounded or conical hills of a dark grey, slightly bluish, basaltic rock: and at the base of or beneath the flanks of these is a strange-looking coarse zeolitic rock called locally "tourmaline-rock." This is as much as can be stated at present respecting the geology of this rather remote place. The presence of gold is said to have been established in the tourmaline-rock, but an assay by the Government Analyst did not confirm this.

The locality gives us three varieties of eruptive rock, viz., the Mesozoic dolerite, the so-called tourmaline-rock, and the bluish basalt. We may here anticipate by diagnosing the pseudo-tourmaline rock as nephelinite, and the basalt as melilite-basalt. The geological age of these rocks, so far as can be hazarded without examination on the spot, is probably Permo-Carboniferous for the nepheline and melilite rocks. The dolerite is considered to belong to the close of the Mesozoic era.

Dolerite.—This varies in degrees of coarseness, but is the typical ophitic dolerite which occupies the summits of the Central Tiers, and of numerous mountains in every part of the island. It is a holocrystalline plagioclase-augite rock, structurally diabasic, and sometimes, where the augite is chloritised, merging into diabase. The well-formed prisms of labradorite felspar, sometimes long and slender, sometimes stout and short, are cemented together by the augite mineral; and these two elements have combined to form a non-vitreous massive rock of essentially the same mineralogical constitution as gabbro and basalt, but as regards grain and structure, intermediate between the two. If we could follow this rock to its deep-seated roots in the earth's crust, where the pressure was greater and the process of crystallisation correspondingly slower, we should probably find it existing there as coarsely crystalline gabbro. On the other hand, we must not regard its present surface as in any way its original one. Much of it, as well as all the overlying rock, has been removed by denudation. Admitting its intrusive nature, there are two theories of its occurrence which press their claims for acceptance. Seeing that its internal structure agrees closely with that of diabasic sills, has it spread laterally from fissures covering up underlying rocks, and leaving an exposed surface now owing to the removal of the overlying strata? On this hypothesis, the dolerite on the tiers and the mountain tops is only a capping, and shafts sunk through it would pierce the stratified sediments below. The level contours of the sidimentary beds abutting on the sides or faces of the Tiers, and simulating infraposition, have suggested this explanation, but we have had no demonstration by any actual trial. The enormous thickness of the dolerite is greater than that of any sills known to us.

The second hypothesis is that what we see represents the massive intra-telluric part of an immense body of eruptive rock, which, as a whole, never reached the surface, but which everywhere thrust out lateral dykes, parts of which we can still trace in the coal measures. Either explanation is surrounded with difficulties, which extended observation alone can solve. This doleritic rock is a product of the gabbroid magma; but we now proceed to notice an entirely different class of rocks, those which have issued from what Rosenbusch calls a theralitic eruptive magma. Deep-seated rocks give the key to the relationships of the volcanic ones. Hence in modern petrology the latter are referred to or compared with their plutonic representatives. Theralite is a plutonic nepheline + lime soda felspar (occasionally potash felspar) rock, the deep-seated parent of nepheline and melilite basalts.

Nephelinite.—This is a nepheline-augite rock. A brief examination serves to show that the long black prisms which form such a striking feature are not tourmaline but augite. The interstices between the prisms are occupied by light brown and yellowish nepheline, which has often decomposed and originated snow-white radiated aggregates of the Zeolite natrolite. The proportions of augite and nepheline vary greatly. Sometimes the augite is extremely abundant, otherwise more sparingly distributed.

The mineral constitution of the rock may be stated as follows :—

Essential minerals	=	Nepheline, augite.
Accessory minerals	=	Olivine, sanidine, apatite, melanite-garnet, magnetite.
Secondary minerals	=	Natrolite, serpentine.

Microscopical characters.—The structure is holocrystalline, hypidiomorphic. No groundmass is present. Nepheline, generally, forms about one-half of the entire rock, sometimes more. It gives large sections bounded by rectangular contours, margined with iron oxide, and sometimes penetrated by augite. Its substance is mostly converted into radiating natrolite : some patches, however, remain water-clear. The clear nepheline encloses slender rods of apatite, as well as other needles, which, from their oblique extinction, we surmise to be augite. The natrolite gives beautiful fan-shaped aggregates, polarising in grey, low yellow, and orange colours. The nepheline crystals are often cut up by rectangular cracks.

The augite is in large prisms of green to violet tints, sometimes showing both colours in the same crystal. Its maximum extinction angle measured from the fissure lines is 45°. It encloses prisms of apatite. A prominent element of the rock is apatite in long transversely-jointed rods and prisms, some of which are large enough to be visible to the unaided eye. Olivine is an infrequent accessory. It has crystalline contours, the usual rough-looking surface with irregular cracks, and is associated with some serpentinous material. Some orthoclase felspar is also present in small quantity. Its transparency indicates the sanidine variety.

No one who has seen the familiar slides of the nephelinite (or nepheline-dolerite as it has been called), of Katzenbuckel in the Odenwald, can fail to recognise the same type in slices of this Hunterston rock. The latter is the same rock reproduced in the Southern Hemisphere. The specific gravity of an average specimen was ascertained to be 2·66.

Melilite-Basalt.—Associated with the nephelinite is the basaltic rock of the small conical hills referred to above. This is dark grey compact basalt, with porphyritic olivine and sometimes porphyritic augite. It has a sp. gr. of 3·15, and dissolves to a large extent in HCl. Microscopically, it is seen to consist of crystals and grains of olivine in a groundmass of crystals of melilite, accompanied by perofskite or picotite. It contains no felspar, neither do we detect nepheline. Nepheline, however, occurs in rocks in such a form as often to be only recognisable by chemical methods, and hence it would perhaps be unsafe to assert its total absence here. The melitite is the most interesting element, as we believe it has not been recorded previously in Australasia. It seems to occur only in one generation, and in thin section yields two forms—the prismatic vertical and the transverse section of the prism. The boundaries of the prism are imperfect, showing crenulated contours, and the elongated sections show a peculiar mid-rib or median line, often beaded, sometimes repeated as several vertical lines when the crystal is broad enough. According to Dana,* the peg structure of melilite, which consists of parallel peg-like inclusions passing from the base inwards, is not always easily seen. We have not seen it in the Hunterston rock, nor in our slices of melilite basalt from the Capo di Bove, near Rome, and from the Hochbohl, Württemberg. The transverse sections of the mineral in our rock have the grey interference colour of felspar, from which, however, they can easily be distinguished by their crenulate contours and isotropism in basal sections. They are mostly, but not always, water-clear, while the longitudinal sections show a prevalent granulation of the substance of the mineral. There is none of the blue interference colour, which is sometimes seen, for instance in the Hochbohl rock. Dana regards melilite as crystallising in lieu of plagioclase, but Rosenbusch† mentions the fact that while augite and melilite exist in the rock in varying proportions, their sum remains constant, and that consequently melilite takes the place of the augite, and not of felspar. He correlates melilite-basalt with the trachydolerite-limburgite series. Short prismatic and granular microlites are abundant; these are probably augite; nevertheless, the structure is holocrystalline. There are numerous minute octrahedra and grains of a highly refractive dark or imperfectly-translucent mineral, which may be spinel or perofskite. In one section we have observed a yellow garnet.

* A Text-book of Mineralogy, E. S. Dana, 1898, p. 427.
† Elemente der Gesteinslehre, H. Rosenbusch, 1898, p. 359.

We have noticed an extremely fine grained variety in which augite is dominant in the porphyritic form as well as granular. This would appear to be an intermediate or aberrant form tending towards the nepheline melilite basalts.

The families of nephelinite, nepheline-basalt, and melilite-basalt are separated by Rosenbusch decisively from ordinary basalts, with which, he says, they have no sort of relation. He groups the three first-named families genetically together, bound to each other by ties of geological valency and association, and forming an integral volcanic or effusive formation, which (with the trachydolerites, tephrites, leucite rocks, limburgites, and augitites) belongs to theralitic magmas.*

We may here add that we have not yet detected nepheline in any of the other Tasmanian basalts. The crystals formerly attributed to nepheline in the Tertiary olivine-basalts of Northern Tasmania have always seemed to us to be so invariably associated with longitudinal sections of apatite as to make it probable that they were the hexagonal transverse sections of the same mineral. A similar confusion seems to have occurred with respect to the Tertiary basalt of Phillip Island, Bass Straits. In a letter recently received from Prof. G. H. R. Ulrich, of Dunedin, he informs us that the late Mr. Cosmo Newberry, not long before his death, analysed the so-called nepheline of that rock and found it to be apatite. One would, however, expect nepheline-basalts to be associated with nephelinite, and it is highly probable that the Shannon district will still be found to yield those lavas.

Viewed from a mining point, these peculiar basaltic rocks do not offer anything particularly encouraging. As they are unique in Tasmania, there is little use in comparing them with mineral-bearing rocks in other parts of the island. The few localities in the world where such rocks are known to occur are not noteworthy as mining ones. The rocks are altogether incongruous with the notion of tin ore occurring in them; and though gold is not intrinsically an impossible metal, distributed in excessively small quantities as in some other eruptive rocks, such as the Port Cygnet phonolitic trachytes for instance, yet payable gold is, so far as we are aware, entirely unrecorded from this family of stone.

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* *Ibid.* p. 352.

THE TASMANIAN ABORIGINES.

By James Backhouse Walker, F.R.G.S.

To anthropologists the aborigines of Tasmania presented an exceedingly interesting object of study. Professor Tylor had remarked that in the tribes of Tasmania, only just extinct, we had men whose condition had changed but little since the early Stone Age, and whose life gave us some idea of the earliest prehistoric tribes of the old world, the Drift and Cave men of Europe. It is therefore much to be regretted that so little information remains respecting the Tasmanians in their wild state. The early voyagers, especially the French, did their best with the opportunities they had in casual meeting with the aborigines, and have left us exceedingly interesting and valuable accounts of their observations. But their visits were too short and their acquaintance with the natives too superficial to allow them to gain any intimate knowledge of native customs, or ways of life and thought. They could at most note down a few noticeable external characteristics.

During the early years of the Colony, when the blacks were, on the whole, friendly, no one thought it worth while to take the trouble of studying their ways, or of making any attempt to investigate their tribal customs. If they had been as picturesque as the Red Indian or the Maori, we should probably have known a great deal more about them. But the scientific study of anthropology had not then begun, and the blacks were so low in the scale of civilization that they were deemed unworthy of attention. For no one then recognised that it was the very fact of their being at the bottom of the scale that would have made a thorough knowledge of their ideas of such interest and importance.

Even after the aborigines were imprisoned on Flinders, when such opportunities lay close to the hand of Dr. Milligan and others, it is sad to reflect how little was done. A vocabulary by Milligan, a paper by Davies, and some observations collected by Backhouse and others, are almost the sum total.

G. A. Robinson was probably the only man who thoroughly understood the aborigines. He could have supplied valuable information as to their tribal usages and ways of thinking, yet, so far as I know, he has not left behind him even the briefest account of the people for whom he ran such risks, though there are still preserved in the Chief Secretary's office very voluminous reports of his expeditions. Robinson told my father many years ago that he had a large quantity of MS. respecting the aborigines, which he intended to publish.

I have in my possession a letter dated from Prahran, Widcombe Hill, Bath, England, March 19, 1864, written by Robinson to the late Mr. Witcomb, in which he says :—" I am now arranging my papers (the vocabulary included) for publication." The papers were never published. Robinson died at Bath, somewhere before 1870, I think; and there is, I suppose, not the least hope of recovering a MS., which would be highly interesting.

The information which has been preserved respecting our native tribes is scattered through scores of books and articles, including casual references in voyages, histories, public documents, and transactions of scientific societies. Many of these works are scarce, some of them almost impossible to obtain. The time and labour required to explore these various sources would be greater than any one but an enthusiast could afford. It is true that West has given an excellent condensed account of the natives in his " History of Tasmania," but it is imperfect, and he cites no authorities. Mr. Bonwick's two books " The Last of the Tasmanians" and " The Daily life of the Tasmanians," deserve more than a passing mention. In these two works the author has collected a great mass of information respecting the history and customs of the aborigines. Every one must recognise the immense service he has done in preserving so much that would otherwise have been irretrievably lost. But excellent and valuable as is the "Daily Life" as a popular and readable account of our native tribes in their original state, it cites no authorites, and does not pretend to strict scientific precision. Brough Smyth's account is more critical, but it is meagre.

When, therefore, in 1890, Mr. H. Ling Roth published his work, "The Aborigines of Tasmania," he did no inconsiderable service to anthropology. Mr. Roth devoted infinite pains to ransacking in every likely corner, so as to gather together every scrap of first-hand information, no matter how fragmentary, about the aborigines. At the end of his book he gives a list of some 114 works, from which he has made extracts. These extracts he has carefully digested and arranged according to subject, with references to the original authorities in all cases. The result is that the student has before him, in a carefully systematised form, everything that is known about the Tasmanian Tribes, and one's first feeling is one of surprise that so much information could have been got together. The first edition was rapidly exhausted, and soon commanded a greatly enhanced price. For the last nine years Mr. Roth has been engaged in making further inquiries and searches, and has during that time been able to amass a considerable amount of new matter, and to correct a number of defects in the book. He has now issued a new edition, handsomely illustrated, and in it we have at last a complete scientific account of our native tribes derived from the original first-hand sources. The work is faithfully and conscientiously done, and the book is in every respect an admirable one. It throws a new light on the aborigines and adds largely to our knowledge of them, enabling us to fix more accurately than has hitherto been possible, their place in the scale of humanity.

Mr. Roth's method of bringing together into a focus all the various statements with respect to any one subject is of great value, since it enables us to weigh these statements against each other, and, in so doing, to reject not a little which is either plainly erroneous or not supported by adequate evidence. This process of elimination has an interesting result. It tends to strengthen our idea of the extraordinarily low state of development which our Tasmanian natives had reached.

We find that in popular accounts they have been credited with a skill and knowledge in various matters, which it is now well-nigh certain they derived from contact with other races, and of which, in their original condition, they were ignorant. Some instances may be given of imported arts which Bonwick, West, and others, even including such a cautious writer as Brough Smyth, have accepted as originally known to the Tasmanians. I may mention the reputed manufacture of ground stone implements, the use of handled implements, of the womera or throwing-stick, and of bone-pointed or jagged spears, the making of different patterns of baskets, the alleged use of the firedrill, and the drawings attributed to them. In all these matters the evidence collated by Mr. Roth goes to show that any knowledge they may have had of these things was acquired after they had come into contact with Australians or Europeans.

Several of these errors in attributing to the Tasmanians implements which they did not know in their native state have arisen from the carelessness or ignorance of observers, some of whom might have been expected to know better, notably G. A. Robinson and Dr. Milligan.

Ground Stone Implements.—This is a typical instance, and will suffice to cover the whole ground of implements distinctively Australian which have been attributed to Tasmanians. In Dr. Barnard Davis's collection are three ground stone implements labelled "Tasmania. (G. A. Robinson)." They were presented by Robinson to Milligan, and by Milligan to Dr. Davis. These are precisely of the kind used by the Australian blacks, and Dr. Tylor has shown conclusively, in a paper read before the British Association, that they were made either by Australians, or by Tasmanians who had learnt the craft from them. The bringing over about 1819 of the Sydney black "Mosquito" (who acted such a mischievous part in leading our natives in their attacks on the settlers), and also the introduction of a "tame mob" of Sydney blacks in 1822, sufficiently account, says Dr. Tylor, for this influence from the mainland. The same influence accounts for handled stone implements, bone-pointed and jagged spears, womera, and various other Australian weapons which have been attributed to the Tasmanians. It may be taken as conclusively proved that the

Tasmanians originally knew nothing of ground stone implements belonging to the Neolithic Australians. As Tylor remarks:—"The Tasmanians were undoubtedly at a low palæolithic stage, inferior to that of the Drift and Cave men of Europe."

Baskets.—In his first edition Mr. Roth figures three patterns of baskets as made by the Tasmanians. One of these, presented by Dr. Milligan to the British Museum, is of the ordinary pattern of very simple construction, of which there are several examples in our Museum, and which are undoubtedly Tasmanian. The other two were presented by G. A. Robinson to Dr. Davis. They are of different and more complicated patterns, and of forms very common in Australia. Whereupon Mr. Roth remarks that these baskets are doubtless Australian: that Robinson was for some time protector of the aborigines in Victoria, and was so unobservant that he did not distinguish between baskets of Tasmanian and Victorian workmanship.

Mode of Obtaining Fire.—A more interesting question, and one which must be considered as still open, is—How did the Tasmanians obtain fire? The early voyagers, seeing rough stone implements resembling flint at the camping places, jumped to the conclusion that the natives obtained fire by percussion of flints. This supposed method may be dismissed from consideration, and the question resolves itself into an inquiry as to how they obtained fire by the usual savage method of the friction of two pieces of wood. Mr. Roth, in his first edition, figures a firedrill (p. xi.) from a specimen labelled as Tasmanian, and presented by Dr. Milligan to Dr. Davis. In the second edition he figures two firedrills, viz., the one above-mentioned and another presented by G. A. Robinson to Sir John Lubbock. Now, R. H. Davis, who wrote a valuable paper on the Blacks, whom he knew after their captivity on Flinders, states that he was *informed* that they used a drill for obtaining fire. The drill method, in which a drill is rapidly revolved between the hands, is in use among some Australian tribes, as it is or was among the South African Bushman tribes, but there is no direct evidence that it was known to the Tasmanians. There is evidence, however, derived from the statements of early settlers, that our blacks obtained fire by the friction of a stick rubbed rapidly up and down a groove in another piece of wood, in the fashion commonly practised in Polynesia. Mr. Roth discusses the subject in an appendix, and inclines to the opinion that probably the groove method was practised by the Tasmanians, and that if the drill method was ever employed by them at all, it was learnt from the Australians.

Drawings.—Peron, in the French expedition of 1802, saw at Maria Island pieces of bark with marks like the gashes which the blacks made on their bodies. Dr. Ross says that at the Ouse he saw squares and circles cut on bark, which he, with some probability, attributed to the blacks. Robinson told Bonwick that on the West Coast, in 1831, he saw drawings of men and women and curious hieroglyphics. West speaks of drawings on bark representing a bullock team and cart, made by natives in the North-West. This is apparently copied from Bunce, who states that one of the V.D.L. Co.'s servants reported having seen such a drawing on a bark hut or shelter of the natives. Calder, who is a most reliable authority for anything which he says he himself saw, in his account of a journey between Lake St. Clair and Macquarie Harbour, in November, 1840, states that on Painter's Plain, near the Surprise River, he found two native huts recently abandoned, on the bark of which were some extraordinary drawings in charcoal of men, kangaroo, dogs, and other figures. Also a battle-piece —a native fight. (J.A.I., p. 21.) At first sight this seems conclusive evidence, but, on turning back to the previous day, we learn that he had then found several articles which indicated that a runaway party of convicts from Macquarie Harbour had passed that way. In any case these drawings were found 40 years after the advent of Europeans. That the aborigines in their wild state had any skill in drawing seems therefore to hang on a very slender thread of evidence.

Canoes.—The native canoes were formed of bundles of bark lashed together with grass or vegetable fibre. Several models of such canoes are preserved in our Museum. It is generally stated in popular accounts (and is quoted by Brough Smyth) that they had also catamarans or rafts, formed of logs 30 feet long, and fastened by cross-pieces tied with bark. The only authority for this statement is Jeffreys, who says that, with the aid of paddles, they made these rafts skim over the water with amazing rapidity. No one else mentions either paddles or rafts.

Fish.—Another point somewhat doubtful is whether the blacks ever ate scaled fish. It is known, of course, that shell-fish formed a considerable portion of their food at some seasons, and that they had no hooks or nets, or other method of catching fish, except spearing them. Lloyd says that they used to spear stingrays for sport. Cook (i. 100) relates that when fish, raw or cooked, was offered to them, they rejected it. No remains of fish have been found about their camps or in their shell heaps. It seems more than probable that they never ate fish, but any information on the point would be valuable.

Clothing.—The chapter on aboriginal clothing is very like the celebrated chapter on snakes in Iceland. The early voyagers describe the aborigines as absolutely unclothed. It is true that some of the women carried a kangaroo-skin slung across their backs, but Cook (i. 101) thought that this was not for clothing, but simply as a means of carrying an infant more conveniently. After intercourse with Europeans they used, at times, to wear skins as a covering. It is certainly strange that in a climate at times so severe as that of Tasmania, with a plentiful supply of skins at hand, they had not learnt to use them as a protection from the weather. That they never learnt to sew skins together for clothing is one of the strongest proofs of their low intelligence, and that they were on a lower plane than the palæolithic Drift and Cave men of Europe, who had bone needles. Yet, though apparently so absolutely wanting in originative or inventive faculty, they showed in their captivity no want of intelligence or capacity to acquire such comparatively difficult accomplishments as reading and writing.

Implements.—There is probably still something to be learned respecting the chipped stone implements of the aborigines. It has usually been assumed that they were of one general form, but I understand that Mr. J. P. Moir, of the Shot Tower, has a number of concave scrapers, and also of gravers, to which he gives the descriptive name of "duck bills." As these are apparently of forms hitherto unrecognised, it would be interesting to have them examined. A few weeks since I accompanied Mr. R. M. Johnston and Mr. Morton on their examination of a native quarry, which was discovered by Mr. Harold Bisdee on the Hutton-park estate, near Melton Mowbray. We found about an acre of ground covered with chippings of chert, showing that it must have been for a very long period a place resorted to by the aborigines for procuring their stone implements. An interesting circumstance was that we found a number of rounded nodules of greenstone (mostly broken) which had evidently been used by the natives for splitting off the flakes of chert, that were afterwards, by careful chipping, shaped into stone axes That the natives had stone implements other than those commonly recognised as such, appears to be highly probable. Mr. Norton Smith has described to me large stones, discovered by him on the North-West Coast, which, in his opinion, bore evidence of human handiwork, but for what purpose they were shaped was doubtful. On our trip to Hutton-park Mr. Bisdee showed us an interesting relic of the aborigines still standing near Tedworth, Constitution Hill. This is a dead tree which still bears the marks of the notches which the black women were accustomed to make to assist them in climbing for opossums. I believe Mr. Morton intends to have this tree removed to the Museum.

Origin.—The question of the origin of the Tasmanians is still an open one. They appeared to belong to the most primeval races of mankind, and to be derived from the same original stock as the Papuans and Melanesians. Indeed, it has been suggested that from this primitive stock (perhaps resembling the Mincopis of the Andaman Islands), both the Melanesians on the one hand and the African negroes on the other, took their origin. It is surmised that they reached Tasmania by way of Australia, and that this palæolithic, woolly-haired negritic stock once peopled the whole Australian Continent, until dispossessed, and probably annihilated, by the present neolithic Australians, characterised by their straight hair and the possession of ground stone implements, the boomerang, throwing-stick, and shield. But on this subject my friend, Mr. R. M. Johnston, may probably have something to say.

Languages.—In concluding these notes, I may mention that an interesting feature in Mr. Ling Roth's Book is a full vocabulary of native words, reduced to a scientific method of spelling, in place of the anomalous and absurd fashion of spelling at present in vogue. It is to be hoped that Mr. Roth's method will secure acceptance. I commend it to the notice of the Lands Office.

Tribal Map.—The book also contains a map, in which the native names of places are shown in red, and an attempt has been made to indicate the main tribal divisions. This is, of course, to a certain extent, conjectural, but it is useful.

The main object I have had in view in writing these Notes is to get the members of the section to interest themselves in obtaining from old settlers and others information respecting the points referred to. That such an attempt is not hopeless, even at the present time, I have reason to know. I recently obtained from two old settlers some most interesting particulars respecting the native method of obtaining fire, which go a long way towards solving the question, and it is quite possible that further inquiry in different parts of the Island would elicit more information. I should like to see the section form a collection of all the portraits of the Aborigines which are in existence. Such a collection would be valuable and interesting, more especially in years to come.

ON THE OCCURRENCE OF A NEW SPECIES OF GARNET AT PORT CYGNET.

By W. A. Macleod and O. E. White.

(Plate.)

The Igneous rock containing this Garnet as a constant accessory constituent, occurs as an outcrop about 6 feet wide on the beach between Port Cygnet and Lymington.

It is intruded between other volcanic rocks, and, as far as could be ascertained from a hasty examination, seems to be the only exposure in this locality. From fossils found it is probably contemporaneous with the Permo-Carboniferous sediments.

The microscopical and chemical examinations of the rock point out its relationship to the Trachyte family, examples of which are so plentiful in this district, and which have been fully described by Messrs. Twelvetrees and Petterd.* Many of the varities of Trachyte mentioned by them have melanite garnet as an accessory constituent.

The percentage of $Si\,O_2$ in this rock does not run very high for a Trachyte, being as low as 55·87%. Trachytes proper often include as much as 62%—64% of Silica.

The Garnets of a brownish-yellow tint are scattered abundantly through the rock, and crystals with well developed trapezoidal faces, measuring sometimes over a quarter of an inch diameter, are plentiful.

Dana (System of Mineralogy, p, 272) says "Garnets containing protoxide of iron often become rusty and disintegrated through the oxidation of the iron, and sometimes are altered more or less completely to limonite, magnetite, or hematite."

These remarks apply to the mineral in question, which, where accessible to the weather, has lost its lustre, and, in many cases, dissolved away. Pseudomorphs (after garnet) of a yellowish-white metallic mineral (undetermined) occur. These are probably iron pyrites.

* On Hauyne Trachyte, &c., in districts of Port Cygnet. Proc. Royal Society, Tas., 1899.

Comparing the analysis of the mineral with the published analysis of the different species of garnet, it will be seen that this is a new variety. In no other recorded types do the oxides of Mn., Mg., and Ca. bear the same proportion to each other, with the exception of some Iron Alumnia Garnets, and there the percentage is much lower, being only between 3°/o and 4°/o of each base.

The Specific gravity =
Hardness = 7·5. Fusibility = 3·5 about.

I. Analysis of massive Garnet from Brazil.
II. ,, ,, Garnet, Port Cygnet.
III. ,, ,, Trachyte ,,

	I.	II.	III.
SiO_2	37·23	36·87	55·87
Al_2O_3	15·22	7·28	18·21
FeO	26·76	17·12	8·01
MgO	3·14	12·49	·46
CaO	4·31	11·98	4·54
MnO	3·40	13·68	2·61
Na_2O	...	...	3·36
K_2O	...	...	5·75
Ignition loss	...	00·29	2·28
		99·71	101·09

Macroscopical characteristics of Garnet Trachyte. Bluish-grey in colour on a fresh fractured surface, studded with crystals of garnet.

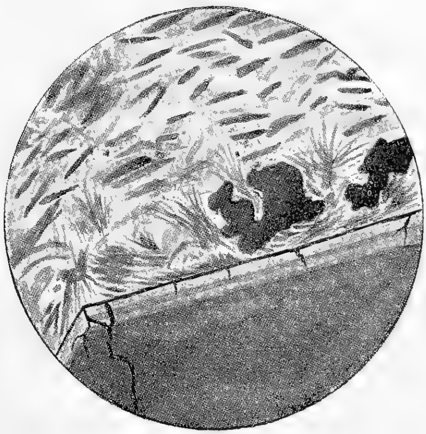
Microscopical characters.—The holocrystalline ground-mass is made up of lath-shaped sanidine felspars, the interspaces being filled with brown mica. No Plagioclase seems to be present, or if so, is difficult to distinguish from the sanidine. Carlsbad twins, as well as single individuals, are plentiful. Fluxional arrangement of the felspars is evident.

Sanidine also is present as phenocrysts, having both tabular and columnar habit, and in some cases shows a zonal tendency. Decomposition of some of the crystals has set in with alteration to muscovite.(?)

The ferro magnesian mineral is a brown Biotite without idiomorphic character. It is strongly pleochroic. Magnetite is sparingly scattered through the ground-mass, and appears to have resulted from the decomposition of the mica, generally accompanying the latter.

The Garnet is in well formed crystals, distributed somewhat unevenly through the rock, colourless in transmitted light. Zonary banding is present, and in many cases augite is enclosed. On the edges of the section brush-like aggregates of a brightly polarising mineral occur. These, we think, may be referred to the soda pyroxene Ægerine.

To this new species of garnet we propose to give the name of "Johnstonotite" as a slight token of our appreciation of the valuable, and in many cases, arduous work done by Mr. R. M. Johnston, in the Geology of this Island.



3.

NOTES ON A "FAYALITE BASALT" FROM ONE TREE POINT.

By O. E. White and W. A. Macleod, B.Sc. B.A.

The rock on which these notes have been written occurs as a basaltic flow in a small promontory, on the far side from Hobart, of Sandy Bay.

The geological age of basaltic flows and tuffs is given by Mr. R. M. Johnston (Systematic Account of the Geology of Tasmania, p. 249 *et seq.*) as being younger than the tertiary leaf-beds, and from the occurrence of this rock and its associates, sections of which can clearly be seen on the Brown's River Road, there seems to be no reason for doubting that the age ascribed is approximately correct. The average thickness of the flow is on the exposed section about nine feet, and the extent of the sheet, as far as it can be traced, is not great. (*Ibid.*, p. 281.)

This paper has been written rather to give an account of the peculiar Petrographical character of this rock than to attempt a description of its geological occurrence, and further, such an attempt would only be a trespass on ground already well worked.

In the title the name "Fayalite Basalt" has been used as descriptive of this rock. This term may be open to some criticism when we consider the definitions given by the leading authorities of the term "Basalt." For example, Rosenbusch defines basalt as a rock consisting essentially of olivine, augite, and plagioclase, and regards such rocks as the tertiary and recent equivalents of olivine, diabase, and melaphyre. This rock will answer the requirements as to geological age, but not those relating to mineralogical constituents, for in some seven sections examined not a trace of augite was discovered. Olivine exists as the red variety Fayalite (FeO, SiO_2), and plagioclase felspar, probably as labradorite. This peculiar mineralogical composition involves almost a total absence of magnesia, and this absence is confirmed by chemical analysis, the result of which is given below. From a structural point of view the term "Fayalite Basalt," seems to be justifiable. The terms "Dolerite," "Anamesite," and "Basalt" are here applied respectively to the coarsely textured, finely textured, but still visible to the naked eye, and the very finely textured or microscopic varieties. This rock, then, would preferably be classed as a basalt as regards texture, though the fayalites are just visible to the naked eye. Briefly, therefore, this rock is a basalt in which fayalite has replaced augite and olivine. Macroscopically, the rock is of a dark, compact appearance; fracture, conchoidal. The fayalite crystals are just visible as small dark red spots, which stand out clearly under an ordinary hand lens. The specific gravity obtained by weighing in air and water, of two specimens is 2·81. According to Von Lasaulx the specific gravity of basalt varies from 2·80 to 3·00.

The following is a chemical analysis of an average specimen of fragments taken from the upper, middle, and lower zones of the flow, care being taken to avoid weathered fragments :—

SiO_2	47·21
Al_2O_3	16·06
Fe_2O_3	11·87
FeO	4·43
CaO	7·34
MgO	·12
K_2O	2·40
Na_2O	7·51
Ignition Loss	2·55
Total...	99·49

From the nature of the case, that is on account of the gradual merging of different varieties of rocks, it is difficult to state definitely a typical average analysis of Basalt, but most analyses show MgO in considerable quantity, say, from two or three to seven or eight per cent., and in several analyses of this rock only traces of MgO were obtained. This would point to the olivine mineral being true Fayalite, that is, FeO, SiO_2. Not having material for Specific Gravity solutions, we were unable to separate any of the fayalite crystals and confirm this point, but trust, at some future time, to investigate this matter, and bring the results of our investigations before the Society.

The following is a brief account of the microscopic characters displayed in thin section by this rock :—The most striking mineral under the microscope is Fayalite, which appears in crystals and grains of a beautiful orange-yellow colour in ordinary transmitted light. In thicker sections the tint deepens to a fine red. In the majority of cases the Fayalites exhibit crystalline outlines, the prismatic form predominating, and giving excellent longitudinal and cross sections. Here and there occur patches of Fayalite exhibiting no discernable crystalline outline. In length the crystals vary from 0·5 m.m. downwards. The inclusions visible under a high power (one-sixth inch) appear to be apatite and needles of felspar, and perhaps glass, though, on account of their minute dimensions, it is difficult to obtain good extinctions under crossed nicols.

Under crossed nicols the Fayalites exhibit the ordinary interference colours and the normal extinction of rhombic crystals. Pleochroism is not noticeable.

We have noticed neither augite nor olivine in any of the sections examined, and most probably these are entirely absent in this rock. Apatite was mentioned above as occurring in the Fayalites. It is also found here and there in the base as long needles of a faint violet-brown tint, and exhibiting pleochroism from a very faint brown tint to a deeper violet-brown (E $\gt$ O). On treating a section with hydrochloric acid the apatites slowly dissolved out, leaving the glass slip visible underneath. The Fayalites were also attacked, though less rapidly.

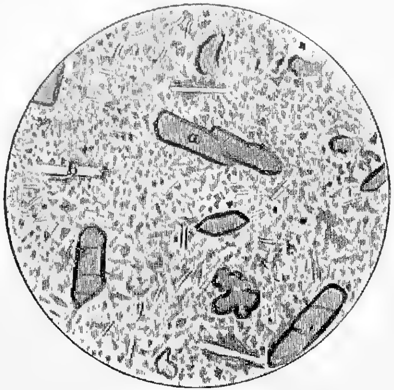
The base consists of a ground-work of glass, penetrated with needles and fine laths of felspar running in all directions, the whole being thickly dusted with grains of magnetite. The felspars exhibit extinction angles, varying from 40° to 48°, which, according to Michel Levy's table for microlites, indicates a basic felspar, probably labradorite or anorthite. The percentage of lime (7·34°/$_o$ CaO) in the analysis, and also that of the alkalies, some 9°/$_o$, point to the felspar being labradorite (in which the proportion of alkalies to lime is approximately one to three) mixed with a little andesine or some more acid felspar. This supposition is based on the assumption that the base is of the same composition as the microlites of felspar,—a somewhat doubtful hypothesis.

This rock appears to have followed the normal order of consolidation,—the apatite and magnetite consolidating first, then the Fayalite and felspars. It is difficult to determine exactly the relation of the Fayalite to the felspar microlite, for, included in the Fayalite crystals, appear thin rods, which in some cases are glass, but in others are doubtful, on account of the difficulty of obtaining good extinctions under crossed nicols. All the microscopic characteristics point to the conclusion that it consolidated quickly, and under little pressure. Sections were taken from both the top and bottom of the flow to determine if there was any difference in these two regions, but the results were disappointing, and it would clearly require a flow of much greater thickness to give any distinct points of difference in crystallisation due to pressure. This rock appears to stand the influence of the weather and sea, and little sign of decomposition was noticed in any of the sections, though here and there, in some of the more weathered sections, traces of some chloritic mineral were seen. If occurring in larger flows it would no doubt make a good stone for such purposes as the foundations of buildings, road-metal, &c.

Appended are two water-colour drawings of Sections—

No. 1. Low power ($\times$ 50) showing (*a*) fayalite crystals; (*b*) apatite crystal. The relative proportions of Fayalite and base are here shown.

No. 2. Shows a fayalite crystal under a higher power ($\times$ 300). The small rod-like inclusions are here shown; also the character of the felspar microlite and magnetite grains in the base. Both drawings are taken under ordinary light.



1. x 50

2. x 300.

A TASMANIAN SPECIES OF HALYSITES.

(By R. Etheridge, Jun., Curator of the Australian Museum, Sydney.)

Mr. Thomas Stephens, M.A., F.G.S., has been kind enough to afford me the opportunity of examining a Tasmanian species of *Halysites* from the River Mersey, between Liena and Mole Creeks. Unfortunately, it has undergone so much alteration by secondary replacement that specific identification is rendered very difficult and uncertain.

In 1862 the late Mr. Charles Gould published a report on "Macquarie Heads," giving a list of fossils from the Gordon River Limestone, and mentioned, amongst others, a species of the genus in question.

Mr. Stephens has favoured me with the following extract from the report in question—"The following are the observations* which I made at the last meeting of the Royal Society with regard to the fossils contained in this limestone:—'In these rocks fossils are abundant; they are only conspicuous, however, in that portion of the beds exposed to the action of running water. It is exceedingly difficult to ascertain their presence on a fractured surface, although they may be abundantly concealed in the specimens, and the ordinary atmospheric agencies appear to simply disintegrate the rock without causing the specimen to be exposed in relief, as is the case with many of those upon the table. Hence it follows that the ground for collecting fossils is limited to the surface of the rocks, between the level of the water and about 30ft. above it, the greatest heights to which floods attain—as might be anticipated. The different beds or zones in the formation are not equally fossiliferous, nor do they contain identical species, one part being conspicuous for the abundance of corals, another of univalve shells, while a third is characterised by containing abundant fragments of large chambered orthocerata, etc. I shall briefly enumerate a few of the most striking, characteristic, and best preserved forms:—

Orthoceratites	2
Lituites	1
Halysites	1
Favosites	2
Raphistoma	1
Orthis	1
Rhynchonella	1
Euomphalus...	2
Murchisonia...	3

* Macquarie Harbour—Report of the Government Geologist to Parliament, 29th July, 1862. *Tasmanian Parliamentary Papers, 1862.*

'The collective evidence of these fossils is unmistakable. They are all Silurian, and some of them, especially the Raphistoma and one species of Murchisonia, are Lower Silurian types.

'The lithological character and associations of the strata east and west (that is, across the strike) of this formation is the only evidence of their age, no fossils having yet been discovered in any other of the group of formations comprised in the western country, except the Silurian mudstones, etc., of the Eldon River. There can, however, be little doubt that they are none of them later than Silurian, while some are evidently referable to the very earliest epochs.'"

To this extract Mr. Stephens adds the following note:—"This is an extract from a Parliamentary Paper containing Mr. Gould's Report on the geology of the country east of Macquarie Harbour, including the limestones of the Gordon River. The passage marked by single inverted commas appears to have been read at a meeting of the Royal Society, but is not printed among its papers."

In Mr. Stephens' specimen, the fasciculo-reticulate corallum measures two and a half wide by three inches long. The intersecting reticulations, or fenestrules, as in the recently described *H. australis*, mihi,† are variable in size and shape, but again, as in the latter, are round, oval, transversely elongated, irregular, or polygonal (hexagonal and pentagonal), varying in size from six millimetres by four, up to eleven by eight millimetres, and even twenty-five by three, with intermediate gradations, and a like variability in the angles of junction of the various plates comprising the corallum. As a rule, the reticulations are longer in one direction than the other, but this does not always hold good.

The coral is exposed on the weathered surface of a piece of limestone, and only in a few places can the inner surfaces of the plates be seen, where they project above the surface of the matrix, and are covered by Beekite rosettes. This alteration and weathering have so far destroyed the finer points of structure that it is not possible to ascertain the number of corallites with accuracy in any one interstice, but sufficient remains to indicate that they were numerous. In a few instances the inter-corallite walls are still visible; these are trenchant and narrow, leaving no room for the presence of interstitial corallites, similar to those of the well-known *H. catenulatus*, Linn. The whole of the corallites seem, therefore, to be "normal," and indicate that we are dealing with a species of the *H. escharoides* group, as distinguished from those forms in which there are both normal and interstitial corallites, typified by the species first mentioned.

† Rec. Austr. Mus. 1898, iii, No. 4, p. 78.

These normal corallites, in the present specimen, average one millimetre in length, in the direction of the chain.

The alteration that the tissues have undergone is even of a more rigorous nature than that described by me in *Halysites australis.* The walls are thickened, in places inordinately so, the original tissues where visible being composed of grey or brown sclerenchyma, but for long distances, several millimetres in fact, the entire wall is replaced by blebs of chalcedonic quartz that have quite destroyed the original matter. At times, although much less frequently, the inter-corallite walls are similarly effaced, but the tabulæ never. In one particular corallite this thickening has progressed so far as to practically reduce the visceral channel to a mere narrow tube, and another has been similarly reduced by chalcedonic blebs.

In a horizontal section prepared for the microscope, where least alteration has taken place, the corallites are seen to be oval in outline, the inter-corallite walls apparently stout and solid, and without any definite proof of the presence of interstitial corallites in them, a very important feature in the structure of *Halysites.* Here and there are traces of the cut edges of tabulæ, and scattered around the edges of the visceral chambers small round bodies are not infrequently seen, of the same colour and texture as the sclerenchyma of the walls. These have a very suspicious resemblance to the distal extremities of septa protruding through the infilling calcite from a lower level, as is so frequently seen in corals of a Favositoid nature. In more than one instance, I believe I can detect a process protruding more or less horizontally from the wall just as a spiniform septum should. There is some reason to believe, therefore, that we are here dealing with a septate form, and consequently, in the additional absence of interstitial corallites, with one allied rather to *Halysites escharoides* than *H. catenulatus*, for in these two points lie the great distinction between the species in question.

In a vertical section, similarly prepared, I have also quite failed to detect any interstitial corallites. The tabulæ are well developed and complete, concave, and from three to four in the space of one millimetre.

The conclusions I am led to by an examination of this coral, and making all allowance for its state of preservation, are—(1) That it is distinct from *Halysites australis*, mihi (2) that it appertains to the group of *H. escharoides*, rather than to that of *H. catenulatus*; (3) whether it is identical with the European *H. escharoides* is a more difficult question to answer, but I am inclined to think not.

This last opinion is based on the much greater size of the reticulations formed by the laminæ, and a laxer form of growth, in this respect corresponding to *H. australis.* This alone, however, cannot be relied on for specific separation, for in the American form ascribed to *H. escharoides* by the late Prof. James Hall,‡ these particular features differ very greatly from those figured and described in typical European examples by Messrs. Milne-Edwards and Haime.§

Under these circumstances I refrain from passing any positive opinion as to the coral's specific identity until I have had an opportunity of examining better preserved examples.

‡ Pal. New York, 1852, ii. t. 35.

§ Brit. Foss. Corals, Pt. 5, 1854, p. 272, t. 64, f. 2 and 2a.

NOTES ON A FOSSIL WOOD FROM COX'S BIGHT.

By W. A. McLeod, B.A., B.Sc.

There being, so far as I can ascertain, no description or notes in the Papers and Proceedings of the Royal Society of Tasmania on replacement fossils of wood by iron pyrites, it seems to me not out of place to record some observations on an interesting specimen of this nature from the locality of Cox's Bight, and kindly placed at my disposal by Mr. Alex. Morton.

This specimen was discovered in the tin deposits at Cox's Bight.

In appearance it is rather deceptive, and at first sight its upper half seems like graphite, being of a dull greyish-black colour. The streak also would be apt to deceive, being somewhat like that of graphite. The extension of the upper half is smooth, showing a slight longitudinal graining, whilst on the ends traces of the original fibres of the wood may be seen. The upper half is united to the lower in a very distinct manner, just as if the two pieces had been cemented together. The lower and larger half is of an entirely different nature in certain respects to the upper. Its surface, though in a certain degree rounded, is rough, and has the appearance of a fragment of a holocrystalline rock of medium texture which has been subjected to friction in the bed of a river. Embedded in it can be seen by the naked eye small grains of quartz of a subangular and rounded nature. On fracture the two halves exhibit striking differences. In the upper half it may, perhaps, be best described as like that of a piece of charcoal wood, and being at right angles to the grain of the specimen, though of a slightly rough and uneven character, and the fresh face is of a metallic-grey colour. The lower half, on the other hand, presents a coarse hackly fracture like that of cast iron, and shows small embedded grains of quartz of a subangular nature. The colour of the fresh face is like that of the upper half, being a metallic-grey.

The total length of the specimen is about three inches, the width about three-quarters of an inch, the depth about one inch, the lower portion being larger than the upper.

The hardness of the upper half was rather difficult to obtain; the outer surface can be pared away with a knife like a piece of graphite, on account of the finely-divided state of the iron pyrites, but on fracture both the upper and lower portions have a hardness approximating that of iron pyrites (6 to 6·5)

The specific gravity of the upper portion when taken by weighing in air and in water is low, being 3·5 instead of 4·5, but on grinding to fine powder, and using the specific gravity bottle method, it is considerably higher. This difference seems to be due to the physical structure, and not to the chemical composition, which shows the upper half to be almost pure iron pyrites ($Fe. S._2$), and can no doubt be accounted for by the slightly porous nature of the mass, resulting from the original wood tissue being entirely replaced by sulphide of iron. The specific gravity of the lower portion is also slightly low, due to the inclusion of quartz particles.

The results of two analyses show the upper half to be almost pure $Fe. S._2$, with traces of $Si. O._2$, metals of the copper group, and, perhaps, some carbon, which latter were not determined, owing to insufficient material to operate on. The lower half gave 26 per cent. $Si. O._2$ and 73 per cent. $Fe. S._2$, with traces of the copper group. No assay of gold and silver was made on account of the smallness of the specimen, though it is probable that traces of these metals would be found.

The microscopic examination of this specimen is most interesting and instructive, and shows very clearly the exact nature and derivation, and throws light on the striking physical differences between the upper and lower portions. Using reflected light and a two-inch objective, the fibrous nature of the upper portion is clearly seen, and on the longitudinal surface these fibres, replaced by iron pyrites, appear closely packed together, and retaining remarkably well their original structure. The iron pyrites on the outer portion shows little signs of crystallisation, but towards the centre of the upper portion becomes more dense and semi-crystalline. On a freshly fractured cross section the structure of the upper half is seen in an even more striking manner than in longitudinal section. The ends of the fibres give circular cross sections and appear as a mass of very minute little rings closely packed together. These longitudinal and cross sections show conclusively the origin of the specimen, though I am unable to give the exact genus and species of the original wood, but perhaps some of the botanically-inclined members of the Society may be able to clear up this point. The lower portion exhibits none of these peculiarities either in longitudinal or cross section, and merely presents the ordinary appearance of massive iron pyrites with embedded grains of quartz of a subangular form, and is apparently purely a mineral deposit, though the adjacent organic matter probably had some part to play in its deposition from solution.

Appended are three water-colour drawings, No. 1 being that of the specimen as seen by the naked eye, a portion having been broken off for analysis; No. 2 a longitudinal view under reflected light with a two-inch objective; and No. 3 a cross section under the same power and light, both of the upper portion.

Fig. 1.

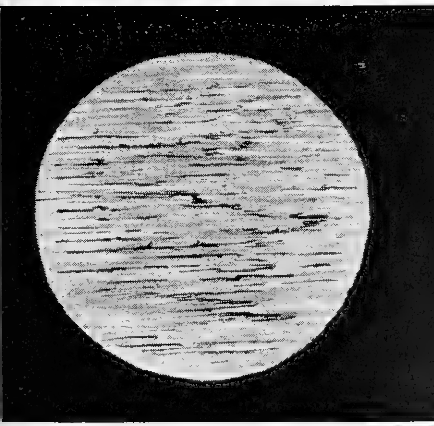


Fig. 2.

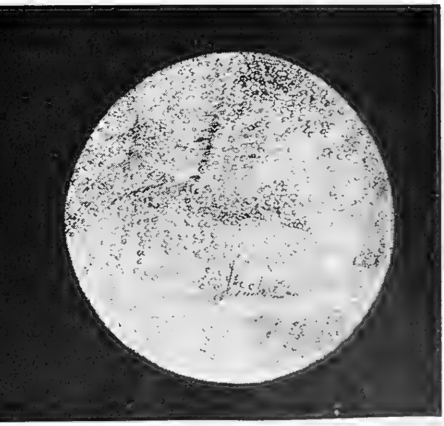


Fig. 3.

The history and chemical changes involved present a most interesting study. Neglecting all the complicate processes resulting in the formation of wood from the ingredients of the soil and air, the most important question that presents itself is: "How has a piece of wood become almost totally changed into iron pyrites, that is, a compound consisting of iron and sulphur, in the proportion of one atom of iron to two atom of sulphur?"

It is a well-known fact that iron pyrites can be precipitated from a solution of sulphate of iron by organic matter, and also from the higher sulphate of iron by carbonates, and it is most probably by the former reaction that this specimen was replaced. The wood, being organic matter, would be the precipitating agent, but there remains the presence of the lower sulphate of iron to be accounted for. This substance is often formed by the reverse process of that above described, that is, when iron pyrites is exposed to the action of air it becomes oxidised into ferrous sulphate, the conditions here being purely oxidising, and in the former case reducing. In many mining districts the waters are largely charged with this sulphate, and frequently large stalactitic crystals are obtained from the roofs of workings and drives. Some such occurrence probably caused the water percolating through the drift in which the piece of wood had become embedded to become charged with sulphate of iron which, on coming in contact with the wood, was reduced and iron pyrites was formed, which gradually took the place of the organic matter consumed in the reduction process. From the strong contrast between the upper and lower portions and from the sharp divisional line, it would appear that the wood had been lying loosely on a deposit of drift containing fine quartz, grains of subangular character, and that the lower half had been precipitated owing to the presence beneath the wood of perhaps decaying organic matter, and so had enclosed particles of the drift on which it was formed.

After these changes were completed, the specimen was altered in shape by physical agencies, as is evinced by the rounded water-worn character of the lower and upper portions. The original drift was probably cut into, and to a greater or less extent removed by the agency of water, and the accompanying attrition rounded off any sharp corners, giving a smooth, round aspect to the specimen, and finally the specimen was deposited in the locality where it was discovered.

It must be remembered that this short historical sketch only presents what seems the most plausible theory which has been presented by chemists and geologists to explain such occurrences.

ON THE GENUS KRAUSSINA IN TASMANIA.

By W. H. Twelvetrees and W. F. Petterd.

In 1852 the late Dr. Davidson established the genus Kraussia (which he afterwards altered to Kraussina) for a small terebratuloid brachiopod with diminutive arms and a very insignificant brachial support, consisting of two divergent lamellae or lateral processes branching off right and left from the median septum of the dorsal valve. The genus now accommodates seven species, all recent, viz.:—

Kraussina rubra, *Pallas*. Found off Natal and Port Elizabeth, South Africa.

,, Cognata, *Sowerby*. Found off Cape of Good Hope.

,, Deshayesi, *Davidson*. Found off Cape of Good Hope, 120 fathoms.

,, pisum, *Valenciennes*. Found off Cape of Good Hope, 150 fathoms.

,, Davidsoni, *Vélain*. Found at the Island of St. Paul, low water mark.

,, Lamarckiana, *Davidson*. Found at Port Jackson, N.S.W.; S.E. Australia; New Zealand; Mouth of River Tamar and in Long Bay, Tasmania.

,, Atkinsoni, *Tenison Woods*. Found Long Bay, South Tasmania, 10 fathoms.

Professor Deslongchamps has carried K. Lamarckiana and K. Davidsoni over to a sub-genus Megerlina, possessing two rudimentary septum processes underneath the calcareous forks supporting the brachial (or more strictly speaking, labial) appendages.

The two Tasmanian species have engaged our attention. The discovery of comparatively smooth individuals of what appear to be K. Lamarckiana at George Town, near the mouth of the Tamar, has suggested an inquiry as to whether these really belong to that species, and if so, what are the real differences between them and K. Atkinsoni. At the time of Davidson's last monograph, the latter was regarded as the sole smooth species of its genus.

Kraussina lamarckiana is frequent at George Town and between there and the Tamar Heads, at and below low water mark, attached to rocks and large stones. Though the shells are apt to escape notice, when once they have been recognised they are afterwards easy of detection. The peduncle is very short, and consequently the shell adheres to the rock rather closely. The species has not been recorded elsewhere along the northern coast of Tasmania, and this is quite in accordance with what often happens in the distribution of brachiopoda. Owing probably to their sedentary habit, numerous individuals of a species are found confined to a small area, while they are absent over the wide distances which separate different colonies of the animals. The Rev. H. D. Atkinson, B.A., informs us that he has dredged specimens in the south of the island in D'Entrecasteaux Channel, but that he has never met with any on the North-West Coast.

The shell is sub-circular in form and generally strongly ribbed. In the smooth variety, however, the pedunculated valve is somewhat sub-trigonal. This difference, though slight, is sufficient to enable us to separate a collection of both kinds at a glance into two series without even paying attention to the presence or absence of ribs. We have subjected the shell of both varieties to microscopical examination in thin sections, but cannot declare any difference in the pattern or size of the perforations. The average diameter of the shell canals is $\frac{1}{900}''$ to $\frac{1}{1000}''$, and they are mostly $\frac{1}{500}''$ to $\frac{1}{700}''$ apart, measured from centre to centre. Their diameter, where they open on the external surface, is about $\frac{1}{350}''$. We append illustrations of the perforations found in the Tasmanian shells of this genus. The figures being photographic and not diagrammatic, may be looked upon as trustworthy representations of these singular structures, considered at various times as connected with sensory organs, with respiratory organs, and with processes of nutrition. After all that has been written on the subject, their function is still unsettled. Structurally the perforations are cross sections of vertical or oblique canals in the shell, which receive caecal prolongations of the mantle of the animal.

In this species the brachial apparatus does not materially change with age, and we profess ourselves unable to detect any decided variation in the form of the calcareous lamellae of the smooth and ribbed shells. These supports are minute, and the brachial (or oral) appendages are correspondingly small, being comprised altogether in the central area of the shell. In shape the oral arms are incurved cirrhated tubes, the cirri of which are about 1/30″ long, and from $\frac{1}{700}$ to $\frac{1}{1000}''$ in diameter. The cirri themselves are hollow tubes, with acuminate terminations and a wavy habit.

Professor E. Deslongchamps in separating Kraussina, Megerlia, Terebratulina, Listhyris, and Platydia from the other brachiopoda, calls attention to the presence of calcareous spicula in their mantle and its appendages. It is not altogether certain that this is a reliable character for forming large groups, and it has yet to be proved that it is of value even for generic distinctions. From sections which have been made for us by Mr. F. E. Hurbury, of Launceston, we observe that the fleshy substance of the oral arm in K. Lamarckiana is strengthened in a remarkable manner by an interlocking mass of branching and denticulate spicula, often of a staghorn form. These do not form a continuous network, but with care can be disarticulated. Evidently this internal skeleton, as it may be called, supports and fortifies the arms, and is mostly found in the animals which have only short brachial supports, the place of which they thus take to some extent.

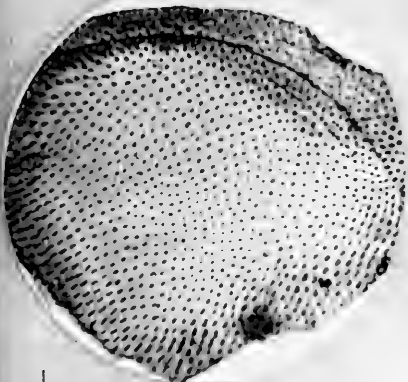
From what we have gathered from our observations detailed above, we are inclined to regard the smooth shell as nothing more than a varietal form of Kraussina Lamarckiana.

Kraussina Atkinsoni.—This small shell, catalogued by Tenison-Woods, was dredged by the Rev. H. D. Atkinson in Long Bay, D'Entrecasteaux Channel. Dr. Davidson says it is the only smooth Kraussina known to him, but as we have just shown, K. Lamarckiana embraces a smooth variety. Davidson has described the shell completely in his monograph of Recent Brachiopoda (p. 127), and we need not repeat what he has done so well. Several specimens have been kindly placed at our disposal by the Rev. H. D. Atkinson, and we have consequently been able to examine thoroughly this little-known shell. The differences between its brachial support, and that of K. Lamarckiana, may be summed up by saying that its lateral lamellae are on a horizontal plane, instead of being directed slightly downwards, and the shape of these is strap-like instead of being swollen as in K. Lamarckiana. The shell canals, too, are unusually large, as may be seen in our illustration. Unfortunately the animal was absent from the valves entrusted to us, and consequently we have to regret not being able to demonstrate the characters of the spicula of this little-known species. That it is a good species, and not a mere variety of K. Lamarckiana, the material at our command is, as we think, sufficient to establish.

Explanation of Plate.

Fig. 1.—Transverse section of shell canals of Kraussina Lamarckiana, smooth variety, taken near surface of shell. ×17. Ordinary light.

Fig. 2.—Oral arm of Kraussina Lamarckiana ×17. The photograph has been taken in polarised light, which illumi-



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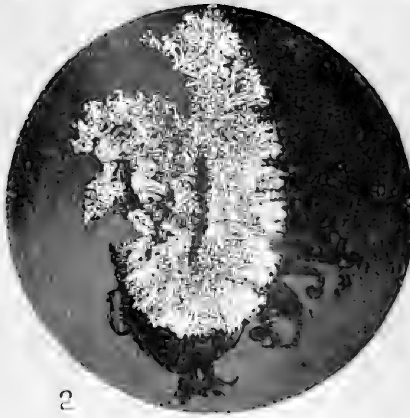

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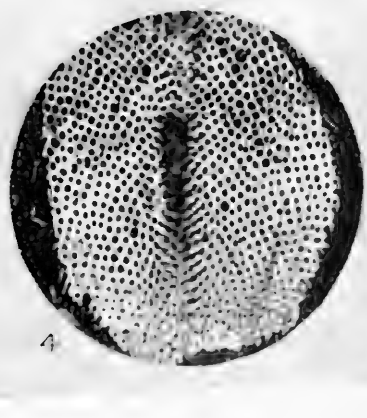

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nates the branching network of white spicula, while the fleshy cirri are left dark, and only dimly visible. This method of illumination very effectively demonstrates the way in which the internal spicular skeleton strengthens the arms.

Fig. 3.—Transverse section of shell canals of Kraussina Lamarckiana (the typical ribbed kind). This represents nearly the whole thickness of the shell, and shows the oblique direction of the tubular canals $\times 17$. Ordinary light.

Fig. 4.—Transverse section of shell canals of Kraussina Atkinsoni. Although the shell is somewhat smaller than K. Lamarckiana, the canals are considerably wider. The dark line in the centre is the mesial septum. $\times 17$. Polarised light.

NOTES ON CORAL REEFS, WITH SPECIAL REFERENCE TO THE FUNAFUTI BORINGS.

By T. Stephens, M.A., F.G.S.

It may be premised that the object of this paper is, not to announce any new discovery, but merely to give a brief summary of what is known of the history of coral reefs, with notices of the chief theories that have been advanced in connection with the subject.

The coral polyps belonging to the family of the Astræidæ, the chief reef-builders, flourish only in the warmer waters of the ocean within the tropics. Their range extends from about 20deg. south to 20deg. north of the Equator; but, under the influence of the Gulf Stream, they are found as far north as the Bermudas. The action of the carbonic acid derived from these minute organisms upon the lime always present in sea water enables them to secrete the carbonate of lime which forms the stony framework popularly known a "coral," and this is all that remains after the death of successive generations of reef-builders working upwards within their appointed range.

Coral reefs are classed under three heads, fringing reefs, barrier reefs, and atolls. The fringing reef lies close to the land in flat beds traversed in all directions by shallow channels and pools, and with larger breaks opposite the mouths of rivers. Building upwards from the sea bottom, where the depth is not too great, the coral polyps die on reaching the surface, and the growth of the reef is then confined to its seaward face. Barrier reefs lie at a distance from land in lines more or less parallel with the nearest coast, and generally rising from great depths on the seaward side. The atoll is a partially-closed ring of coral formation with no land in the centre, the typical coral island, though, as at Funafuti, the ring often consists of numerous detached islands.

Darwin's theory may be briefly stated. A careful and widely extended study of the life and work of the reef-building coral polyps had proved that their operations cannot be carried on at a greater depth than about 25 fathoms, and that when the formation gradually built up by successive generations on the stony remains of their predecessors reached the surface, all upward growth of live coral ceased. Darwin knew of numerous instances where the remains of old coral reefs existed on land slopes at various heights above the sea level, which proved that there had been no subsidence at those particular points. But there was also in evidence the fact that countless numbers of coral reefs and islands rising from great depths, and with no land near them, were scattered over vast areas in the Indian and Pacific Oceans. The obvious conclusion was, that these must either have been built up on a corresponding number of submarine peaks and ridges conveniently situated at just the right depth below the sea level, or that the coral polyps had begun their work, ages ago, around and among the peaks and ridges of a slowly subsiding continent, building ever upwards as the land went down, until it was entirely submerged, and he unhesitatingly adopted the latter hypothesis.

(Reference to diagram.)

The Darwinian theory was first published in 1842. It was received with acclamation by scientific authorities in all parts of the world, and quite twenty years passed before any serious objections to its general acceptance began to be formulated. With the indomitable energy, quick perception, and freedom from prejudice, which were his chief characteristics, Darwin studied all the results of fresh explorations made by contemporary workers that could throw light upon the subject, but could find no ground for any material modification of his original theory. With the improvements that were made, especially in England and America, in the mechanical appliances of surveying ships, the exploration of the great depths of the ocean was greatly facilitated, and, after the famous voyage of H.M.S. *Challenger*, Dr. John Murray, one of the naturalists of the expedition, propounded a new theory which was supported by several leading scientists.

Before giving an account of this theory, it is necessary to briefly mention some of the additions to our knowledge of marine natural history since the date of the voyage of H.M.S. *Beagle*. The results of the *Challenger* Expedition, and of other previous explorations of the depths of the ocean, have shown that the floor of every sea, outside the range within which it is affected by deposits of river sediment, or by the wearing away of the coast line, is covered down to considerable depths with the shells and skeletons of myriads of marine organisms, which have lived either on the sea bottom or floating near the surface. The latter, especially in the warmer seas, are present in such vast numbers, that, though the individuals themselves are mostly very minute, their remains, accumulated during the course of long ages, form a very large proportion of the materials which have been gradually built up on the original foundation.

Among the silica-secreting denizens of the surface waters are simple animal forms such as the *Radiolaria*, and vegetable organisms belonging to the *Diatomaceæ*. Among those that secrete carbonate of lime are the *Pteropoda*, and familiar representatives of this class are *Hyalea* and *Cleodora*, specimens of which, with their beautiful translucent shells, are often collected by means of tow nets let down from passenger steamers or sailing ships. Of other forms, the *Foraminifera* comprise most of the minute animals with dense shells, such as those of the *Globigerinæ* and *Orbulinæ*.

The thin shells of the Pteropods, after the death of their tenants, sink so slowly that they are dissolved away before reaching great depths, and their remains are rarely found where the depth exceeds 1000 fathoms. The dense shells of the *Globigerinæ* sink to much greater depths before being dissolved, and are found all over the sea bottom down to about 2,500 fathoms. The remains of the surface organisms reaching greater depths are chiefly the silicious skeletons of Radiolarians and Diatoms. These are blended with the other materials slowly accumulating in the deepest parts of every ocean, forming a reddish brown sediment which has received the distinctive name of *Red Clay*.

The main point which has to be grasped, and it is not easy to realise it, is that, during past ages and up to the present day, there has been a never-ceasing downfall of the remains of these short-lived organisms, which has gradually raised the sea bottom over wide areas to a considerable altitude. The deposit thus formed is now known under the general name of *ooze*. That portion of it which is found at a depth not exceeding 1,000 fathoms has been called *Pteropod ooze*, from the large percentage of the remains of Pteropods contained in it. The same kind of formation extending from 1,000 to 2,500 fathoms is called *Globigerina ooze* for a similar reason, and this is succeeded by *Diatom* and *Radiolarian ooze* until these last are blended with the ultimate residuum—*Red Clay*—on the floor of the deepest seas. In connection with this part of the subject it may be noted that the great chalk formation, which occupies a large extent of country in the south of England, and on the continent of Europe, and which beneath London is about 700ft. thick, is practically identical with the deposits that have just been mentioned. It has been proved by microscopic examination that chalk is nothing more than what may be described in general terms as *Globigerina ooze* in a consolidated form, which had accumulated by slow oceanic sedimentation, long ages ago, on an ancient sea floor.

The conclusion arrived at by Dr. Murray of the *Challenger* Expedition was, that coral reefs and islands were gradually built up on tops of submarine peaks or ridges already existing at a depth not exceeding 25 fathoms, or on banks which, in the course of ages, had been raised to the necessary height by the process of sedimentation that has been described. (Reference to diagram.)

In a letter quoted by Professor Judd, which was written by Darwin to Professor Agassiz in 1881, the year before his death, he remarks that he "has expressly stated that a bank at the proper depth would give rise to an atoll, which could not be distinguished from one formed during subsidence;" and he goes on to say that he "can hardly believe in the existence of as many banks (there having been no subsidence) as there are atolls in the great oceans, within a reasonable depth, on which minute oceanic organisms could have accumulated to the depth of many hundred feet." The letter concludes with the following words:—"If I am wrong, the sooner I am knocked on the head and annihilated so much the better. It still seems to me a marvellous thing that there should not have been much and long-continued subsidence in the beds of the great oceans. I wish some doubly-rich millionaire would take it into his head to have borings made in some of the Pacific and Indian atolls, and bring home cores for slicing from a depth of 500 or 600 feet."

The "millionaire" did not turn up, but Darwin's last wishes for the settlement of the question one way or another were not consigned to oblivion, and at last, in 1896, the Royal Society of London organised an expedition under the leadership of Professor Sollas, which was materially aided by the Admiralty, the Government of New South Wales, and leading scientific men in Sydney. A site was selected for boring operations in the Ellice Group, due north of Fiji, and about 8deg. south of the Equator. A lagoon encircled by a fringe of reefs and coral islands, the largest being Funafuti, forms the atoll, which is about 12 miles long and eight miles broad. From soundings taken by Captain Field, of H.M.S. *Penguin*, it appears that this atoll resembles a vast wall-like structure built on a cone-shaped elevation or mountain rising from a depth of about 2,000 fathoms, with a gradually increasing slope up to a contour line about 140 fathoms deep, the rise from this level up to near the surface being almost precipitous. The intention was to bore to a depth of at least 600 feet, so as to ascertain how far down the coral reef extended, and to determine, if possible, the nature of the foundation on which it rested. The boring was commenced in May, 1896, but was carried on under great difficulties, the tubes constantly getting choked by sand lying in irregular layers among masses of solid coral. A depth of 105 feet was reached, but eventually the work had to be abandoned.

In June, 1897, a second expedition was despatched from Sydney, under the charge of Professor David. Many improvements had been effected in the machinery and boring tools, and good progress was made in spite of the difficulties that were again encountered, such as the sudden and frequent changes from solid rock to bands of loose sand. A depth of 643 feet had been reached in solid coral limestone, when a complete breakdown in the machinery stopped the work. This second expedition had, however, proved that true coral reefs exist at a depth of about 80 fathoms below the range within which the coral polyps live and carry on their work.

But those who had taken such a lively interest in these two expeditions were not content to abandon the undertaking without an attempt to obtain further evidence. In 1898 a third expedition was sent out from Sydney, and the boring was continued until it reached a depth of 1,114 feet in "coral reef rock."

No detailed account of the results of the boring will be published until the examination of the cores sent to the Royal Society of London has been completed. The one important fact that has been established is, that submerged coral reefs exist at Funafuti at a depth of over 1100 feet, and at least 150 feet below the base of the wall-like formation of the atoll.

While writing the latter portion of these notes, I received a copy of Mrs. Edgeworth David's charming account of the expedition of 1897,* from the postscript to which, by Professor T. G. Bonney, I have extracted the substance of the results of the soundings taken during the visit of H.M.S. *Penguin*. Besides giving a graphic description of the voyage, with notices of its object, and some of its results, Mrs. David deals fully with the romantic side of life on a coral island, and the manners and customs of an isolated native community, and the book will be found excellent reading by all who are interested in such subjects.

* "Funafuti, or Three Months on a Coral Island," by Mrs. Edgeworth David.

ADDITIONS TO THE FUNGUS FLORA OF TASMANIA.

By L. Rodway.

Little need be said as an introduction to this—a bare list of new species, to be added to Tasmanian Fungi. The attention paid to this subject does not warrant sufficient space being taken up by publishing descriptions. Two plants, however, I would allude to, because they establish new genera. Myxomycidium pendulum is a delicate pendulate stalked club, about ½in. long, very watery and fragile, growing on rotting Eucalypts; and Cerion coccineum, is a little waxy, crimson peziza, emerging from dead wood, with long filiform, much curved, or sigmoid sporidia. The other new species belong to already-established genera, and I must refer the student to a forthcoming number of the "Kew Bulletin" for their description. Most of the new species contained in my paper of November, 1897, will be found described in the "Kew Bulletin," June, 1898.

Hymenomycetes.

Amanita grisea Mass. et Rod., n.s.
Amanitopsis vaginata, Bull.
Clytocybe cerussata, Fr.
Collybia eucalypti, Mass., n s.
Collybia iris, Mass. et Rod., n s.
Mycena tenerrima, Berk.
Hygrophorus rodwayi, Mass., n.s.
Marasmius rugulosus, Berk. et Curt.
Marasmius proximus, Berk. et Br.
Marasmius rodwayi, Mass., n.s.
Russula semicrena, Fr.
Xerotus atro-virens, Mass., n.s.
Leptonia obscura, Mass., n.s.
Hebeloma atro-sanguinea, Mass. et Rod., n.s.
Crepidotus parasiticus, Mass. et Rod., n.s.
Stropharia coronilla, Bull.
Stropharia stercoraria, Fr.

Hypholoma flexipes, Mass. et Rod., n.s.
Psilocybe œdipus, Mass., n.s.
Psathyra tasmanica, Mass. et Rod., n.s.
Panæolus phalanarium, Fr.
Panæolus complanatus, Linn.
Polyporus tasmanicus, Mass., n.s.
Polystictus hirsutus, Fr.
Trametes heteromalla, Cooke.
Clavaria cinerea, Bull.
Myxomycidium pendulum, Mass., n.s.
Craterellus multiplex var niveus, Mass., n.s.
Corticium rubro-punctatum, Mass. et Rod., n.s.
Corticium glabrum, Berk. et Curt.
Hymenochœte tuberculosa, Cooke.
Tremella viscosa, Mass., n.s.
Gyrocephalus luteus, Mass., n.s.

Gasteromycetes.

Nidularia pisiformis, Tull.
Cyathus vernicosus, D.C.
Lycoperdon pusillum, Fr.
Bovista olivacea, C. et M.
Polysaccum microcarpum, C. et M.
Secotium sessile, Mass. et Rod., n.s.
Hymenogaster nanus, Mass. et Rod., n.s.
Hymenogaster lævisporus, Mass. et Rod., n.s.
Rhizopogon rubescens, Tull.
Hysterangium neglectum, Mass. et Rod., n.s.
Hysterangium affine vor irregulare, Mass et Rod., n.s.

Discomycetes.

Curreyella trachycarpa, Mass.
Peziza plicata, Mass. et Rod., n.s.
Phœopeziza ochracea, Mass. et Rod., n.s.
Aleurina tasmanica, Mass., n.s.
Helotium sessile, Mass. et Rod., n s.
Ombrophila aurantiaca, Mass., n.s.
Propolis faginea, Karst.
Cerion coccineum, Mass. et Rod., n.s.
Coccomyces trigonus, Karst.
Karschia atherosperma, Mass. et Rod., n.s.

HYSTERIACEÆ.

Lembrosia geographica, Mass. et Rod., n.s.

PYRENOMYCETES.

Cordyceps dovei, Rod.
Hypocrea cerebriformis, Berk.
Bagnisiella rugulosa, Cooke.
Dothidiella inæqualis, Cooke.

SPHÆROPSIDES.

Centhospora innumerosa, Mass., n.s.
Melanconium eucalypti, Mass. et Rod., n.s

HYPHOMYCETES.

Acremonium alternatum, Link.
Illosporium coccineum, Fr.
Volutella ciliata. Fr.

ON A NEW CORDICEPS.

By L. Rodway.

Plate.

The genus Cordyceps comprises a well circumscribed group of Sphæriaceous Fungi, all very similar in habit, structure, and fructification.

Their habit is to commence life within the bodies of insects; usually when these are in the larval stage. Here the ordinary vegetative growth proceeds, namely, development of hypbal tissue. This soon disturbs the comfort and health of the host, who, in most instances, then seeks seclusion and dies. The fungus continues to grow, and absorbs all but the hard chitinous parts. When food runs short, fructification commences. One or more stems, sometimes of considerable length, grows from the host-remains, and towards the end of each stem are developed numerous partially or entirely sunk little sacks. Each sack contains several cylindrical bags or asci. Each ascus contains eight thread-like spores, and each spore splits up into numerous segments. Each segment is the unit of a new individual.

The species of the genus are distinguished by the shape of the spore-bearing body or club. The species are fairly numerous, but the earlier found specimens were small, and consequently interested few, except students of mycology. The discovery of giant forms in New Zealand and Australia, however, brought them within the ken of the curiosity gatherer.

The first to gain this attention was the caterpillar fungus of New Zealand, C. larvarum, W., also known as C. robertsii, Cooke. This fungus grows on a large caterpillar, the larva of a Pielus, but possibly also on other hosts. The club of this species is very slender, many inches in length, and pointed at the apex. The sporiferous portion is very slightly thickened. A few forms closely allied to, if not absolutely identical with this have been found in New South Wales, so it is possible it may yet be found in Tasmania.

Shortly after this, attention was drawn to the fine Cordyceps commonly found in Tasmania. In this species, C. gunnii, Berk., the club is stout, and of varied length, sometimes attaining six or eight inches; the fertile portion is somewhat thickened, dark coloured, and ends obtusely.

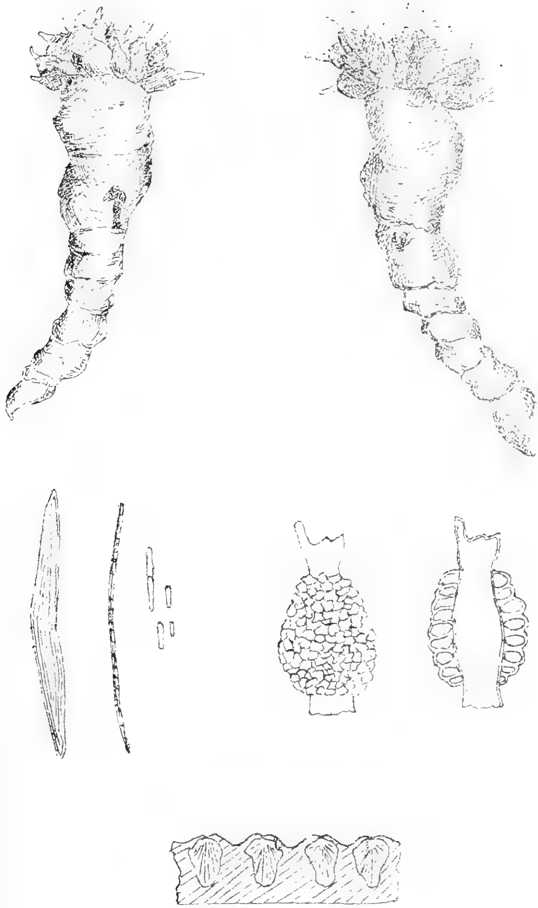
In 1858 Gray described a distinct species found by Mr. Hawkes near Launceston. It is nearly as large as some forms of C. gunnii, but the club is much bent, often branched, and the apex abruptly blunt.

Recently the late Entomologist of New South Wales, Mr. Oliff, in a pamphlet under the auspices of the local Department of Agriculture, drew attention to the forms found in Australia, at the same time describing many forms as new species. I doubt if mycologists will accept them all. C. selkirki and C. coxii are too close to C. larvarum, and C. trictenæ owes its existence to an unfortunate oversight. It is founded on a lithograph that the author, in good faith, understood had never been published; unfortunately, however, it is a fac-simile of the plate accompanying Berkeley's description of C. taylori (Sphæria taylori Berk.) in Hooker's London Journal of Botany, N.S., Vol. II., 1843. One of these new species, C. scottianus, though close to C. entomorrhiza Dick, is probably distinct, and is of interest to us, as it has been once found in Tasmania.

Some years ago Mr. H. Stuart-Dove, of Table Cape, sent me a most interesting specimen, that differs markedly from any described species. In habit it approaches C. taylori, Berk., in so far that the clubs are numerous, and arise from a cordlike extension of the mycelium, but it differs, not only in size and lesser immersion of the perithecia, but in the sporiferous portion, forming an oblong enlargement near the apex of the club, but leaving a narrow, irregular, barren end. The following description sufficiently explains details:—

Cordyceps dovei, n.s. Sporocarp formed of an irregular thick cord-like stipes arising around the head of the host, clubs very numerous, 5—7 m.m. long, the base and apex slender and barren, perithecial portion ovoid and much thickened. Perithecia numerous, rather large, protruding, causing a coarsely granulated surface, dark red-brown, rest of fungus brown ochre. Asci cylindrical, sporidia 8, filiform breaking up into numerous segments.

On a Coleopterous larva in a decayed trunk of Fagus cunninghami at Mount Bischoff, by Mr. H. Stuart-Dove, after whom it is named.



Cordyceps dovei, Rod.

BOTANICAL NOTES.

By L. Rodway.

In his great work, "Flora Tasmaniæ," Hooker describes and figures Pilitis milligani. Unfortunately, his specimens were devoid of corolla, except the persistent bases, and in order to make the plate complete, corollas were provided from imagination. Unfortunately, imagination was in error, for, unlike its immediate relatives, Pilitis milligani has a fairly persistent corolla with conspicuous lobes. In those days it was the custom to separate the small group of plants to which this belongs into three genera:—Richea, with deciduous bracts and hypogynous scales; Pilitis, with persistent bracts and hypogynous scales; and Cystanthe, with persistent bracts and no hypogynous scales. All forms possessed a peculiar feature, the corolla lobes were minute, and the essential organs were exposed by a circumciss of the corolla near the base, and its falling off immediately on maturity. Both Mueller and Bentham considered it desirable to reduce these genera to one. They are all referable now to the genus Richea.

Last December I had the opportunity of examining R. milligani in quantity, and in all stages of inflorescence, and found this condition of the corolla considerably modified. The corolla is tubular, and about 1.5 c.m. long, the lobes about 2 m.m. and free. The long stamens and style pass through, and usually split the corolla down on one side. The flower appears pronouncedly protandrous, and the corolla fades, and turns brown with the stamens, usually remaining as a cast-off or persistent brown sheath round the faded stamens or style. In a few instances the corolla appears to drop early, but even then it is first split on one side, and not carried off as a calyptra.

I sent specimens to Kew, with the suggestion that the old name Pilitis should be revived, but it did not meet with their approval. This partial persistence of the corolla is most interesting, demonstrating the connecting line between Richea and Dracophyllum.

Eucalyptus acervula, Sieb.—Unfortunately, in the course of his well-intentioned efforts to elucidate the complex mass of organisms included in the genus Eucalyptus, our late Master, Baron von Mueller, was not always free from adding to the confusion. This species I wish to allude to was one of the unfortunates. Originally described by Sieber, it was included by Hooker in his Flora, where E. gunnii was also figured and described. E. acervula is a very common Tasmanian gum, and though in some respects nearly related to E. gunnii, is consistently distinct. Its habit and bark, its thinner undulate leaves, and numerous flowers, its peculiar turbinate fruit, with protruding valves, make it very distinct, yet Mueller not only combines it in his Eucalyptographia with E. gunnii, but rejects the type established by Hooker of that species, and replaces it with a plate of the typical E. acervula, Sieb. In spite of my respect for his genius, I do not see how this can be maintained. There is one other source of confusion here. Mueller, in Bentham's "Flora Australiensis," describes E acervula, Sieb., under the name E. stuartiana. He describes and figures in his Eucalyptographia a form closely allied to the many flowered forms of E. viminalis, Lab., under this name taking exception to his own description in the Flora, and all this in spite of the fact that the name E. stuartiana had long previously been appropriated for a form of E. gunnii, H., by Miguel.

There is one interesting feature about E. acervula, Sieb , worth recording—it develops an outer operculum to its flowers, that is shed at an early stage. I believe E. globulus, Lab., is the only other species in which this member has been observed.

Eucalyptus vernicosa H.—This interesting eucalypt on Mount La Perouse attains a height of 20ft. The leaves are all opposite, and the flowers solitary in the axils. These features I found constant for the whole country, from the Hartz through Adamson to Perouse, a distance of about 30 miles.

On the West Coast the smaller forms retain the opposite leaves, but the flowers are three together on short peduncles. On Mount Geikie, the taller plants bear larger alternate leaves, but with similar flowers. Here occurs also a small form of E. muelleri, T. B. Moore, only 15-20ft. high, which, though very similar in general appearance to E. vernicosa, still maintains its distinctness in its crenulated leaves with less oblique venation and flattened operculum. I would record also that during my trip throughout the Perouse I searched diligently for a plant answering to the description of Diplarrhena latifolia, B., and though, according to Oldfield and Stuart, it occurs from one-third to the summit of La Perouse, I found nothing of it. Diplarrhena moræa, Lab., throughout the whole district, as well as on some other Southern mountains is exceptionally luxuriant, the leaves are broad and the flowers large, and I have little doubt that this robust form is responsible for the name.

On the hills adjoining La Perouse the rare Ranunculus gunnianus, H. occurs. Here the flowers are all yellow.

Hibbertia hirsuta B., which chooses for its habitat pastures in open situations, our Domain being a favourite locality, indulges in the interesting habit of producing cleistogamic flowers. In the spring, a copious supply of buds are formed. The calyx does not spread, the petals remain minute, and cover in the stamens ; pollen is shed, and self-fertilisation takes place, the bud only bursting with the growth of the fruit. It is easy to understand the advantage this is to the plant. The flowering that takes place in the warmer months is liable, owing to the dry locality the plant lives in, to be seriously interfered with. The spring flowers, on the other hand, are too early to gain the attention from insects necessary for cross-fertilisation. The difficulty is got over in the above manner.

DESCRIPTION AND MEASUREMENTS OF SOME MALLICOLO CRANIA.

By Arthur H. Clarke, M.R.C.S., etc.

Note A. Of the eight crania which I have been able to measure, one was in the Tasmanian Museum, five were kindly lent to me by Dr. Beatty, and two by Mr. Gunn, of H.M.S. Royalist.

The measurements were taken, and indices calculated on the system explained in a paper by Mr. W. R. Harper and myself, giving the measurements of the Tasmanian crania in our Museum.

Note B. Of these eight skulls, four (3 male and 1 female) are of quite a different type from the others, the first class (No. 1-4) has a very much more receding forehead than the second; the first four skulls are also more dolicho-cephalic than the others.

Note C. These skulls show the general characteristics given by Dr. Busk as typical of the Mallicola.

"(1) The small size of the calvaria or cerebral part as compared with the facial portion of the skull.

(2) The great development of the mastoid region (this is very marked in our series of skulls).

(3) The great prominence of the zygomatic arches, and the comparative narrowness of the frontal region.

(4) The intervention of the temporal between the parietal and alisphenoid, which, as is well known, is so common a condition in the Tasmanian and Papuan branches of the Melanesian race."

Note A. Dr. Beatty subsequently presented one skull, and Mr. Gunn two skulls, to our Museum.

Note B. Papers and proceedings of the Royal Society of Tasmania for 1897.

Note C. Measurements of Mallicolo Crania by Dr. Busk, "Journal" of Anthropological Society, Vol. VI., page 200.

This feature is also very marked in our specimens.

The most interesting feature displayed by these skulls, however, is the peculiar deformity of the calvarium, which may be described as follows:—A well-marked furrow about $3\frac{1}{2}$ c.m. in width is seen to rise from the parieto-squamosal suture on one side, pass upwards over the bregma parallel to and usually behind the coronal suture, and to lose itself at the opposite parieto-squamosal suture. The bregma, as a rule, lies at the bottom of this furrow, and so is depressed; but, in some cases (e.g., No. 4), it lies behind the furrow, and in others (e.g., No. 3) it lies in front.

In No. 3, the furrow is shallower, and much broader, than in the other skulls. This peculiar furrow is shown in each of the eight skulls which I examined. It is especially marked in Nos. 1, 2, and 3. A peculiar deformity of the frontal bone is shown in No. 3. This consists of a keel-shaped elevation, continuous with the Sagittal suture, which runs down the frontal bone, till it is lost just above the ophryon. On either side of this keel there is a well-marked groove. Apparently this is a suture which has been absorbed late in life.

In two skulls the obelion is depressed. Nos. 1, 3, and 4 show a peculiar flattening at the Lambda, so that, in 3 and 4, the occipital bone rides over the two parietals.

The parietal eminences are not very prominent in any of the skulls except in No. 4, where they are well marked.

The temporal ridges are very prominent in Nos. 1, 3, and 4, but are faintly marked in the remainder of the crania.

The glabella is not very prominent in any skull, but is more fully developed in Nos. 1, 2, and 3.

The orbits are rectangular in form. The nasal bones are well-formed, but have been broken in nearly all the skulls.

The nasal aperture is fairly wide, and narrows very gradually. The nasal spine is, as a rule, well marked, and is double.

In the skulls Nos. 1, 2, and 3, the malar bones are prominent and massive; they are less so in the remainder of the skulls.

In Nos. 5, 6, 7, and 8, the hollow under the malar-maxillary suture is deep; but, in Nos. 1, 2, 3, and 4, it is more shallow.

The palate is parabolic in every case.

SUTURES.—The Sagittal suture is simple in all the skulls, with the exception of No. 1, where there is a wormian bone. It is completely absorbed in No. 2 externally, but a trace of the suture can be seen on the internal table. The coronal suture is simple except at the pterion, where epipteric bones are present in several of the skulls. This suture is absorbed in No. 2 below the temporal ridge on both sides, and is very faint.

In No. 3, it is absorbed on both sides below the temporal ridge. The pterion is K-shaped in several of these skulls; in the remainder, it is H-shaped, or there is an epipteric bone interposed. Wormian bones are present in the lambdoidal suture in several of the skulls, and in some in the parieto squamosal suture.

Two of the crania have an interpanetal bone.

One of the skulls (No. 1) is metopic. This condition is more common among the Mallicolo than in other races, as in the Museum of the Royal College of Surgeons in London. One skull out of eight is metopic, and another shows traces of a frontal suture. Only one of these crania has a lower jaw complete This is small in all its measurements. The condylar height exceeds the coronoid by 2m.m.

In no skull is there a complete set of teeth. Most of the teeth, however, seem to have been lost after death, except in No. 4 (which appears to be the skull of an old woman), 6 and 8.

The molars have all been erupted in every case, except in No. 8, where the third molars are not developed.

In 1 and 2, these teeth are ground smooth, but in the remaining skulls, where present, they do not show the same signs of grinding. The bicuspids, where present, show the same grinding.

The incisors have been lost in every case.

No. 6 has a canine which is slightly worn.

There is no sign of caries in any of the teeth.

CRANIAL CAPACITY.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	1,325	1,220	1,410	Micro-cephalic
Female	4	1,143	1,020	1,260	"
Total	8	1,234	1,020	1,410	"

These crania are therefore micro-cephalic.

The average capacity of seven crania in the Museum of the Royal College of Surgeons in London is 1,294, as compared with this average of 1,234.

CEPHALIC INDEX.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	69·4	64·9	73·3	Dolicho-cephalic
Female	4	70·7	65·9	74·1	"
Total	8	70·0	64·9	74·1	"

NOTE A. These skulls are, therefore, dolicho-cephalic, with an average cephalic index of 70.0.

Dr. Busk, in eight skulls, gives an average index of 70.8, and Flower in the collection of the Royal College of Surgeons one of 71.5 in eight skulls.

VERTICAL INDEX.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	71·2	66·0	75·0	Tapeino-cephalic
Female	4	72·5	70·8	77·3	Metrio-cephalic
Total	8	71·9	66·0	77·3	Tapeino-cephalic

These skulls are, therefore, tapeino-cephalic, having an average index of 71.9.

Dr. Busk, in eight skulls, finds a higher index, viz., 75.5, and Flower, in eight skulls, one of 72.6, so that both these observers find a higher index than is present in the specimens which I have been able to measure.

FRONTAL INDEX.

Sex.	No.	Average.	Minimum.	Maximum.
Male	4	70·9	64·5	74·2
Female	4	73·5	67·2	76·7
Total	8	72·2	64·5	76·7

The average frontal index is 72.2.

STEPHANIC INDEX.

Sex.	No.	Average.	Minimum.	Maximum.
Male	4	95·9	89·4	98·9
Female	4	94·6	93·9	95·6
Total	8	95·3	89·4	98·9

This average Stephanic Index is 95.3.

NOTE A. Flower takes this index from the Ophryo-occipital, and not the greatest length, thus making the index higher.

INDEX OF FORAMEN MAGNUM.

Sex.	No.	Average.	Minimum.	Maximum.
Male	4	80·3	78·4	81·6
Female	4	83·8	78·4	90·0
Total	8	82·1	78·4	90·0

The average index is, therefore, 82.1.

ORBITAL INDEX.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	95·0	91·7	97·3	Megaseme
Female	4	94·9	89·2	94·3	"
Total	8	94·95	89·2	97·3	"

This average 94.95 classes this series of skulls as megaseme.

In eight skulls Flower finds an average of 89.8, placing his specimens in the same class.

NASAL INDEX.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	52·7	47·1	58·1	Mesorhine
Female	4	51·7	51·1	52·3	"
Total	8	52·2	47·1	58·1	"

This average of 52.2 classes these skulls as meso-rhine.

Flower, in eight crania, finds a higher average of 53.9, classing his specimens as platyrhine.

GNATHIC.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	105·6	102·0	109·6	Prognathous
Female	2	101·1	101·0	101·1	Mesognathous
Total	6	104·1	101·0	109·6	Prognathous

The Females are mesognathous, but the males prognathous. The average index in our specimens, 104.1, is lower than that in six specimens measured by Flower, in which it is 105.0.

PALATO-MAXILLARY INDEX.

Sex.	No.	Average.	Minimum.	Maximum.	Class.
Male	4	106·5	103·2	109·0	Dolich-uranic
Female	2	105·6	103·6	107 5	"
Total	6	106·2	103·2	109·0	"

This average of 106.2 classes these crania as dolich-uranic.

FACIAL INDEX.

The zygomata were so imperfect that this measurement could only be taken in crania Nos. 1 and 2, in which it amounted to 75·6 and 63·4 respectively.

DIAMETERS OF BRAIN CASE.

		1	2	3	4	5	6	7	8
Sex		M	M	M	F	F	M	F	F
Age		Adlt	Adlt	Adlt	Adlt	Adlt	Adlt	Adlt	Adlt
Capacity		1410	1350	1320	1170	1260	1220	1120	1020
Longitudinal	Ophryo-occipital	171	186	183	171	170	168	165	161
	Glabello-occipital	176	191	187	176	172	170	168	162
	Nasio-occipital	173	190	186	176	167	169	168	162
	Glabello-iniac	155	167	158	160	156	159	149	151
Basi-bregmatic Height		132	126	129	125	133	127	119	115
Transverse	Maximum	129T	124P	124T	116T	121P	124T	122P	120P
	Asterionic	106	116	104	105	100	106	98	102
	Stephanic	95	91	104	91	96	82	87	98
	Minimum Frontal	94	89	92	87	91	80	82	92
	Supra-Auricular	115	118	116	110	112	119	108	108
	Temporal	129	123	124	116	120	124	120	119

CIRCUMFERENCES OF BRAIN CASE.

		1	2	3	4	5	6	7	8
Horizontal	Total	495	506	498	472	486	476	469	459
	Post-auricular	285	299	294	267	262	267	265	240
	Pre-auricular	210	207	204	205	224	209	204	219
Median	Total	507	518	509	486	496	488	472	459
	Frontal	125	128	130	126	124	120	125	113
	Parietal	137	146	135	126	126	118	120	123
	Occipital	112	109	118	107	107	119	105	99
	Lambdo-iniac	83	80	79	63	77	80	67	65
	Inio-opisthic	29	29	39	44	30	39	32	34
	Length of Foramen Magnum	38	35	32	30	37	37	32	34
	Basion to Nasion	95	100	94	97	100	94	90	90
Transverse	Total	425	413	427	415	420	421	390	385
	Supra-Auricular	295	280	295	282	290	286	274	272
	Infra-Auricular	130	133	132	133	130	135	116	113
Length of Foramen Magnum		38	35	32	30	37	37	32	34
Width of Foramen Magnum		31	28	26	27	29	29	28	27
Basi-alveolar Length		97	102	102		101	103	91	

FACE MEASUREMENTS.

		1	2	3	4	5	6	7	8
Transverse	Biorbital External	103	101	103	99	97	98	90	99
	Biorbital Internal	95	95	95	93	90	92	85	93
	Bijugal	101	110		103	106	110		
	Bizygomatic	123	123		121				
Vertical	Ophryo-alveolar	93	88	82		79	79	86	
	Nasio-alveolar	69	69	63		58	55	64	
	Spino-alveolar	18	19	18		13	12	19	
Nasal Region	Nasio-spinal height	51	51	46	47	45	43	44	44
	Width anterior nares	24	25	26	24	23	25	23	23
	Length nasal bones	23							24
	Width nasal bones	17							18
Orbits	Width	34	37	36	37	35	33	34	37
	Height	32	36	33	33	33	32	32	34
	Orbital interval	27	25	23	24	23	25	22	24

FACE MEASUREMENT (Continued).

		1	2	3	4	5	6	7	8
PALATE ...	Length	55	63	56		55	59	53	
	Width	60	65	59		57	64	57	57
AURICULO-ORBITAL DISTANCE RIGHT		66	66	64	62	66	65	68	66
AURICULO-ORBITAL DISTANCE LEFT		62	66		62	65	63	64	64
MASTOID HEIGHT		42	35	43	40	35	44	29	28
ZYGOMATIC PROJECTION		P.	P.	P.	P.	P.	P.		

INDICES.

	1	2	3	4	5	6	7	8
Cephalic	733	649	663	659	703	729	726	741
Vertical	750	660	690	710	773	747	708	710
Frontal	729	718	742	750	752	645	672	767
Stephanic	989	978	894	956	948	976	942	939
Foramen magnum	816	800	812	900	784	784	875	794
Orbital	941	973	917	892	943	970	941	919
Nasal	471	490	565	511	511	581	523	523
Gnathic	1021	1020	1085		1010	1096	1011	
Palato-maxillary	1090	1032	1054		1036	1085	1075	
Facial								

MEASUREMENTS OF LOWER JAW.

		1	2	3	4	5	6	7	8
HEIGHT ...	Symphysial					23			
	Molar					22			
	Coronoid					59			
	Condyloid					61			
WIDTH... ...	Bigonial					82			
	Bicondylar					100			
	Bimental					40			
	Ramus...					32			
GONIO-SYMPHYSIAL LENGTH						76			

RETURN OF THE ANTARCTIC EXPEDITION.

CONVERSAZIONE AT THE TOWN HALL, WEDNESDAY, APRIL 18, 1900.

WELCOME TO THE LEADER, SCIENTIFIC STAFF, CAPTAIN, AND MEN.

A welcome, in the form of a conversazione, was given by the Council of the Royal Society of Tasmania at the Town Hall, on Wednesday evening, April 18, to Mr. Borchgrevink and those who accompanied him on the recent Antarctic Expedition. The attendance was large and fashionable, and amid such a gathering it would be impossible to give anything like an accurate list of names. A perusal of the names of those who tendered a welcome to the returned explorers will show how representative was the gathering. Owing to the indisposition of his Excellency the Governor, the Chief Justice (Sir John Dodds) presided. Lady Gormanston and party, however, were present. In addition to Mr. Borchgrevink, the members of the scientific staff and the officers and crew of the steam yacht Southern Cross were on the platform, and also a couple of dogs that had taken part in the expedition. In one corner of the platform was a map showing the points that the different explorers had reached. As Sir John Dodds, Mr. Borchgrevink, and others ascended the platform, the city organist played English and Norwegian national anthems.

The Chief Justice said—

In consequence of the regretted absence of His Excellency the Governor, who is *ex officio* President of the Royal Society, and the inability of Sir James Agnew, senior Vice-President, to attend, the Council have conferred upon me the great honour of presiding at this meeting. We have this evening the pleasure of welcoming Mr. Borchgrevink and his companions back to the port from which, sixteen months ago, they sailed away on their adventurous visit to seas and lands that may (in a sense of the word no longer applicable to any other region of the world) be called unknown. But our pleasure is mingled with sorrow that one of those who left us in the Southern Cross, one who, during his brief stay in Hobart, made many friends who will not soon forget him, has not returned. I believe that it is now some eight years since Mr. Borchgrevink came to Australia, fired with the ambition of making a voyage of discovery to the Antarctic regions. In his many endeavours to accomplish this purpose he was greatly assisted by one well known to members of our Royal Society, the late Baron von Mueller, of Melbourne. After experiencing much disappointment, Mr. Borchgrevink's hopes, or rather a part of what he hoped for, seemed at length likely to be realised. A Norwegian steam whaler arrived in Australia on her way to the Antarctic in search of the sperm and other whales. Abandoning at once the scholastic work on which he was engaged in New South Wales, Mr. Borchgrevink proceeded to Melbourne in the hope of being able, with Baron von Mueller's assistance, to arrange for a passage in the whaler. But in this he was disappointed: whales, and not scientific discoveries, were the business of the Norwegian captain's voyage and he had no wish te encumber the very limited accommodation of his vessel with a passenger whose objects were likely to clash with his own. Nothing daunted, however, Mr. Borchgrevink, finding that there was a vacancy on board for an ordinary sailor, offered his services, and they were accepted. The whaler at length arrived near Cape Adare. A boat was lowered, Mr. Borchgrevink being one of the crew. Determined to be the first to set foot on the shore, he achieved this by jumping out of the boat into the icy water, with the result that he could fairly claim the distinction of being the first man to stand on Antarctic ground since the voyage of Captain Ross, sixty years before. So far as whales were concerned, this expedition was not a success; but so far as it stimulated Mr. Borchgrevink to "stick to his guns," I think that we may venture to say that the voyage of the whaler "Antarctic" by no means merely resulted in a waste of time and money. For we now find Mr. Borchgrevink more than ever determined to arrange an expedition to the south polar regions and, with a view to rousing public interest in his plans, giving lectures in these colonies, at home in England, and in the United States. At last he met with his reward. Sir George Newnes, widely and honourably known for his public spirit and liberality, fitted out at his own expense the well-equipped little vessel that now lies at one of our wharves, and Mr. Borchgrevink was appointed to the leadership and entire management of the expedition. As you all know, he arrived here in November, 1898, and just before Christmas in that year started on his long journey in search of the South Magnetic Pole. It rightly belongs to Sir Geo. Newnes to make known to the world the full details of what this expedition has accomplished. We have, however, already heard sufficient to justify us in greeting our guests to-night as the first explorers who have penetrated that mysterious land of whose limits we as yet know so little, but which we assuredly may speak of as a continent, since, on a very moderate estimate, its size exceeds that of Australia. Mr. Borchgrevink is also the first to have reached the Southern Magnetic Pole; and it gratifies our just pride as citizens of Greater Britain that our flag has now been raised over this end of the great earth magnet, as it was raised nearly seventy years ago over the northern end by Mr. Borchgrevink's great predecessor in Antarctic work, Sir James Clark Ross.* In the situation of the two magnetic poles there is a wide difference. The Northern Magnetic Pole is on the mainland of America, in a region more or less inhabited, or at least which is further south than districts permanently occupied by the Esquimaux, forming, indeed, a part of the Dominion of Canada. On the other hand, the South Magnetic Pole lies beyond many hundreds of miles of ice-covered ocean and land, and fully two thousand miles from the nearest dwelling of man. But I do not invite you to welcome our guests to-night as mere adventurous explorers—as men who have suffered hardships and overcome difficulties in going where no one has been before, and who by-and-bye will excite in us an arm-chair interest through the narration of those hardships and difficulties. They have a far more important, a far more serious claim to our regard; for they have carried with them into those unknown regions of the earth scientific training and skill, and they have brought back results which will in due time be built up into that ever-growing fabric of co-ordinated knowledge which is one of the chief glories and delights of the human mind. It is especially appropriate to us, as members of a Society whose aim is the promotion of Science, to bear this in mind; but I will proceed upon a broader basis than the fact that I am addressing the Royal Society of Tasmania. It is the birthright of every civilised man or woman to take joy in the progress of knowledge, even of knowledge which in all its details we individually do not, perhaps cannot, understand. And this is the true answer to that irritating question which shallow minds sometimes put when they hear of some new scientific discovery, "But is it of any use?" One wants to ask such people in return, "What do you mean by *use?* Do you mean something that will help some one to get richer?" For we can hardly help suspecting that this is the idea in most cases underlying the question. When we say a thing is of *use*, we understand by this that it satisfies or helps to satisfy some *human want.* And is not the desire to

* Sir John Ross was in command of this Arctic expedition, but it was his nephew, Lieut. J. C. Ross who first reached the Magnetic Pole, 1831.

comprehend more and more thoroughly the great universe in which we live, and the laws which govern it, one of the very strongest wants of civilised humanity? Does not the man who fails to appreciate this fact stand self-condemned as at bottom merely a barbarian? Let us take a hasty glance at the chief branches of science which will be furthered by Antarctic research, not only by the expedition whose successful return we are this evening celebrating, and others of a similar character—that is to say, by operations conducted principally on land—but by all the various methods of exploration and investigation of the Antarctic regions which we may feel certain will more and more fully and vigorously be adopted in the coming century. I have time for little more than a bare enumeration. First, there is the geographical problem. As was pithily said by Major Darwin at the last meeting of the British Association, the greatest unknown feature of the Antarctic regions is the Antarctic Continent itself. The whole unknown region embraces an area of some six or seven million square miles, with a circumference of, say, 9,000 miles. The magnitude of these figures is rather appalling, and it is clear that the work of becoming acquainted with such an area, or even with such parts of it as may prove accessible, will last for many years, and engage many expeditions. What is most wanted at first is to attack the problem in a way which may be described as taking samples—as many as possible. Mr. Borchgrevink's expedition has just obtained a sample in a region of especial interest, that surrounding the Magnetic Pole. But besides this detailed examination of small portions, more extended operations acting circumferentially would be of great interest, particularly as giving us a truer idea of the extent of the Continent and of its outlying islands and archipelagos. At present no man can say whether nearly the whole area I have mentioned is continental or only about half of it, or, it may be, even less than that. Such preliminary reconnaissances may take the form of either coasting voyages or land travel along or near the coasts. The nature of the icy covering of both sea and land will determine the best course to pursue, and in different parts of the circuit different methods will very possibly be found most effective. Either form of expedition will find far more objects of investigation, coming under the head of physical geography, than the mere charting of coast lines. On the one hand, there is the vertical contour of the land to be observed, and the problems, merging into the domains of the physicist and the geologist, connected with its glacial covering, its mode of accumulation, structure, movements, and ultimate separation and dispersion. Petrological examination of the rocks will doubtless throw light on the history of this portion of our planet; indications will there be found either of the permanence, or the reverse, of its glaciated condition during past geological ages. On the other hand, observers on the sea will be able to gain information as to its depth and the vertical distribution of temperature, nature of sedimentary deposits, the character and inter-relation of floating ice in all its varieties, the seasonal changes and movements of the ice and their bearings on the temperature of the water and on oceanic circulation generally throughout the whole Southern Hemisphere. Much of this work will involve the undertaking of voyages of circumnavigation outside the areas where ice obstruction is a serious impediment. If these are prosecuted simultaneously with observations taken within the icy regions, of course the results will be much more capable of effective co-ordination. Passing from the domain of physical geography proper, the next branch of science to be mentioned is Meteorology. And here, more than in any other department, is the necessity apparent for observations continued for as long periods of time, and extending to as many stations as possible. At present any view we please as to meteorological conditions on the Antarctic land may be held, because we have no facts by which to regulate our speculations. Observations within the Antarctic region proper should be conducted in conjunction with the establishment of stations at such places as Cape Horn, the Falkland Islands, and the South Shetlands, the Crozets and Kerguelen, Macquarie Island, and the Auckland Islands. It will be seen that the places mentioned, together with a few others in their neighbourhood, fall naturally into three geographical groups, which we may designate as the South Atlantic, the South Indian Ocean, and the South Pacific. If with each group is associated a station to the south of it, within the Antarctic circle—say at Graham's Land, Enderby Island, and the Balleny Islands respectively—there will be three observational areas situated at about equal intervals round the globe, each of which would suffice to determine exactly the track of every cyclonic disturbance crossing it, while the three in conjunction would probably suffice to render account of every meteorological event of Antarctic origin that took place during the time the stations were maintained. This idea was suggested at the last meeting of the British Association by M. Arctowski, the meteorologist of the recent "Belgica" Expedition, who brought it forward as a scheme for international co-operation, and we may note that a similar scheme, due to Lieut. Weyprecht, of a set of international circumpolar stations was carried out some years ago in the Arctic regions with considerable results to science. But in our hemisphere such a system would be likely to produce far more important results, owing to the much greater simplicity of the meteorological conditions, and the consequent probability that such observations would lead to a fuller understanding of the laws regulating the phenomena. It is obvious that such a set of observing stations on land would co-operate most importantly with any simultaneously conducted voyages of observation outside the pack ice area, for investigation of the phenomena of floating ice and oceanic currents and temperature, and that such co-operation would be mutual. It would extend not only to the gathering in of the scientific harvest, but to many points of practical convenience besides. I may also remark that observations of ice and current seem likely to have a bearing no less considerable than that of direct meteorological phenomena upon the problems of our climate and weather, problems of an importance highly practical as well as theoretical. It seems difficult to resist the impression that the rainfall of the southern half of Australia, of Tasmania and New Zealand—not to mention South Africa and South America—must in its seasonal variations be largely influenced by the movements of the Antarctic ice; movements which we already know have the effect of causing large alterations, year by year, in the areas of open water—and perhaps, too, in the temperature of the water—whence our rain is derived by evaporation. If meteorological science, through such observations as I have referred to, ever arrives at the point when forecasts of our seasonal rainfall could be made 12, or even six months in advance, it is difficult to over estimate the pecuniary benefit that would accrue to the leading industries of Australasia.

I have left myself no time to do more than just mention two of the most important of the other scientific domains certain to be extended by Antarctic research. These are Biology, especially Marine Biology, and the science of Terrestrial magnetism The former was one of the principal objects of that great national undertaking, the cruise of the Challenger, which may be said to have inaugurated a new province of knowledge which has since been extended in a surprising way by the efforts of all the leading countries of the world, and which at the present time needs for its further development—perhaps more than anything else—the pushing forward of investigation into more southern regions. With regard to Terrestrial magnetism, we may bear in mind that its study formed the chief aim of the voyages of the Erebus and Terror, voyages which most people think of mainly in connection with geographical discoveries in the region from which Mr. Borchgrevink and his companions have just returned, but in which those discoveries formed only an incident. Although appealing but slightly, if at all, to "the practical man," to science terrestrial magnetism is of the very highest interest, with its bearing on questions of pure physics on the one hand, and on the structure and history of our planet on the other. For our further understanding of this subject, observations, extended both in time and place, in southern regions are urgently needed.

The purpose of my remarks has been to draw your attention to the many and diverse questions whose solutions lie hidden in these southernmost parts of the earth—questions for the most part, though not wholly, of abstract interest—and to remind you of the prizes of knowledge which await the attack of investigators such as those for whose welcome we are met to-night. And we *do* welcome them most heartily, not only for themselves and for what they have achieved, but because their labours are representative of the interest in Antarctic research which, after many years, is now again awakening, and which brings promise of more and more of such achievement in the years to come. This is an interest we share with all the civilised nations of the earth, an interest deepened by the thought that we are confronted with problems which hereafter will engage the attention "of the loftiest minds when you and I, like streaks of morning cloud, shall have melted into the infinite azure of the past."

The Bishop of Tasmania said—

Mr. Chairman, and Ladies and Gentlemen,—Everyone will understand with what warmth and cordiality the Royal Society of Tasmania welcomes back the members of the Antarctic Expedition. They have indeed established a record. No expedition, with the exception of that of Ross, can be even compared with it for results, and it may well be that it may have contributed more than all previous expeditions put together in scientific results. Even the veriest tyro could not have lived for twelve months on the Antarctic continent without obtaining deeply interesting results, and we may be confident that Mr. Borchgrevink and his staff spent every available moment in observations and scientific research. We all of us remember the eagerness with which Stanley's account of his journey across Africa was awaited. I think I may assure the leader of this expedition that his story of the first sojourn on a still more unknown continent will be looked for with still greater eagerness.

And now, Mr. Chairman, perhaps it will not be out of place if I put before this audience, first, a very brief summary of what has up to the present been accomplished in Antarctic regions, and next, some of the points on which we hope for light. It may be that a pathetic appeal to Mr. Borchgrevink, backed up by your pleading faces, may even permit him to give us, when he speaks, a few crumbs upon which to live till his record is published.

The map prepared for you by Mr. Morton will enable you to follow quite easily this short account of past Antarctic discovery.

The credit of first getting near the South Polar regions lies with the Dutch. In 1598, that is, in Queen Elizabeth's reign, Admiral Mahn discovered the South Shetlands in lat. 64°. But it is England that claims to have first crossed the Antarctic Circle (67° 30′ S.); Captain Cook twice crossed it in 1773 and 1874, and in 1874 he reached 71° 10′, and afterwards was the first to completely circumnavigate the Antarctic ice fields.

What is specially interesting in recording Antarctic travel is the fact that lat. 70° S. seems to be almost an English enclosure beyond which only one ship not English in its starting point has ever yet penetrated. I will come to the exception presently.

If you will look at the map you will note that a good many have approached lat. 70°, but few have crossed it. The Russian Bellinghausen just reached it in 1819-20, in two places, but did not cross it. Now follow the course of English enterprise within the charmed circle. Cook twice crossed in 1773-4. Biscoe in 1830 possibly crossed behind Enderby Land. But it is Weddell who made the next great step after Cook. In two sealing ships he beat Cook by three degrees, and reached 74° 15′ S., and saw no ice southward except three icebergs, but dare not proceed on account of time. The white space, therefore, on the map is not all ice, but uncharted surface. Weddell's furthest south, accomplished in a ship, is right in the middle of that white space. And so we come to Ross and Crozier's famous achievements. You will note also how Ross pierced towards the Pole from opposite sides, reaching in two successive years 78° 10′ from the Tasmanian side, and 71° 30′ from the opposite side. He also landed on two islands near Victoria Land—Possession Island and Franklin Island—(78° 10′ has been therefore until now the furthest south). The only ship not fitted out in England which has crossed 70° S. is the "Antarctic," with which Mr. Borchgrevink's name is also connected. So Norway has had the credit of reaching in a whaler 74° S., and also of recording the first landing on the Antarctic continent, and of gathering the first specimen of plant life at so high a latitude.

There sit before us now some 30 men who have beaten Ross by some 40 miles, have done it on land, and are with marvellous consistency keeping back their fascinating secrets.

The next expedition, ladies and gentlemen, is likely to be a joint one next year—an English and a German ship—sent by their respective Governments. I believe it is intended to divide the South Polar region into four quadrants, each ship to take two of them—and to take opposite pairs. Thus England would take what we may call for once "the Rosses"; Germany, the "Enderby" and "Weddell" quadrants.

I trust I have not wearied you by this rapid sketch. If you will bear with me for a few more minutes I will indicate just a few points upon which we desire information. Mr. Borchgrevink, when appealed to thus definitely, may be able to grant some slight favour to this audience, if it would be consistent with his engagements First and foremost—the *Magnetic Pole.* Ross believed he was within 160 miles of it, and located it with some certainty at 75° 5′ S. (the *North* Magnetic Pole being 73° 35′). We long to ask Mr. Borchgrevink whether he reached the Magnetic Pole. That, I fear, he may not tell to-night, but I wonder whether he may tell us whether Ross was right or wrong. Just that and no more.

The *Barometer.* At present it has been believed that the normal pressure in latitudes above 65° S., at sea level is 29° or less. We long to know whether this is confirmed. So, again, rain was said to be very rare, but snow fell every other day. Or, if we turn to *Icebergs*—At present the bergs of the Antarctic fields are known to be flat and stratified, breaking off from long lines of coast, *not* from deep fiords and down valleys, as at the North Pole. Has he found any exception to this rule? Or, if we turn to *Geology*, we have been given to understand heretofore that the Antarctic rocks are much the same as those on the West Coast of Tasmania. How exciting to our miners. There is also the theory that a continent once existed, of which Kerguelen, the Crozets, and Marion Island are mountain tops. Is there any fresh light?

Turning to *Flora.*—Up to the present Fuegia is said to be the centre of Antarctic Flora, and yet, strange to say, it contains English plants which grow nowhere in intermediate places; 44 per cent. of New Zealand flora being also Antarctic. Have any additions been made to this subject?

And lastly, and to some of us it is the most interesting subject—

What of *animals* and *birds*? Are there any land animals or land birds?

Turning to sea animals and sea birds—Did Mr. Borchgrevink meet with our mysterious mutton birds between May and September, when they vanish entirely from our world? We have learnt at present that other sorts of petrels form well-defined rings, guarding the Pole, or acting as beautiful signals whereby almost to fix the latitudes roughly. Thus the albatrosses stop at 55° S., and white-bellied petrels take their place; but these, again, do not leave the dreaded pack through which all ships have to pass on the way to the inner open water. So the ice pack and the white-bellied petrel give way simultaneously to the black-bellied petrel, who conducts voyagers to the regions of the snowy petrel, which delights apparently in perpetual frost. Such facts (if they are facts) add romance to the mysterious Antarctic, and we long to know whether we may now add to our knowledge. It was Mr. Hansen's department.

I think that Mr. Borchgrevink may at least tell us by an imperceptible wave of the hand, or some slight motion, whether he has settled the question of the "right whale." Ross said he saw plenty. The Antarctic saw none. What is the truth? And if they again saw on many seals long and deep scars in parallel lines. Is it the shark which is responsible? If the Royal Society cannot elicit for your benefit answers to any of these questions, then we feel we really may ask for something to make up for our disappointment. That something is this—that when Mr. Borchgrevink unpacks his collections at home he will ask Sir George Newnes to grant us a few specimens. I have no doubt Mr. Morton's patriotic rapacity will do all that is possible. Ladies and gentlemen, the Royal Society at this splendid meeting desires to exclaim, in company with you all, "Well done, Southern Cross."

The Secretary of the Royal Society (Mr. Alex. Morton) read the following letters and telegrams:—

Letter from His Excellency, regretting his inability to attend and preside.

London.—Royal Geographical Society, April 4, 1900.—To C. E. Borchgrevink. — "Warmest congratulations." (Sir) Clements Markham, President.

Christiania, University of Christiania, April 3, 1900.—To C. E. Borchgrevink. — "Congratulations. Your success creating sensation."—Professor Neilsen.

Royal Society of New South Wales, April 9, 1900.—"Hearty congratulations to members of the Antarctic Expedition, from the Rayal Society, Sydney." —G. H. Knibbs, hon. sec.

Royal Society of Victoria, April 9, 1900.—"Hearty congratulations successful Antarctic Expedition."—(Prof.) W. E. Kernot, President.

Royal Society of South Australia, April 10, 1900.—"Royal Society of South Australia joins in hearty congratulations to the Antarctic Expedition." —(Dr.) W. L. Cleland, President.

Royal Society of Queensland, April 11, 1900. — "Please convey congratulations of Royal Society of Queensland to the members of the Antarctic Expedition." —J. F. Cailey, hon. sec.

Royal Geographical Society of Victoria, April 9, 1900.—"President and members of the Royal Geographical Society, Victoria, heartily welcome back Mr. Borchgrevink and his brave Antbrave Antarctic explorers."—(Sir) John President.

Royal Geographical Society of South Australia, April 4, 1900.—"Hearty congratulations; splendid result; expedition surpassing all previous Antarctic explorers; deeply regret Hansen's death; glad other members of the party are in good health, and hope the Southern Cross may call at Adelaide."—J. L. Bonython, Vice-President.

University of Victoria, Melbourne, April 6, 1900.—"Heartiest congratulations; as a member of the forthcoming Antarctic Expedition, anxious to see you."—Professor Gregory (Professor of Geology).

Norwegian Society, Melbourne, April 6, 1900.—"Norwegians congratulate you heartily on the success you have obtained."—A. J. Schrender, Vice-President.

Premier's Office, Hobart, April 14, 1900.—"The Premier regrets that absence from Tasmania on public business will prevent him being present at the conversazione to be held at the Town-hall on Wednesday, April 18, to welcome Mr. Carsten Borchgrevink and the scientific staff and officers of the Southern Cross. He will be obliged if Mr. Morton will convey to Mr. Borchgrevink and his plucky staff and officers his hearty congratulations upon the success of their Expedition, and upon their safe return to Tasmania." — N. E. Lewis, Premier.

From the Hon. Sir James Agnew, K.C.M.G., M.D., Chairman of the Royal Society of Tasmania.—My Dear Mr. Borchgrevink,—I greatly regret my inability to be present at the Town-hall this evening, but although absent, I desire, partly as being senior vice-president of our Royal Society, to give you and your brave companions my most cordial welcome on your safe return (unfortunately with one exception) from the Antarctic regions; and also to express my heartiest congratulations on the success of the work you have accomplished in the great cause of science. The published records of the work will be looked for with keenest interest by all your numerous friends in Tasmania. With best wishes to Mrs. Borchgreevink and yourself for a pleasant voyage on your return to the Old World,—I am, very sincerely yours, J. W. Agnew. C. E. Borchgreevink, Esq., F.R.G.S. Hobart. April 18, 1900.

Town Clerk's Office, Hobart, April 10, 1900.—Alex. Morton, Esq. Sir,— "I have the honour to acknowledge the receipt of your favour of the 9th inst., and wish to thank you for the kind invitation therein contained. The R.W. the Mayor desires me to state that, he being far from well, intends leaving town for Easter, and it is more than probable that he will be unable to be back on the date mentioned; but has instructed the senior Alderman (Mr. George Hiddlestone) to welcome Mr. C. E. Borchgrevink and the officers of the Antarctic

Expedition, on behalf of himself, Aldermen, and citizens."—I have, etc., J. W. C. Hamilton, Town Clerk.

Chamber of Commerce, Hobart, Tasmania, April 18, 1900. To C. E. Borchgrevink, Esq., Leader of the Antarctic Expedition.—Dear Sir,—"As representing the members of the Chamber of Commerce, I have sincere pleasure in welcoming you and your staff on your return to this port, after bravely enduring the extreme hardships of the South Polar Regions. I trust that all the information you desired to obtain by the expedition have been secured, and that you will return to Europe to enrich our geographical knowledge, and receive the encomiums you have so well deserved; and I trust to fully re-establish good health. The mercantile community of Hobart feel especially interested in the result of your labours, because this port has been the starting and returning point of the two most celebrated expeditions to Antarctic regions."—Yours, etc., C. H. Grant, President.

Field Naturalist Club of Victoria, Melbourne, April 10, 1900.—Alex. Morton. Dear, Sir,—"At our meeting last evening, I was instructed by resolution to forward the congratulations of the above club to the members of the Antarctic Expedition on their safe return and trust you will convey same to them." — Yours, etc., George Coghill, hon. sec.

Launceston Microscopical Club, Launceston, April 12, 1900.—C. E. Borchgrevink, Esq., F.R.G.S., etc. Sir,—"On behalf of the members of the above club, we beg to tender our hearty congratulations upon your safe return from the perilous voyage of discovery so nobly undertook in the interests of science, to the regions bounding the Southern Pole. We trust that in due course, when the final results of your work are made known to the world, the forecasts made two years ago will be amply verified. We also hope that, in the near future, you will be spared to have the privilege of leading a second expedition, so as to still further enhance our store of knowledge respecting the Antarctic regions. It is with deep regret that we heard of the lamented death of Mr. Hansen, of the zoological staff. We offer our sincere condolence, trusting his demise at the post of duty may to some extent mitigate the loss."—We have the honour to remain, on behalf of the Launceston Microscopical Club, yours, etc., W. F. Petterd, President; F. E. Burbury, acting hon. sec.

To Carsten E. Borchgrevink, F.R.G.S.—Sir,—The Council of the Civil Service Association of Tasmania desire to join with other public bodies in the colony in tendering to you and to the scientific staff and officers of the ship Southern Cross a very hearty welcome upon your return to our shores from the Antarctic regions. Although we do not expect you to publish here any of the results of your explorations, we feel assured your discoveries during your arduous expedition will necessarily prove of intense interest to the world at large and of great utility in scientific circles. We wish the Southern Cross a pleasant voyage to Europe, and we trust that you and each of your comrades will receive a due recognition of the indomitable pluck and perseverance you have exhibited. We remain, yours faithfully, Bernard Shaw, President; A. Moat, Secretary. Hobart, April 18. 1900.

The Treasurer (Hon. B. S. Bird), on behalf of the Government, welcomed the leader and members of the expedition, and expressed regret at the absence of the Premier, which was unavoidable. He was proud to take part in the welcome which the Government accorded to the leader and members of the expedition. They welcomed the men, but not entirely without sorrow, as the expedition had cost a life. Still they were anxious to offer the explorers a true British welcome. (Applause.) Of course they would like to hear some of the particulars of the expedition, but they must wait until a report was published by Sir George Newnes. Some people were apt to ask what was the benefit of the expedition? Whether the results of the expedition had a commercial or geographical value, the information obtained must be of great interest. All they could do at present was to heartily congratulate Mr. Borchgreevink and his party on their attempt to bridge the gulf between the ignorance that was and the knowledge that now existed. He hoped to see a further exploration made.

as the expedition just made would be a base for future operations. It was to be hoped that Mr. Borchgreevink himself would lead another party with the same brave spirit that had characterised the recent exploration.

The Chief Secretary (Hon. G. T. Collins) endorsed what Mr. Bird had said. He would briefly extend to the leader and members of the expedition the heartiest congratulations and welcome that they could give. The Government took an interest in the expedition, and on behalf of the northern part of the Island, as well as for the south, he welcomed the explorers back. (Applause.)

The Hon. Adye Douglas, as President of the Legislative Council, also tendered a welcome to the captain and members of the expedition. The party were to be congratulated on the success of their mission. Such a large and representative meeting should be gratifying to Mr. Borchgreevink, whom he hoped would soon return to Tasmania, and give them more information than had yet been imparted. (Applause.)

The Hon. Nicholas Brown, on behalf of the Assembly, also delivered a congratulatory address. The results of the voyage were not yet known, but all were aware that a great deal of bravery had been shown by members of the expedition, which entitled them to the warmest of welcomes. Tasmania was an outpost of Great Britain, and was also an outpost in the cause of science. The Royal Society of Tasmania had done much in the way of fostering and extending science. Although the benefits of the recent exploration seemed remote, they would in the future have an important bearing on the world generally.

Alderman Hiddlestone (in the absence of the Mayor) read an address of welcome from the City Council. After congratulations, the address noted that the citizens had eagerly awaited the return of the explorers, and now still more eagerly awaited the report of their expedition: and, finally, expressed regret at the death of Mr. Hansen. Alderman Hiddlestone added several hearty words of congratulation and welcome on his own account.

Addresses of welcome were also presented by the following bodies:—The Marine Board of Hobart (by Captain T. M. Fisher); Australian Natives' Association (by Mr. A. J. Nettlefold).

The Chairman explained that Colonel Legge wrote congratulating Mr. Borchgrevink and the other members of the expedition on the success that had attended their undertaking.

Mr. Borchgrevink, who was received with long-sustained applause, said:—Lady Gormanston, Sir John Dodds, ladies and gentlemen,—I am rather in an unfortunate position to-night in one way—wishing to say much and still obliged to say little. I shall not make an exception from a rule I always follow—multum in parvo; I like to say much in little, and I hate doing the reverse. However, I feel that the good-bye we of the Southern Cross got from Hobart, and the reception we have got here to-night, justify me in opening-out my heart so much that I find some revelations I must make. ("Hear, hear," and applause). Well, we have been successful. We have carried-out the aim of the expedition. (Loud applause.) Thanks, that is, to all on board, from my scientific staff to the humblest sailor. (Applause.) Everyone has been a cog in that wheel which is necessary to carry human knowledge onwards. Standing here to-night speaking not alone on behalf of myself, but also on behalf of those who risked their lives, and who at all times were ready without murmur to endure all for the purposes for which they had joined the expedition—I feel that we are a small band and that Providence has kept a protecting hand over us, and helped us in our efforts; and I feel also that this small band will only be the poineers of a roll of illustrious Britons who we hope will benefit by our experience. (Applause.) Not least, I believe, will Tasmania benefit by giving a helping hand in future Antarctic research; for I believe that the opening up of Antarctic exploration in the year 1900 must in time to come be a bright intellectual landmark in the history of the culture of the nations of the Southern Hemisphere. (Applause.) When we left, the Bishop was kind enough to inform me that he did not expect impossibilities from us; I was very glad to hear it, and I hope he will maintain that kind feeling now. (Laughter and applause.) Especially as touching upon the position of the Magnetic Pole. He asked whether Sir Jas. Clark Ross's calculations of the position of the South Magnetic Pole were accurate or not. It is impossible for me to say; because the South Magnetic Pole is not stationary. We have at present determined the present position of the South Magnetic Pole; and we have been fortunate enough to penetrate further south than man ever put foot before—deg. 78.50. In the biological direction great discoveries have been made, some of which must needs startle the scientific world and upset former theories about these regions. When I in 1896, at the Imperial Institute, before the International Geographical Congress, had the honour to lay down my first plan of Antarctic exploration, I proposed to winter on the Antarctic Continent. That plan had never been put before the world before, and considerable doubt arose as to whether it would be feasible, or at least advisable, to venture it, because of the meteorological conditions there. We did not know whether the forces within the Antarctic circle would be too hard for human endurance and energy; and when we landed on that small slip of land, where our modest little hut was put up, we did not know whether the water at high level would come over the slip of land, nor whether the cold would be too much for us; and we did not know the force of the wind in those regions. Touching on meteorology, I will say that the forces observed in the Antarctic circle are far beyond expectation, and we have had hard and difficulties from these conditions, which also will come as lightning from a clear sky to the scientific world. I cannot but feel that your good-bye to us here in Hobart followed us, stimulating us through times of trial. We felt that kind hearts beat in the nearest civilised country to us—Tasmania. (Applause.) We knew that kind hearts beat in Europe also; but still our thoughts drew us to the nearest land where we last found interest and heartiness. As a result of this expedition great discoveries must rapidly follow. I hope shortly to be able to lay some of our experiences before the Royal Geographical Society of London, and thus help the great national enterprise of Antarctic exploration, which is proposed. Some of our ancestors—some of the old Vikings—settled on the English shore, and so the Great British nation and the Norwegian stand near together. (Applause.) I hope the British Antarctic enterprise will be still successful, and I hope some Norwegians may be able to share in it. (Applause.) It is good to feel for the small countries. I know that it is an honour to sail under the flag of such a nation as the British—(applause)—and that each small nation standing under the Union Jack is nearer to victory than any other. (Renewed applause.) As a boy I read the reports of Sir James Clark Ross's voyage with admiration; now, after our experience, I read them with reverence. (Applause.) How that great navigator, without the help of steam, managed to do what he did, and enlighten the scientific world as he did, I do not know.—There were lion hearts aboard the Erebus and Terror. (Applause.) Great risks are met with within the Antarctic circle, and I think it would be wrong of me not to put great weight on one point in advising future expeditions; that point is—two vessels! (Hear, hear.) When the vessel left us down there, we first really realised that we were cut off from the great beating world—2,500 miles south of Australia—with no means whatever of returning to civilisation, in case the Southern Cross met with disaster. To-day, now we have succeeded in landing here, I feel the more how much each has had to depend on the other—how each, from the humblest sailor upwards, has had to do his utmost towards our success; and I feel how much one must recognise the protecting hand of Providence all through. In thanking you for your kind reception to-night, I will only say—I hope and believe that in the future any Antarctic expedition, from whichever country it may come, will call here—(applause)—as a better port and kinder hearts cannot be met with. (Loud applause.)

A number of solos on the organ were played by Mr. T. Julian Haywood, and Mr. J. Brown, with the Vice-regal band, played a piece composed by him self, in honour of the members of the expedition, and entitled "The Southern Cross Waltz."

At the conclusion of the programme, refreshments were served in the ante-room.

LIST OF THE TASMANIAN SHELLS IN THE TASMANIAN MUSEUM COLLECTION, WITH THE NAMES OF MANY SPECIES THAT ARE NOT YET REPRESENTED THEREIN.

By M. Lodder.

Class CEPHALOPODA.

1 *Argonauta nodosa,* Solander. The "Paper Nautilus."
2 *Sepia mestus.* Gray.
3 —— *capensis.* D'Orbigny.
4 —— *australis.* D'Orbigny.
5 —— *elongata.* D'Orbigny and Férussac.
6 *Spirula peronii.* Lamarck.

Class GASTROPODA.

7 *Murex, Pteronotus triformis.* Reeve.
8 ——— *P. triformis.* Reeve. Var. *zonatus.* Tenison-Woods.
9 ——— *Pteronotus angasi.* Crosse.
10 ——— *Phyllonotus umbilicatus.* Tenison-Woods (as Trophon). Syns. M. scalaris, A. ad. non. Brocchi; Phyll. angasi, Tryon non Crosse; P. octogonus, Bednall non Quoy and Gaim.
11 ——— *ocinebra brazieri.* Angas. Syn. Trophon tumidus, Petterd.
12 *Typhis arcuatus.* Hinds. Syn. T. japonicus, A. Ad.
13 *Trophon goldsteini.* Tenison-Woods.
14 ——— *petterdi.* Brazier. Syn. T. clathratus, Tenison-Woods.
15 ——— *brazieri.* Tenison-Woods. Syn. Siphonalia castanea, ibid.
16 ——— *assisi.* Tenison-Woods. Syn. T. squamosissimus, ibid. Type specimens of the latter.
17 ——— *australis.* Tenison-Woods.
18 ——— *mariæ.* Tenison-Woods. No specimens.
19 ——— *laminatus.* Petterd. No specimens.
20 *Purpura succincta.* Martyn.
21 ——— *succincta.* Mart. Var. *textiliosa.* Lamarck.
22 ——— *baileyana.* Tenison-Woods.
23 *Ricinula undata.* Chemnitz. Syn. Purpura humilis, Crosse; Purpura reticulata, Quoy.
24 ——— *Sistrum adelaidensis.* Crosse.

These are all varieties of Crosse's species	Purpura littorinoides.	Tenison-Woods.	
	,, propinqua.	,,	
	,, albo-sutura.	,,	
	Cominella albo-lirata.	,,	Type.

25 *Triton spengleri.* Chemnitz.
26 ——— *waterhousei.* Adams and Angas. No specimens.
27 ——— *fusiformis.* Kiener. No specimens.

28 *Triton quoyi.* Reeve. Syn. T. verrucosus, Reeve.
29 ——— *eburneus.* Reeve.
30 ——— *subdistortus.* Reeve.
31 ——— *bassi.* Angas.
32 ——— *nodiferus.* Lamarck. No specimens.
33 *Ranella argus.* Gmelin. Syn. R. vexillum, Sowerby.
34 ——— *leucostoma.* Lamarck.
35 *Fusus spectrum.* Adams and Reeve. Var. *novæ-hollandiæ.* Reeve.
36 ——— *australis.* Quoy and Gaimard. No specimens.
37 ——— *ustulatus.* Reeve.
38 ——— *ustulatus.* Rve. Var. *legrandi.* Tenison-Woods.
39 ——— *pyrulatus.* Reeve. A doubtful specimen
40 *Latirofusus nigrofuscus.* Tate. Syn. Fusus spiceri. Tenison-Woods.
41 *Fasciolaria fusiformis.* Valenciennes. No specimens.
42 ——— ,, *coronata.* Lamarck.
43 *Peristernia clarkei,* Tenison-Woods (as Siphonalia).
44 ——— ,, *turrita* Tenison-Woods ,,
45 ——— ,, *paiviæ.* Crosse.
46 *Megalatractus maximus.* Tryon.
47 *Siphonalia dilatata.* Quoy and Gaimard.
48 ——— ,, *dilatata.* Q. and G., var. *adusta.* Philippi.
49 ——— ,, *tasmaniensis.* Adams and Angas. No specimens.
50 *Pisania reticulata.* A. Adams.
51 ——— *bednalli.* Brazier. Syn., P. Tasmanica, Tenison-Woods.
52 *Cantharus eburneus.* Petterd (as Trophon).
53 *Cominella lineolata.* Lamarck. Syns. C. alveolata, Kiener ; C. tasmanica, Tenison-Woods.
54 ——— *costata.* Quoy and Gaimaral. Syn. C. Angas-Crosse.
55 ——— *tenuicostata.* Tenison-Woods.
56 ——— *tritoniformis.* Blainville. Syns. Adamsia typica, Dunker ; Agnewi typica, Tenison-Woods ; Urosalpinx tritoniformis, Tryon.
57 ——— *josepha tasmanica,* Tenison-Woods. No specimens.
58 *Eburna, zermira australis.* Sowerby. No specimens.
59 *Nassa fasciata.* Lamarck.
60 ——— *pauperata.* Lamarck.
61 ——— *monile.* Kiener. Syns. N. jacksoniana ; Quoy and Gaim.; N. tasmanica, Tenison-Woods.
62 *Nassa jonasi.* Dunker. Syn. N. labecula. A. Adams.
63 ——— *compacta.* Angas.
64 ——— rufocincta (m).
65 *Neritula lucida.* Adams and Angas. No specimens.
66 *Voluta, amoria undulata.* Lamarck. Syn. V. augasi. Sowerby.
67 ——— ,, ,, ,, var. *sclateri.* Cox. } No specimens.
68 ——— ,, ,, ,, var. *kingi.* Cox. }
69 ——— *alcithoë fusiformis.* Swainson.
70 ——— ,, *papillosa.* Swainson.
71 ——— ,, *papillosa.* Swainson, var. *macquariensis,* Petterd. No specimen.

72 *Voluta, alcithoë roadnightæ.* M'Coy. No specimen.
73 ——— *mamillana mamilla.* Gray.
74 *Lyria mitræformis.* Lamarck.
75 *Mitra testacea.* Swainson. Syn. M. badia. Reeve.
76 ——— *glabra,* ,, Syn. M. declivis. Reeve.
77 ——— *australis* ,,
78 ——— *pica.* Reeve.
79 ——— *franciscana.* Tenison-Woods.
80 ——— *capensis.* Dunker. Syns. M. vincta, A. adams; M. weldii, Tenison-Woods.
81 ——— *teresiæ.* Tenison-Woods.
82 ——— *tasmanica.* ,,
83 ——— *scalariformis.* ,,
84 ——— *scita.* ,,
85 ——— *legrandi.* ,,
86 *Erato lachryma.* Gray. No specimen.
87 *Marginella formicula.* Lamarck.
88 ——— ,, ,, var. *muscaria,* Lamarck.
89 ——— *tasmanica.* Tenison-Woods.
90 ——— *turbinata.* Sowerby.
91 *Marginella turbinata.* Sowerby; var. *volutiformis* (m.), Reeve.
92 ——— *stanislas.* Tenison-Woods.
93 ——— *minutissima.* ,,
94 ——— *allporti.* ,,
95 ——— *cypræoides.* ,, Type.
96 ——— *cymbalum.* Tate. No specimens.
97 ——— *ovulum.* Sowerby. Syn, petterdi, Beddome. No specimens.
98 ——— *denticulata.* Tate. No specimens.
99 ——— *mixta.* Petterd. No specimeus.
100 ——— *johnstoni.* ,,
101 ——— *minima.* ,,
102 ——— *beddomei.* ,, No specimens.
103 ——— *volvaria lubrica.* Petterd.
104 ——— *mayi* (type Frederick Henry Bay).
105 *Olivella leucozona.* Adams and Angas.
106 ——— *australis.* Tenison-Woods. No specimens.
107 ——— *nympha.* Adams and Angas.
108 *Ancillaria marginata.* Sowerby. Syn. A. marmorata, Reeve.
109 ——— *fusiformis.* Petterd. No specimens.
110 ——— *petterdi.* Tate. Syns. A. obtusa, Petterd non Swainson; A. obesula, Tate. No specimens.
111 *Columbella semi-convexa.* Lamarck.
112 ——— *achatina.* Sowerby.
113 ——— ,, ,, var. *Roblini,* Tenison-Woods.
114 ——— ,, ,, var. *pulla,* Gaskoin.
115 ——— ,, ,, var. *badia,* Tenison-Woods.
116 ——— *lincolnensis.* Reeve.

117 *Columbella menkeana.* Reeve. Syn. C, xavierana, Tenison-Woods.
118 ——— *miltostoma.* Tenison-Woods.
119 ——— *dictua.* Tenison-Woods. Type.
120 ——— *impolita.* Sowerby. Syns. C, austrina, Gaskoin ; C. infumata, Crosse.
121 ——— *angasi.* Brazier. Syns. C. interrupta, Angas non Gaskoin ; C. minima, Tenison-Woods.
122 *Columbella tenisoni.* Tryon. Syn. C. minuta, Tenison-Woods non Gould.
123 ——— *albo-maculata.* Angas. C. tayloriana, Reeve. No specimens.
124 ——— *alba.* Petterd. No specimens.
125 ——— *attenuata.* Angas. Syn. Terebra beddomei, Petterd. No specimens.
126 ——— *legrandi.* Tenison-Woods.
127 ——— *speciosa.* Angas. Syn. Mangilia atkinsoni, Tenison-Woods.
128 ——— *filosa.* Angas. No specimens.
129 *Cancellaria granosa.* Sowerby. Syn. C. undulata, Sowerby.
130 ——— *levigata* ,,
131 ——— *tasmanica.* Tenison-Woods.
132 ——— *spirata.* Lamarck. Syn. C. excavata, Sowerby. No specimens.
133 *Terebra kieneri.* Deshayes. T. spectabilis, Hinds ; T. addita, Deshayes ; T. jukesii, Deshayes. Synonymous according to Tryon.
134 ——— *fictilis.* Hinds. Syn. Acus bicolor, Angas.
135 ——— *ustulata.* Deshayes. No specimen.
136 ——— *Hastula brazieri.* Angas. Syn. T. acutis-costata, Tenison-Woods.
137 ——— *Euryta harrisoni.* Tenison-Woods, as Mangilia. No specimens.
138 *Pleurotoma, Surcula quoyi.* Reeve. Syn. P. philippineri, Tenison-Woods.
139 ——— *Drillia sinensis.* Hinds. Syn. D. coxi, Angas. No specimens.
140 ——— ,, *angasi.* Crosse. Syn. D. berandiana, Crosse.
141 ——— ,, *minuta.* Tenison-Woods.
142 ——— ,, *tæniata.* ,, Type.
143 ——— ,, *agnewi.* ,, Type.
144 ——— ,, *woodsi.* Beddome. No specimens.
145 ——— ,, *legrandi.* ,, No specimens.
146 ——— ,, *incrusta.* Tenison-Woods. Perhaps Clathurella lallemantiana, Crosse
147 ——— *Clathurella lallemantiana.* Crosse.
148 ——— ,, *bicolor.* Angas.
149 *Pleurotoma Clathurella parvula.* Reeve. Syns. C. crassina, Angas; C. philomenæ, Tenison-Woods ; Siphonalia pulchra, Tenison-Woods; Drillia atkinsoni, Tenison-Woods.

150 *Pleurotoma Clathurella granulosissima.* Tenison-Woods. No specimens.

151 ———— ,, *sculptilior.* ,,

152 ———— ,, *sculptilis.* Angas.

153 ———— *Daphnella tasmanica.* Tenison Woods.

154 ———— ,, *kingensis.* Petterd. No specimen.

155 ———— *Cythara compta.* Adams and Angas. Syn. Daphnella varix, Tenison-Woods.

156 ———— ,, *maccoyi.* Petterd. No specimen.

157 ———— *Mangilia australis.* Adams and Angas, as Bela Var. *mitralis,* Adams and Angas.

158 ———— ,, *tasmanica.* Tenison-Woods.

159 ———— ,, *st. gallæ.* Tenison-Woods.

160 ———— ,, ,, Var. *benedicte,* ibid. No specimen.

161 ———— ,, *desalesii.* Tenison-Woods.

162 ———— ,, *picta.* Adams and Angas. Syn. M. meredithæ, Tenison-Woods.

163 ———— ,, *alucinans.* Sowerby. Syn. Clathurella browniana, T. Woods.

164 ———— ,, *immaculata.* Tenison-Woods.

165 ———— ,, *delicatula.* ,, No specimens.

166 ———— ,, *alternata.* ,,

167 ———— ,, *cancellata.* Beddome.

168 ———— ,, *anomala.* Angas.

169 ———— ,, *paucimaculata.* Angas. No specimens.

170 ———— ,, *adcocki.* Sowerby. No specimens. Syn. M. gracilina, Tenison-Woods.

171 *Conus anemone.* Lamarck. Var, *novæ hollandiæ.* A. Adams.

172 —— *carmeli.* Tenison-Woods. Probably type.

173 —— *rutilus.* Menke. Syn. C. tasmanicus Tenison-Woods; C. macleayana, ibid; C. smithii, Agnas.

174 *Cypræa umbilicata.* Sowerby.

175 ———— ,, ,, var. *alba,* Cox. No specimens.

176 ———— *angustata.* Gmelin.

177 ———— ,, ,, var. *Comptoni,* Gray.

178 ———— *declivis.* Sowerby.

179 ———— *piperita.* Solander.

180 *Trivia australis.* Gray.

181 *Cassis semigranosa.* Wood.

182 ——— *achatina.* Lamarck; var. *pyrum,* Lamarck.

183 ——— ,, ,, var. *paucirugus,* Menke.

184 ——— ,, ,, var. *nivea,* Brazier.

185 ——— ,, ,, var. *tumida,* Petterd.

186 *Natica conica.* Lamarck.

187 ——— *beddomei.* R. M. Johnston. Syn. N. effosa, Boog Watson.

188 ——— *ampla.* Philippi. Syn. N. didyma, Bolten.

189 ——— *sagittata.* Menke. No specimens.

190 ——— *tasmanica.* Tenison-Woods.

191 ——— *nana.* ,, Not sure of this.

192 *Natica Mamilla umbilicata.* Quoy and Gaimard. Var. ***globosa,*** Tenison-Woods.
193 *Sigaritus lævigatus.* Lamarck.
194 *Lamellaria, Marsenina indica.* Leach,
195 *Vanikoro orbignyana.* Recluz. No specimen.
196 *Calyptræ calyptræformis.* Lamarck.
197 *Crepidula Ianacus unguiformis.* Lamarck.
198 ——— *onyx.* Sowerby. Syn. C. immersa, Angas. No specimen.
199 *Hipponyx antiquatus.* Lamarck. Syn. H. foliacea, Quoy and Gaimard.
200 ——— *subrufus.* Lamarck. No specimen.
201 ——— *Amathea australis.* Quoy and Gaimard. Syn. A. conica, Schumacher.
202 *Solarium, philippia lutea.* Lamarck.
203 ——— *reevei.* Hanley. No specimens.
204 *Adeorbis vincentianus.* Angas. No specimens.
205 *Scalaria au tralis.* Lamarck.
206 ——— *granulosa.* Quoy and Gaimard.
207 ——— *aculeata.* Sowerby.
208 ——— *jukesiana.* Forbes. Syn. S. delicatula, Crosse.
209 ——— *lineolata.* Sowerby.
210 ——— *philippinarum.* Sowerby.
211 ——— *crossea labiata.* Tenison-Woods.
212 ——— „ *concinna* Angas.
213 ——— „ *cancellata.* Tenison-Woods. Types. Syn. Delphinula johnstoni, Beddome.
214 ——— „ *minuta.* Petterd. No specimens.
215 *Ianthina communis.* Lamarck.
216 „ *exigna.* „ No specimen.
217 *Turritella tasmanica.* Reeve. Syn. T. Gunnii, Reeve.
218 ——— *australis.* Lamarck. Syn. T. granulifera, Tenison-Woods.
219 ——— *tasmaniensis.* Tenison-Woods. Syn. T. atkinsoni, ibid.
220 ——— *acuta.* Tenison-Woods. T. lamellosa, B. Watson.
221 ——— *sinuata.* Reeve.
222 ——— *higginsi.* Petterd. No specimens of this and the three next.
223 ——— *incisa.* Reeve.
224 ——— *sophiæ.* Brazier. Syn. T. incisa, Tenison-Woods non Reeve.
225 ——— *subsquamosa.* Dunker.
226 ——— *clathrata.* Kiener. Syn. T. constricta, Reeve.
227 *Vermetus dentiferus.* Quoy and Gaimard.
228 *Siliguaria australis.* Quoy.
229 ——— *weldii.* Tenison-Woods.
230 *Eulima augur.* Adams and Angas.
231 ——— *tasmanica.* Tenison-Woods.
232 ——— *tenisoni.* Tryon. Syn. E. micans, Tenison-Woods.

233 *Eulima marginata.* Tenison-Woods. No specimens.
234 ——— *aphelas.* ,, ,,
235 ——— *legrandi.* Beddome. ,,
236 ——— *petterdi.* ,, ,,
237 ——— *lodderæ.* Tate. Syn. E. vitrea, Petterd, non A. Adams. No specimens.
238 ——— *mucronata.* Sowerby.
239 *Stylifer, Cythnia robusta.* Petterd.
240 ——— ——— *lodderæ.* ,,
241 *Turbonilla hoffmani.* Angas. Syns. T. angasi, Tenison-Woods; T. nitida, Adgas non A. Adams.
242 ——— *acicularis.* A. Adams. Syn. T. Macleayana, Tenison-Woods.
243 ——— *mariæ.* Tenison-Woods.
244 ——— *tasmanica.* ,,
245 ——— *beddomei.* Petterd.
246 ——— *fusca.* A. Adams. Syns. Elusa bifasciata, Tenison-Woods; T. erubescens, Tate.
247 ——— *festiva.* Angas. No specimens.
248 *Eulimella, Styloptygma tasmanica.* Tenison-Woods.
249 *Aclis micra.* Petterd. No specimens.
250 ——— *turrita.* ,, ,,
251 *Odostomia tasmanica.* Tenison-Woods.
252 ——— *angasi.* Tryon. Syn. O. lactea, Angas non Dunker.
253 *Odostomia eburnea* (Metcalf). Angas.
254 *Oscilla ligata.* Angas. Syn. Parthenia Tasmanica, Tenison-Woods.
255 *Syrnola michaeli.* Tenison-Woods.
256 ——— *bifasciata* ,, syn. Obeliscus jucundus, Angas.
257 ——— *tincta.* Angas. Syn. Eulima aurantia, Petterd.
258 *Mathilda circinnata.* A. Adams. Syn. Aclis tristriata. Tenison-Woods.
259 ——— *Cingulina australis.* Tenison-Woods
260 *Pyramidella actæopyramis concinna.* A. Adams. Syn. Rissoa, Ceratia, punctata-striata, Tenison-Woods. Type.
261 ——— *Obeliscus tasmanicus.* Petterd.
262 *Littorina mauritiana.* Lamarck. Syns. L. unifasciata, Gray
263 L. undulata, Gray; L. paludinella, Reeve.
264 ——— *philippi.* Carpenter. No specimens of this and two following.
265 ——— *nodulosis.* Gmelin. Syn. L. pyramidalis. Quoy and Gaimard.
266 ——— *punctata.* Gmelin.
267 *Risella melanostoma.* Gmelin. Syns. R. nana, Lamarck; R. fimbriata, Philippi; R. plana, Quoy and Gaimard; R. aurata, H. and R. Adams; R. lutea, Gray.
268 *Litiopa lauta.* A. Adams. Syn. Diala punctata. Tenison-Woods.
269 ——— *semistriata.* Philippi. Syn. Diala varia, A. Adams; Rissoa mariæ, Tenison-Woods.

270 *Alaba, Diala monile.* A. Adams. Syn. D. tesselata, Tenison-Woods.
271 ——— *st. claræ.* Tenison-Woods, as Rissoina.
272 ——— *picta* A. Adams. No specimens.
273 *Cerithium rhodostoma.* Adams. Syn. C. serostina, A. Adams.
274 ——— *icarus.* Bayle. Syn. C. tenue, Sowerby.
275 ——— *eludens.* ,, Syn. C. dubium ,,
276 ——— *Bittium granarium.* Kiener.
277 ——— ,, *lawleyanum.* Crosse.
278 ——— ,, *turboniloides.* Tenison-Woods } No specimens.
279 ——— ,, *semilævis.* ,, }
280 ——— ,, *cylindricum.* Boog Watson }
281 *Cerithiopsis crocea.* Angas. Syns. C. albo-sutura, Tenison-Woods; C. atkinsoni, ibid; C. purpurea, Angas.
282 ——— *johnstoni.* Petterd. No specimens
283 ——— *angasi.* Semper. Syn. C. clathrata, Angas **non** A. Adams.
284 *Bittium cylindricum.* B. Watson.
285 *Bittium minimum.* Tenison-Woods.
286 *Triforis tasmanica.* Tenison-Woods.
287 ——— ,, ,, Variety ?
288 ——— *scitula.* A. Adams. Syn. T. fasciata, Tenison-Woods. No specimens
289 ——— *pfeifferi.* Crosse.
290 ——— *festiva.* Adams.
291 ——— *angasi.* Crosse.
292 *Potamides ebeninus.* Bruguière. No specimen.
293 ——— *Batillaria cerithium.* Quoy and Gaimard. Bittium turritella, Q. and G.
294 ——— *Batillaria australis.* Quoy and Gaimard.
295 ——— *Lampania diemense.* ,, ,,
296 *Tatea rufilabris.* A. Adams. Syn. T. Huonensis, Tenison-Woods.
297 *Rissoina concatenata.* Tenison-Woods.
298 ——— *variegata.* Angas.
299 ——— *cincta.* Angas.
300 ——— *spirata.* Sowerby. Var. *d'Orbignyi*, A. Adams.
301 ——— *striata.* Gray. R. elegantula, Angas.
302 ——— *gertrudis.* Tenison-Woods.
303 ——— *flexuosa.* Gould. R. turricula, Angas non Pease; R. Angasi, Pease.
304 ——— *approxima.* Petterd. No specimen.
305 ——— *suprasculpta.* Tenison-Woods. No specimen.
306 ——— *kershawi.* ,, No specimen.
307 *Rissoia flindersii.* Tenison-Woods.
308 ——— *tasmanica.* ,, as Stylifer.
309 ——— *unilirata.* ,, Type specimens.
310 ——— *minutissima.* ,, Type specimens.
311 ——— *agnewi.* ,,
312 ——— *cyclostoma.* ,, Var. *rosea*, Tenison-Woods.

313 *Rissoia melanura.* Tenison-Woods.
314 —— *angeli* ,,
315 —— *layardi.* Petterd. No specimen.
316 —— *bicolor.* ,,
317 —— *approxima.* ,, No specimen.
318 —— *dubia.* ,, No specimen.
319 —— *badia.* Petterd non Watson. No specimen.
320 —— *hisseyana.* Tenison-Woods as Littorina.
321 —— *Apicularia strangei.* Brazier. No specimen. R. lineata, Petterd non Risso.
322 —— *Anabathron contabulata.* Frauenfeld. No specimen.
323 —— *flammea.* Frauenfeld. R. sophiæ, Brazier; R. setia, flamia, Beddome. No specimen.
324 *Rissoia, Setia brazieri.* Tenison-Woods.
325 —— *Ceratia mariæ.* ,, ??? *
326 —— ,, *maccoyi.* ,, No specimen.
327 —— *Cingula atkinsoni.* ,,
328 —— *Rissoia plicata.* Hutton. Alvania cheilostoma.
329 —— ,, *hulli.* Tate. Dunkeria fasciata, T.-Woods non non Adams.
330 —— ,, *bayntoni.* Beddome. No specimen.
331 —— *Amphithalmus petterdi.* Brazier. R. pulchella, Petterd non Risso. No specimen.
332 —— *Amphithalamus olivaceus.* Dunker. R. Diemensis, Petterd; Diala tumidau, Tenison-Woods.
333 —— *Cingula atkinsoni.* Tenison-Woods.

FRESH-WATER SPECIES.

334 *Hydrobia cristallina?* Pfeiffer. No specimen,
335 —— *gunni?* Frauenfeld. ,,
336 —— *tasmanica?* Martins. ,,
337 —— *turbinata.* Petterd. ,,
338 *Bithynella, Potamopyrgus nigra.* Quoy and Gaimard.
339 —— ,, *nitida.* R. M. Johnston. (A fossil species.) No specimens.
340 —— ,, *dulvertonensis.* Tenison-Woods.
341 —— ,, *dunrobinensis.* Tenison-Woods. No
342 —— ,, *dyeriana.* Petterd. No specimen.
343 —— ,, *simsoniana.* Brazier. ,,
344 —— ,, *woodsi.* Petterd. ,,
345 —— ,, *brownii.* ,, ,,
346 —— ,, *marginata.* ,, ,,
347 *Amnicola? petterdiana tasmanica.* Tenison-Woods.
348 —— *Beddomeia diemense.* Frauenfeld.
349 —— ,, *launcestonensis.* R. M. Johnston.
350 —— ,, *bellii.* Petterd. No specimen.
351 —— ,, *hulli.* ,, ,,

* Can find no description of this species.—M. LODDER.

352 *Amnicola ? Beddomeia lodderæ.* Petterd. No specimen.
353 ———— ,, *tasmanica.* Tenison,Woods, as Valvata.
354 *Pomiatopsis striatula.* Menke.
355 ———— *badgerensis.* R. M. Johnston. No specimens.
356 *Assiminea yiennæ.* Tenison-Woods. A. tasmanica. Tenison-Woods.
357 ———— *bicincta.* Petterd.

LITTORAL (MARINE) SPECIES.

358 *Truncatella marginata.* Kuster. No specimen.
359 ———— *scalarina.* Cox. E. Tasmanica, Tenison-Woods.
360 ———— *ceylonica.* Pfeiffer. T. micra, ,,
361 *Nerita punctata.* Quoy and Gaimard.
362 *Liotia tasmanica.* Tenison-Woods.
363 ——— *clathratus.* Reeve.
364 ——— *incerta.* Tenison-Woods.
365 ——— *angasi.* Crosse.
366 ——— *lodderæ.* Petterd.
367 ——— *annulata.* Tenison-Woods.
368 ——— *compacta* Petterd,
369 ——— *Liotina australis.* Kiener.
370 *Cyclostrema kingii.* Brazier. No specimen.
371 ———— *josephi.* Tenison-Woods.
372 ———— *micra* ,,
373 ———— *susonis* ,,
374 ———— *spinosa* ,, No specimen.
375 ———— *microtata.* Petterd.
376 ———— *tatei.* Angas.
377 ———— *cirsonella Weldii.* Tenison-Woods. C. australis, Angas.
378 ———— *johnstoni.* Beddome. No specimen.
379 ———— *Bruniensis.* Beddome.
380 *Phasianella australis.* Gmelin. Syn. P. tritonis, Chemmitz ; P. venosa, Reeve ; P. decora, Lamarck.
381 *Phasianella ventricosa.* Quoy and Gaimard. Syn. P. turgida, Philippi ; P. venusta, Reeve ; P. sanguinea, Reeve ; P. zebra, Gray : P. reticulata, Reeve.
382 *Phasianella rosea.* Angas.
383 *Phasianella angasi.* Crosse.

(N.B.—P. delicatula, Tenison-Woods, is only the young form of P australis.—Gmelin.)

384 *Turbo curcullata.* Tenison-Woods. Type specimen, from King Island.
385 *Turbo gruneri.* Philippi. T. circularis, Reeve. Probably from King Island.
386 *Turbo Marmorostoma undulata.* Martyn.

N.B.—Turbo simsoni, Tenison-Woods, is the young of this.)

387 *Turbo, Collonia roseopunctata.* Angas. Monilea rosea. Tenison-Woods.

388 *Imperator, astralium fimbriatum.* Lamarck. Carinidea fimbriata, Swainson.

389 ———— *astralium aurum.* Jonas. C. granulata, Swainson; C. tasmanica, Tenison-Woods.

390 *Trochus, Minolia vitiliginea,* Menke. M. tasmanica, Tenison-Woods.

391 ——— *Minolia pressiana.* Philippi. Gibbuli weldii, Tenison-Woods.

392 ——— *Minolia prodicta.* Fischer. M. angulata, A. Sams. No specimen,

393 ——— *Monilea turbinata.* Tenison-Woods. No specimen.

394 ——— *Gibbula coxi.* Angas.

395 ——— ,, *culcosa.* A. Adams.

396 ——— ,, *aurea.* Tenison-Woods. G. tiberiana, Crosse.

397 ——— ,, *solorosa.* Tenison-Woods. This is given as *Thalotia solorosa* in T. Woods's Census by some mistake.

398 *Trochus, Callistrochus tasmanicus.* Petterd, as Gibbula tasmanica

399 ——— *Calliostoma meyeri.* Philippi. Zizyphinus armillatus, Reeve non Wood.

400 ——— ,, *fragum.* Philippi.

401 ——— ,, *Zizyphinus legrandi* and *L. allporti.* Tenison-Woods.

402 ——— ,, *incerta.* Reeve. No specimen.

403 ——— *Astele subcarinata.* Swainson. Entrochus perspectivus, A. Adams.

404 *Thalotia baudina.* Fischer. No specimen.

405 ——— *dubia.* Tenison-Woods. No specimen.

406 *Cantharidus conicus.* Gray.

407 ——— *badius.* Wood.

408 ——— *leucostigma.* Menke.

409 ——— *bellulus.* Dunker. No specimen.

410 ——— *peroni.* Philippi.

411 ——— *irisodontes.* Quoy and Gaimard. C. iriodon. Philippi.

412 ——— *nitidulus.* Philippi.

413 ——— *apicinus.* Menke. No specimen.

414 ——— *lesueuri.* Fischer. Thalotia picta, Tenison-Woods. No specimen.

415 ——— *pulcherrimus.* Wood. No specimen. Thalotia mariæ, Tenison-Woods.

416 ——— *fasciatus.* Menke. Bankivia varians, Beck.

417 *Trockocochlea compta.* Tenison-Woods. No specimen.

418 *Monodonta constricta.* Lamarck.

419 ——— *striolata.* Quoy and Gaimard. M. concamerata, Gray and Wood.

420 ——— *zebra.* Menke. M. porcata, A. Adams; Trochocochlea tæniata, Quoy and Gaimard.

421 ——— *odontis.* Wood.

422 ——— *adelaidæ.* Philippi. Diloma australis, Tenison-Woods; gibbula depressa, Tenison-Woods.

423 *Euchelus baccatus.* Menke.
424 ——— *scabrinsculus.* Adams and Angas. E. Tasmanicus,
425 *Clanculus nodulosus.* A. Adams. No specimens.
426 ——— *limbatus.* Quoy and Gaimard. C. variegatus, A. Adams? C. zebridus, Adams.
427 ——— *floridus.* Philippi. C. gibhosus. A. Adams.
428 ——— *undatus.* Lamarck.
429 ——— *mageuri.* Adams.
430 ——— sp. Not Magueri.
431 ——— *dunkeri.* Koch. C. rubens, Angas.
432 ——— *philomenæ.* Tenison-Woods.
433 ——— *aloysii.* Tenison-Woods.
434 ——— *raphaeli.* ,,
435 ——— *conspersus.* Adams. No specimen C. Yatesi, Crosse.
436 ——— *dominicanæ.* Tenison-Woods.
437 ——— *plebeius.* Philippi. C. nodoliratus, A. Adams; C. Angeli, Tenison-Woods; C. lauretanæ, Tenison-Woods; Gibbula multicarinata, Tenison-Woods.
438 *Stomatella imbricata.* Lamarck.
439 *Gena strigosa.* A. Adams. G. nigra, Adams non Quoy and Gaimard; G. plumbea, Adams.
440 *Minos petterdi.* Brazier, as Fossarina.
441 ——— *funiculatus.* Tenison-Woods, as Fossarina.
442 ——— *legrandi.* Petterd, as Fossarina. No specimen.
443 *Schismope atkinsoni.* Tenison-Woods.
444 ——— *pulchra.* Petterd.
445 ——— *beddomei.* ,, No specimen.
446 ——— *tasmanica* ,, ,,
447 *Haliotis nævosa.* Martyn.
448 ——— *albicans.* Quoy and Gaimard.
449 ——— *emmæ.* Gray.
450 *Fissurella australis.* Krauss
451 *Megatebennus trapezinus.* Sowerby. Fissurella scutellum, Gray.
452 ,, *concatenatus.* Crosse and Fischer.
453 *Lucapinella nigrita.* Sowerby,
454 *Glyphis crucis.* Beddome. No specimen.
455 *Macroschisma tasmaniæ.* Sowerby. No specimen.
456 ——— *weldii.* Tenison-Woods. M. tasmanica, Tenison-Woods.
457 ——— *weldii.* T. Woods. Var. *rosea radiata*, T, Woods. No specimen.
458 *Puncturella harrisoni.* Beddome. P. henniana, Brazier.
459 *Emarginula candida.* Sp.? A. Adams.
460 *Subemarginula australis.* Quoy and Gaimard.
461 ——— *tasmaniæ.* Sowerby.
462 ——— *tugosa.* Quoy and Gaimard.
463 ——— *Tugalia intermedia.* Reeve.
464 *Zeidora legrandi.* Beddome. Legrandia tasmanica, Beddome.
465 *Scutus anatinus.* Donovan.

466 *Acmæa septiformis.* Quoy and Gaimard. A. scabrilirata, Angas: A. Petterdi, Tenison-Woods.
467 ——— *cantharus.* Reeve.
468 ——— *consodea.* Quong and Gaimard.
469 ——— *calamus.* Crosse and Fischer.
470 ——— *crucis.* Tenison-Woods.
471 ——— *alba.* Tenison-Woods.
472 ——— *subundulata.* Angas. No specimen.
473 ——— *marmorata.* Tenison-Woods.
474 ——— *jacksoniensis.* Reeve. No specimen.
475 ——— *costata.* Sowerby.
476 ——— *flammea.* Quoy.
477 *Patella limbata.* Philippi. Two boxes.
478 ——— *aculeata.* Reeve. No specimum.
479 ——— *ustulata.* Reeve. P. Tasmanica, Tenison-Woods.
480 ——— *Nacella parva.* Angas. No specimen.
481 ——— ,, ,, Var. *tasmanica*, Pilsbry. No specimen.
482 ——— *Scutellastra chapmani.* Tenison-Woods.

Sub-Class POLYPLACOPHORA.

Chitons.

483 *Lepidopleurus inquinatus.* Reeve. No specimen.
484 *Callochiton inornatus.* Tenison-Woods, as Tonicia C. lobatus; Carpenter, M.S. No specimen.
485 *Ischnochiton crispus.* Reeve. T. haddoni, Pilsbry.
486 ——— *divergens.* Reeve. No specimen. T. proteus, Reeve.
487 ——— *contractus* Reeve. No specimen. T. pallidus, Reeve.
488 ——— *carinulatus.* Reeve. No specimen.
489 ——— *australis.* Sowerby.
490 ——— *novæ hollandiæ.* Gray.
491 ——— *Haploplax smaragdinus.* Angas and Pilsbry. Var. *picturatus*,
492 ——— ,, *mayi.* Pilsbry. No specimen.
493 *Callistochiton antiquus.* Reeve.
494 *Plaxiphora petholata.* Sowerby.
495 ——— *glauca.* Quoy and Gaimard non Gray. No specimen.
496 *Acanthochites zelandicus.* Quoy and Gaimard.
497 ——— *asbestoides.* Carpenter.
498 ——— *coxi.* Pilsbry. No specimen.
499 ——— *speciosus.* H. Adams. No specimen.
500 ——— species? The type is in the Melbourne Museum. No specimen.
501 *Cryptoplax striatus.* Lamarck. Var. *Gunni*, Reeve.
502 *Chiton pellis-serpentis.* Quoy and Gamard.
503 (——— *sinclairi.* Gray. Is very doubtfully Tasmanian.) No specimen.

504 *Chiton coxi.* Pilsbry. No specimen.
505 ——— *muricatus.* Adams. ,,
506 ——— *æreus.* Reeve. ,,
507 ——— *tulipa.* Quoy and Gaimard. No specimen.
508 *Schizochiton nympha.* Rochebrun. ,,
509 *Lorica volvox.* Reeve. No specimen. Chiton ciamolius, Reeve.
510 ——— *angasi.* Adams and Angas.
511 *Enoplochiton undulatus.* Quoy and Gaimard. No specimen
512 *Liolophura gaimardi* Blainville. ,,

SUB-CLASS OPHISTHOBRANCHIA.

513 *Philine aperta.* Linné.
514 *Tronatina brenchleyi.* Angas. No specimens.
515 ——— *minuta.* Petterd. No specimen.
516 *Ringicula australis.* Hinds.
517 *Cylichna arachis.* Quoy.
518 ——— *atkinsoni.* Tenison-Woods.
519 ——— *pygmæa.* Adams.
520 *Volvula rostrata.* A Adams.
521 *Diaphana nivea.* Petterd. No specimens.
522 ——— *brazeri.* Angas. No specimens.
523 *Bulla australis.* Gray. B. oblonga, Adams. No specimens.
524 *Haminea zealandiæ.* Gray. H. obera. Sowerby.
525 ——— *brevis.* Quoy and Gaimard. No specimen.
526 *Akera tasmanica.* Beddome.
527 *Aplysia tasmanica.* Beddome.
528 ——— *tasmanica.* Tenison-Woods.

SUB-CLASS PULMONATA (LAND SHELLS).

529 *Vitrina millegani.* P. feiffer. No specimens.
530 ——— *verreauxi.* ,,
531 ——— *fumosa.* Tenison-Woods. No specimen.
532 *Helix launcestonensis.* Reeve.
533 —— *hamiltoni.* Cox.
534 —— *tamarensis.* Petterd.
535 *pictilis.* Tate. H. lodderæ, Petterd.
536 —— *aspersa.* Müller. Acclimatised alien.
537 *Zonites cellarius.* Müller. ,, ,,

N.B.—I have only listed the species that I have added to the Museum collection. Mr. Johnston gives a full list in his papers.

538 *Bulimus dufresni.* Leach.
539 ——— *tasmanicus.* Pfeiffer.
540 *Pupa lincolnensis.* Angas. No specimen.
541 *Limax legrandi.* Tate. ,,
542 *Cystopelta petterdi.* Mate. ,,
543 *Succinea legrandi.* Cox. ,,
544 ——— *australis.* Pfeiffer. ,,

545 *Cassidula zonata.* Adams. Auricula Dyerana, Tenison-Woods.
546 *Alexia meridionalis.* Brazier. A. Harrisoni, Beddome. No specimen.
547 *Marinula patula.* Lowe. Cremnobates solida, Swainson; M. xanthostoma, Adams.
548 *Ophicarnelus australis.* Quoy and Gaimard. O. cornea, Swainson.
549 ——— *minor.* Mousson. No specimen.
550 ——— *parvus.* Swainson. ,,

For *Limnœa*, *Amphipeplea*, *Physa*, and *Planorbis*, see Mr. R. M. Johnston's list in Proc. R. Zoc,, Tas.., 1890, p. 145.

551 *Physa eburnea.* Sowerby.
552 *Ancylus cumingianus.* Bourg. No specimen.
553 ——— *irvinœ.* Petterd. Probably variety of preceding.
554 ——— *tasmanicus.* Tenison-Woods. No specimen.
555 *Gundlachia petterdi.* R. M. Johnston.
556 ——— *beddomei.* Petterd.
557 *Amphibola, Ampullarina fragilis.* Quoy and Gaimaɹd. H quoyana, Potiez and Michaud.
558 *Ampullarina minuta.* Tenison-Woods.
559 *Siphonaria funiculata.* Reeve.
560 ——— *zonata.* Tenison-Woods. S. denticulata, Q. and G.; var. Tasmanica, T. Woods.
561 ——— *denticulata.* Quoy and Gaimard. S. Diemensis, Quoy and Gaimard.
562 *Dentalium tasmaniensis.* Tenison-Woods. No specimen.
563 ——— *weldiana.* ,,
564 *Cadulus petterdi.* Brazier.

Class PELECYPODA.

565 *Aspergillum, Humphreya strangei.* Adams and Angas.
566 *Gastrochœna tasmanica.* Tenison-Woods.
567 *Teredo*, sp. ?
568 ———, sp. ?. No specimen
569 *Kuphus*, sp. ?. ,,
570 *Pholas obturamentum.* Hedley.
571 *Barnea australasiœ.* Gray.
572 *Solen vaginoides.* Lamarck.
573 *Saxicava artica.* Linné. S. australis, Lamarck.
574 *Panopœa australis.* Sowerby.
575 *Carbula zealandia.* Gray.
576 ——— *scaphoides.* Hinds.
577 *Neœra tasmanica.* Tenison-Woods.
578 *Myodora brevis.* Stutchburg.
579 ——— *ovata.* Reeve.
580 ——— *tasmanica.* Tenison-Woods.
581 ——— *elegantula.* Angas.
582 ——— *pandorœformis.* Stutchbury. No specimen.
583 ——— *albida.* Tenison-Woods. No specimen.

584 *Myochama anomioides.* Stutchbury. No specimen.
585 ——— *Woodsi.* Petterd.
586 *Anatina angasi.* Crosse and Fischer.
587 ——— *creccina.* Valenciennes.
588 ——— *recta.* Reeve. A. Tasmanica, Reeve?
589 ——— *anserifera.* Spengler. No specimen.
590 *Mactra rufescens.* Lamarck.
591 ——— *polita.* Chemnitz. M. australis, Lamarck.
592 ——— *pura.* Deshayes.
593 ——— *ovalina.* Lamarck. M. depressa, Sowerby.
594 ——— *matthewsi.* Tate. No specimen.
595 ——— *hemimactra cretacea.* Angas.
596 *Lutraria oblonga* Gmelin. No specimen.
597 *Paphia novæ zealandiæ.* Chemnitz. No specimen.
598 ——— *Mesodesma erycinœa.* Lamarck. M. eiemenensis, Quoy and Gaimard.
599 ——— ,, *præcisa.* Deshayes. No specimen. M. obtusa, Crosse and Fischer.
600 ——— *Donacilla elongata.* Deshayes.
601 ——— *Anapa cuneata.* Lamarck. A. triqueta, Hanley; A. smithi, Gray; A. tasmanica, T. Woods.
602 *Semele exigua.* H. adams. No specimen.
603 ——— *Warburtoni.* Tenison-Woods.
604 *Gari zonalis.* Lamarck. G. stricta, Doshayes; G. compta, Deshayes.
605 ——— *Atkinsoni.* brazier. No specimen.
606 ——— *Amphichæna modesta.* Deshayes. No specimen.
607 *Hiatula biradiata.* Wood.
608 ——— *vitrea.* deshayes. No specimen.
609 ——— *florida.* gould, No spe imen.
610 *Tellina tristis.* deshayes. T. deltoidalis, Lamarck.
611 ——— *diemensis.* ,, No specimen.
612 ——— *albinella,* Lamarck.
613 ——— *Arcopagia lecussata* Lamarck.
614 ——— *Angulus australis.* Deshayes. No specimen.
615 ——— *Metis umbonella.* Lamarck. ,,
616 ——— *Macoma mariæ.* Tenison-Woods.
617 *Rupellaria crenata.* Lamarck.
618 ——— — *carditoides.* ,,
619 ——— *brevis.* Quoy and Gaimard. No specimen.
620 ——— *obesa.* Deshayes. ,,
621 ——— *diemenensis.* Quoy and Gaimard.
622 *Choristodon rubiginosum* Adams and Angas. No specimen. Clementia tasmanica, Petterd.
623 *Venus tasmanica.* Reeve. No specimen.
624 ——— *Chione striatissima.* Sowerby.
625 ——— ,, *macleayana.* Tenison-Woods. = Stutchburyi, Gray.
626 ——— ,, *humphreyi.* Donovan.

627 *Venus Chione scalarina.* Lamarck. No specimen.
628 ——— ,, *conularis.* ,, ,,
629 ——— ,, ,, var. *strigosa,* Lamarck.
630 ——— ,, ,, ,, *aphrodina.* ,,
631 ——— ,, ,, ,, *peronii.* ,,
632 ——— ,, ,, ,, *aprodinoides.* ,, No specimen.
633 ——— ,, *tristis.* Lsmarck.
634 ——— ,, *fumigata.* Var. *lævigata.* Sowerby. No specimen.
635 ——— *Circumphalus lamellatus.* Lamarck.
636 ——— *Timoclea australis.* Sowerby.
637 ——— *Ventricola gallinula.* Lamarck.
638 ——— *Anaitis roborata.* Hanley.
639 *Cytherea diemensis.* Hanley.
640 ——— *multistriata.* Sowerby.
641 ——— *disrupta.* Sowerby.
642 ——— *rutila.* Sowerby.
643 ——— *citrina.* Lamarck.
644 ——— *mercenara paucilamellata.* Dunker. Callista victoriæ, Tenison-Woods.
645 ——— *gouldia Tasmanica.* Tenison-Woods.
346 *Dosinia cærulea.* Reeve.
647 ——— *grata.* Deshayes.
648 ——— *scabriuscula.* Philippi. D. Japonica, Reeve. No specimen.
649 ——— *coryne.* A. Adams. No specimen.
650 ——— *crocea.* Deshayes. No specimen.
651 ——— *immaculata.* Tenison-Woods.

(I think this only a young form of D. cœrulea, Rve.—M.L.)

652 *Tapes undulata.* Born. No specimen.
653 ——— *galactites.* Lamarck. Rupellaria sub decussata, Deshayes.
654 ——— *fabagella.* Deshayes. Rupellaria reticulata, Tenison-Woods.

(N.B. – The fresh water bivalves should come in here, but there are no examples in the Museum collection.)

655 *Cardium tenuicostatum.* Lamarck.
656 ——— *papyraceum.* Chemnitz. No specimen.
657 ——— *pulchellum.* Reeve.
658 ——— *cygnorum.* Deshayes.
659 *Chama,* sp. ?. No specimen.
660 *Chamostrea albida.* Lamarck.
661 *Lucina pecten.* Lamarck.
662 ——— *tatei.* Angas. L. minima, Tenison-Woods.
663 ——— *perobliqua.* Tote. No specimen.
664 *Cyclas Cumingi.* Adams and Angas.
665 *Loripes globosum.* Forskal.
666 ——— *assimilis.* Angas.
667 ——— *icterica.* Reeve.
668 *Cryptodon flexuosus.* Montford. No specimen.
669 *Mysia tasmanica.* Tenison-Woods, as Diplodonta Tas.

670 *Mysia sphæricula.* Deshayes. No specimen.
671 *Tellimya anomala.* Angas, as Mysella anomala. No specimen.
672 *Lasæa rubra.* Philippi. Poronia australis, Souverbie ; P. scalaris, Philippi.
673 *Lepton trigonnle.* Tate. No specimen.
674 *Kellia rotunda.* Deshayes. ,,
675 ——— *solida.* Angas. ,,
676 ——— *Pythina deshayesiana.* Hinds. No specimen.
677 ——— *Mylitta tasmanica.* Tenison.Woods, as Pythina tasmanica.
678 ——— ,, *auriculata.* E. A. Smith.
679 *Crassatella kingicola.* Lamarck.
680 ——— *aurora.* Adams and Angas. No specimen.
681 ——— *Banksii.* ,, ,, ,,
682 *Cardita Quoyi,* Deshayes.
683 ——— *bimaculata.* Deshayes. C. gunni, Deshayes ; C. atkinsoni, Tenison-Woods.
684 ——— *raouli.* Angas. No specimen.
685 ——— *amabilis.* Deshayes,
686 *Mytilibardia crassicostata.* Lamarck. M. excavata, Deshayes.
687 ——— ,, var. *Tasmanica.* Tenison-Woods. Doubtfuliy different.
688 *Unio legrandi.* Petterd.
689 —— *depressus.* Lamarck. S. Esk R., near Ben Lomond.
690 *Trigonia margaritacea.* Lamarck.
691 ——— *dubia.* Sowerby.
692 ——— *cuticostata.* McCoy. No specimen
693 *Nucula grayi.* D'Orbigny.
694 ——— *minuta.* Tenison-Woods. N. minima, Angas.
695 ——— *micans.* Angas. No specimen.
696 *Leda crassa.* Hinds.
697 —— *ensicula.* Angas. L. lefroyi, Beddome.
698 *Arca, Barbatia,* carpenteri, Dunker ; B. radula. E. A. Smith.
699 ——— ,, *trapezia.* Deshayes. No specimen. Arca lobata, Reeve.
700 ——— ,, *domingensis.* Lamarck. B. laminata, Angas ; Arca mccoyi, Tenison-Woods
701 ——— ,, *semitorta.* Lamarck. No specimen.
702 ——— ,, *pistachia.* ,, No specimen.
703 ——— ,, *squamosa.* ,, No specimen.
704 *Pectunculus striatularis.* Lamarck.
705 ——— *obliquus.* Reeve.
706 ——— *gealei.* Angas. P. flabellatus, T. Tenison-Woods. No specimen.
707 ——— *holosericus.* Reeve. No specimen.
708 *Limopsis belcheri.* Adams and Reeve. L. Tenisoni, Tenison-Woods·
709 ——— *bassi.* E. A. Smith.
710 ——— *rubricata.* Tate.
711 *Mytilus latus.* Chemnitz non Lamarck.
712 ——— ,, Var. *tasmanicus,* Tenison-Woods.
713 ——— *edulis.* Linne.

714 *Mytilus hirsutus.* Lamarck.
715 ——— *rostratus.* Dunker.
716 ——— *menkeanus.* Philippi.
717 ——— *ater.* Fraunfeld. M. crassus, Tenison-Woods.
718 *Modiola australis.* Gray.
719 ——— *albicostata.* Lamarck.
720 ——— ,, Var. *polita,* Tenison-Woods. No specimen.
721 ——— ,, ,, *nebulosa* ,, ,,
722 ——— *arborescens.* Chemnitz, Lamarck.
723 ——— *confusa.* Angas.
724 ——— *inconstans.* Dunker. No specimen.
725 ——— *vexillum.* Reeve. M. picta, Dunker non Lamarck. No specimen.
726 *Modiolaria cumingiana.* Dunker.
727 ——— *impacta.* Hermann.
728 ——— *barbata.* Angas.
729 *Paulucciæ.* Crosse and Fischer.
730 *Myrina,* sp. No specimen.
731 *Modiolarca trapezina.* Lamarck.
732 ——— *tasmanica.* Beddome.
733 *Avicula scalpta.* Reeve. A. georgiana, Quoy and Gaimard.
734 *Meleagrina albina.* Lamarck. No specimen.
735 *Crenatula modiolaris.* Lamarck. No specimen.
736 *Vulsella ovata.* Lamarck. V. tasmanica, Reeve.
737 *Pinna tasmanica.* Tenison-Woods.
738 *Spondylus tenellus.* Reeve.
739 *Lima multicostata.* Sowerby. Radula lima, Linné. No specimen.
740 —— *Limatula bullata.* Born.
741 *Pecten asperrimus.* Lamarck.
742 ——— *bifrons.* Lamarck.
743 ——— ,, Var. *tasmanica,* Adams and Angas. No specimen.
744 *Pecton mariæ.* Tenison-Woods.
745 ——— *aktinos.* Petterd.
746 ——— *undulatus.* Sowerby. No specimen.
747 ——— *Vola meridionalis* (Brazier). Tate.
748 ——— ,, *fumata.* Lamarck. No specimen.
749 ——— ,, ,, Var. *alba.* Tate. No specimen.
750 *Placuanomia tone.* Gray. No specimen.
751 *Ostræa edulis.* Linné. O. angasi, Sowerby.
752 ——— *cucullata.* Born. No specimen.
753 ——— *rutupina.* Jeflerey. Var. edulis. No specimen.
754 *Waldheimia flavescens.* Lamarck.
755 *Terrebratella rubicunda.* Solander. No specimen.
756 ——— *cancellata.* Koch. ,,
757 ——— *megasella cumingii,* Davidson. No specimen.
758 *Mühlfeldtia, megertina lamarckiana.* Davidson.
759 ——— ,, *atkinsoni.* Tenison-Woods. No specimen.

This list is as nearly accurate as I can at present make it. I shall be glad at any time to receive remarks as information from collectors who may differ from me as to various identifications.

PAPERS & PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR THE YEARS

1900-1901.

(ISSUED JUNE, 1902.)

Tasmania:

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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.

ROYAL SOCIETY OF TASMANIA.

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* Members who next retire in rotation.

Royal Society of Tasmania.

ABSTRACT OF PROCEEDINGS, MAY, 1900.

A meeting of the Royal Society of Tasmania was held in the Art Gallery on Thursday, May 10, 1900, His Lordship the Bishop of Tasmania, Vice-President, presiding. An apology was received for the absence of the Hon. Sir James Agnew, K.C.M.G., M.D. (Senior Vice-President). This being the opening meeting of the present session of the Society, the Bishop gave a brief resume of the 1899 session's work.

At the commencement of a new session it may be as well if I put before the members of the society a few facts regarding the Royal Society and the Museum during the last 12 months, and then pass on to speak of our immediate hopes and intentions.

The Museum is constantly receiving valuable additions. Only the other day by the action of Mr. Morton a gift was received of English birds, some 173 specimens, beautifully set up.

We are met in the picture gallery, and it will interest you to know that one group of friends has given us pictures in the last year valued at £1,200. Others, too, have been given, making seven paintings in all.

Even these few facts will indicate how good a case we have when we ask the Government to fulfil their old promise to give us additional accommodation in the new wing, which has become absolutely necessary to us. The estimate of £4,000 was passed by both Houses in the year 1890, but in the time of financial depression it was impossible to claim it, and it lapsed. The Government has expressed itself entirely favourable, officially, to the estimate being once more passed. It will be fresh in your memories also that the Antarctic expedition was welcomed by an enthusiastic audience in the Town Hall under the auspices of the Royal Society. I think we may say that everything that could be done was done by our energetic secretary to receive the expedition fittingly. We are promised an Antarctic night by Mr. Morton as soon as the history of the expedition is made public, and I fancy we shall have to adjourn to the Town Hall if we are to find room for our audience.

I now turn to the future. Two sections will be at work, besides the central meetings of the society, the medical and historical sections, which, of course, feed the more important meetings. Who will take up the burning scientific question of the day? Shall it be the medical session or the whole society?

The most important subject I have kept to the last. It is known to most members that last January it was agreed in Melbourne that the next meeting of the Australasian Science Association should be held in Hobart. Our reputation for making such gatherings successful is, I regret to say, painfully high. All we can hope to do is to preserve our level. No effort will be spared to do this.

In the face of that coming meeting, would it not be possible to have the new wing of the Museum ready, or nearly ready. There is a work, too, which we may hope to present by that date. You are aware that we have one distinguished botanist among our members—Mr. Rodway—whose work is held in the highest esteem among his brother workers. Mr. Rodway has at length finished his great work on the "Botany of Tasmania," a work which is far ahead of anything that has yet appeared, and we are glad to be able to state that the Government will probably agree to publish it. It will be a noble gift to present to the association at its Hobart meeting in 1902. We have, however, another delightful prospect. It seems that the British Antarctic Expedition, which will, of course, be fitted out with the greatest care, and be as complete as human skill can make it, may be expected to visit Hobart at the close of 1901, before proceeding south. Surely we ought to make every effort to hold the Association meeting at such a date as to enable all scientific men in Australasia to meet here to unite with us in sending off the expedition with the combined good wishes of all the scientific societies in this hemisphere. To compass this end we ought to be prepared, if necessary, to hold the association meeting in December, 1901, rather than in January, 1902.

We can depend upon Mr. Morton to watch events, and to inform us in good time what we should do.

We will now proceed to the business put down for this evening.

New Members.

Dr. D. H. E. Lines, Professor E. G. Hogg, M.A., and Mr. F. E. Burbury were elected members of the Society.

Paleontological Papers.

Mr. R. M. Johnston, F.S.S., read a paper "On the Further Notes on Permo-Carboniferous Fossil Cliffs at Darlington, Maria Island." "Observations regarding the discovery of a portion of a Fossil Reptile, found on the North-West Coast."

The papers were illustrated by lantern-slides, which the lecturer announced that he owed to the courtesy of the Secretary, Mr. Alex. Morton, who recently visited Maria Island. The slides were prepared by Mr. Beattie.

Aerial Navigation.

Mr. E. O. Litchfield read an essay on the history and present position of aerial navigation, particularly with reference to a gas and screw vessel now in preparation. The lecturer explained that the invention he had to describe was a combination of the gas and screw principles. The field or aerostation had been highly attractive to experimental scientists for a long time, and particularly during the past century. The problem was—how to design vessels heavier than air which could be driven through the air? As concerned the lifting of heavy weights by gas, many satisfactory and convincing experiments had been made by aeronauts. The difficulty now lay in constructing a vessel so compact and substantial as to travel through the air. The vessel of which he had to speak would carry just sufficient hermetically-sealed gas to bear the weight of the structure. Ascent and descent would be accomplished by the upward or downward pressure of suspensory screws. Mr. Litchfield illustrated his paper with a number of interesting lantern pictures.

A vote of thanks to Messrs. Johnston and Litchfield brought the meeting to a close.

J. B. WALKER, F.R.G.S.

JUNE, 1900.

The monthly evening meeting of the Royal Society was held in the Art Gallery of the Tasmanian Museum on Tuesday, June 19, Mr. Thos. Stephens, M.A., F.G.S. (vice-president) in the chair.

Apologies.

The secretary read apologies for absence from Sir James Agnew, the Bishop of Tasmania, and the Speaker of the House of Assembly.

Election.

The following were elected members of the society:—Messrs. G. E. Moore, M. Inst. C.E., H. J. Daniels, C. B. Petersen, and W. O. Wise.

The Late J. B. Walker.

The Chairman (Mr. T. Stephens) said he had to call the attention of those present to the handsome portrait of the late J. B. Walker, which had become the property of the society through the kind instrumentality of Mr. Beattie. Mr. Stephens became acquainted with Mr. Walker in connection with a prize won by that gentleman for a poem written in the early sixties. A few years later he became acquainted with Mr. Walker personally, and he knew him from that time to the end. Mr. Walker was prominently known in connection with many good works, and his connection with the Royal Society was intimate and singularly honourable. The society was, therefore, deeply indebted to Mr. Beattie for his kindly and valuable gift.

Colonel Legge, R.A., read a paper on "The Birds of Australia: Birds, Nests, and Eggs," for Mr. A. J. Campbell, of Victoria. The paper was illustrated by a very interesting and complete series of lantern slides.

"The Falls of Niagara as a Geological Chronometer," by Professor E. G. Hogg, M.A. The lantern slides shown were interesting, and the paper contained much matter of scientific value. Opening with some remarks tending to show how profoundly the natural drainage system of a country was modified by the country's glaciation, Professor Hogg proceeded to the description of the glaciated area of the United States, particularly as to the locality of the Great Lakes and the immediate neighbourhood of Niagara. The original ice-sheet here, he said, was estimated roughly to have had a thickness of about 30,000 feet. Various details were given showing the difference that has resulted in the contour and formation of the Great Lakes region since pre-glacial times, and so the broad influences which resulted in the making of Niagara were traced. The lecturer closed with some account of the condition and history of the Falls—whose actual age is variously estimated by opposing geological schools at from 7,000 to 30,000 years.

The meeting closed with votes of thanks to authors of papers.

JULY, 1900.

No meeting.

AUGUST, 1900.

The monthly meeting of the Royal Society was held at the Museum on Monday August 13, His Excellency the Administrator, Sir John Dodds, C.J., presiding.

Before the proceedings commenced Mr. T. Stephens, M.A., F.G.S., speaking as a vice-president, said that, on a former occasion, the society had congratulated His Honor, Sir John Dodds, on the distinctions conferred upon him in recognition of high services rendered in the course of a long public career. Any honourable distinction of this kind reflected credit not only on the recipient, but also on the country to which he belonged, and the institutions in whose welfare he had personally interested himself. On behalf of the Fellows of the Royal Society, of which His Honor would now become President, he desired to tender their hearty congratulations on the rank and position he was again about to assume as Administrator of the colony. (Hearty applause.)

Sir John Dodds, in reply, said:—Mr. Stephens, Ladies and Gentlemen,—I am taken completely by surprise. I did not know that I was to receive, nor did I expect, this further mark of your kindness. It adds to the many obligations under which my fellow-colonists have placed me, and I thank you very sincerely for the generous approval that you have given to the more than kind words in which Mr. Stephens has offered your congratulations. In whatever office it has pleased the people of Tasmania to place me, I have endeavoured to discharge the duties of that office to the best of my ability, and I most gratefully acknowledge and appreciate the encouragement and assistance that I have invariably received from the people amongst whom I have lived the greater part of my life. (Warm applause.)

Apologies were received from the senior vice-president, Sir James Agnew, K.C.M.G., and Mr. A. G. Webster, regretting that, owing to ill-health, they were unable to attend.

NEW MEMBERS.

The following gentlemen were elected members of the society:—Rev. W. R. Cunningham, Messrs. Thos. Bennison, Wm. Burn, C. B. Target, C.E., of Hobart, and Mr. W. J. Norton Smith, of Burnie.

PAPERS.

MAGNETIC SURVEY OF TASMANIA.

Professor E. G. Hogg, M.A., of the Tasmanian University, read a paper, which was illustrated by some specially-prepared lantern slides, entitled "The Proposed Magnetic Survey of Tasmania."

The writer said the discovery of the approximate position of the Southern Magnetic Pole by Sir James Ross, in 1840, was largely instrumental in causing Hobart to be selected by the Royal Society of London as the station of observation of the scientific expedition sent out under its auspices in the early forties, to investigate magnetic phenomena in this part of the Southern Hemisphere. Detailed magnetic observations were carried out in Hobart under the superintendence of Lieutenant Kay, R.N., from 1842 to 1850. During this period both the magnetic dip and the horizontal intensity passed through minimum values, though not in the same year, while the magnetic declination was found to be steadily increasing at the rate of about 1½min. per annum. Dr. Neumayer, who had been investigating magnetic phenomena for some years in Victoria, and had carried out a magnetic survey of that country, visited Hobart in 1863. He found the magnetic declination of Hobart to be 10deg. 25min. 9sec. E., a value not far removed from that calculated from Kay's observations on the rate of variation. The next determination of the declination was made by His Excellency Sir J. H. Lefroy, in 1881. He found it to be 8deg. 49min. E., or, rather more than 2deg. in defect of the value computed from Kay and Neumayer's observations. The explanation of this difference is probably to be found in the fact that, shortly after Neumayer's determination of the declination, it attained its maximum easterly value, and has since that time been slowly moving towards the west. Since 1881 no further observations on the magnetic elements of Hobart appear to be available, and some considerable uncertainty exists as to their value at Hobart, and their annual rate of change. Absolute magnetic observations have been carried on without intermission in Victoria since 1858. During each of the past two years the New Zealand Government has voted the sum of £500 for the purposes of the magnetic survey of that colony, and considerable progress has been made. During the coming summer Professors McAulay and Hogg propose to begin a magnetic survey of Tasmania, a set of instruments of the latest pattern having been placed at their disposal by the University of Sydney through the kind offices of Professor Pollock. They intend to limit their work this summer to the absolute determination of the magnetic elements at the following selected stations:—Hobart, Port Esperance, Port Davey, Strahan, Mt. Lyell, Wynyard, Longford, Scottsdale, St. Helen's, Spring Bay, and possibly Oatlands. From the observations made at these widely distributed stations they hope to be able to construct a rough magnetic map of Tasmania, showing the approximate positions of the lines of equal magnetic declination, dip, and horizontal intensity. To ascertain the annual rate of variation of the magnetic elements it will be necessary to re-determine their values after the lapse of a few years. In order that their work may be easily available to future observers, and may also be of assistance to surveyors, Professors McAulay and Hogg have applied to the Government for a grant of £150 to enable them to erect suitable permanent marks on the sites of observation, and to defray other expenses incidental to the survey. If this grant of public money is made it is proposed that the work of the survey shall be carried out in co-operation with the Surveyor-General's Department. In addition to the magnetic observations at the selected stations, it is intended to lay out at each place the true geographical meridian, and to determine the bearings relative to the site of observation, of any prominent landmarks, etc. A detailed description of each site of observation will be lodged with the Surveyor-General.

The paper dwells briefly with the importance to navigation and surveying of a correct knowledge of the magnetic declination. It points out that if the rate of variation of the magnetic elements of Tasmania were once determined it might be possible, by examination of the magnetic records of Victoria and New South Wales, to learn approximately the value of the elements in Tasmania in the recent past, and by connecting the present observations with those made in the past form a fairly accurate conception of the magnetic history of Tasmania during the last 60 years.

A letter was received from Mr. Counsel, Surveyor-General, indicating that he supports Professor Hogg's views.

The Treasurer (Hon. B. S. Bird) said he felt that the work proposed to be undertaken was very important, and Ministers had placed £150 on the estimates towards the cost of this magnetic survey, so important in connection with navigation and scientific surveying. (Applause.) He moved a vote of thanks to Professor Hogg, which was very heartily accorded.

Mr. Stephens, in reference to Professor Hogg's mention of the record which he had sent him of the magnetic variation in 1839, said that he had received the record from the late Mr. Molesworth Jeffrey, who was with Sir John Franklin when he took the observation at Lachlan, near New Norfolk. This was in 1881, when he (Mr. Stephens), being engaged on the revision of the old map of Tasmania, had reported to the Government that, if there were much longer delay in reconciling the survey system of the colony, which was based on magnetic lines, with the true bearings established by the trigonometrical survey, inextricable confusion would be the result. The matter was taken up by Sir Henry Lefroy, and a reform of the survey system initiated by the Government, which, though interrupted by a change of Ministry, is now progressing as satisfactorily as is possible under existing circumstances. In connection with Professor Hogg's mention of causes of local variation Mr. Stephens cited a remarkable instance of the deflection of the compass needle, which he had noted on the summit of a peak in the Midland district, and recommended Rocky Cape, Badger Head, and a point between Bridport and Cape Portland as being, with Port Davey, the best sites for magnetic observations in Tasmania, so far as freedom from elements of local disturbance is concerned.

MUSEUMS AND ABORIGINALS.

The Bishop of Tasmania read a paper entitled, Notes on a Visit to the Museums at Perth and Adelaide, with special reference to the Blacks of West Australia, as follows:—

"During a recent visit to West Australia and South Australia, I found time to visit the Museums, and to discourse with the curators. I think a few observations will be of interest.

"I was struck here by the immense

amount of work still to be done in many departments of science. The botany of West Australia has been apparently well studied, but there are fields of science virtually unexplored—shells, insect life, and, perhaps fauna; for these a great deal has to be done. But there is yet another department needing attention, and that without delay. The crying need in West Australia seems to be for a small body of men who would study the habits and customs of the aboriginals of the colony. In no colony in Australia are they so numerous, and in no colony have they been so little studied. The reason is obvious. For the last ten years this colony has been engaged in the tremendous task of providing the resources of civilisation for a quadrupled population, and before that period the colony was small in number, and oppressed with the state of too much land area. The Government, however, is most generous to science, as a yearly grant now raised to £4,000 to the Museum in Perth testifies; and there is no reason now why this pressing duty in regard to the natives should not be taken in hand effectively. I put the question, indeed, to Dr. Stirling, in Adelaide, whether there was still room for a work on the Blacks of West Australia commensurate with such books as those of Roth, of Spencer and Gillen, and of the Horn Expedition. Dr. Stirling answered in the affirmative without hesitation, adding that, though the Australian black all through the continent is the same person, yet the effect of a long western coast line of thousands of miles with the food it gave, and the habits it fostered, must make us look forward with the deepest interest to the work on the blacks of this vast region, which has still to be written; and as the native population tends to diminish, I ventured to urge the question in Perth, suggesting, indeed, that steps should soon be taken to found a Royal Society, which does not at present exist. I went further and reminded them of the meeting in Hobart of the Science Association in 1902, and I even proceeded to suggest that West Australia might make a bold move, and try, at all events, to induce the Australasian Association to visit Perth in 1904.

"It seemed also a fitting opportunity to remind the Museum authorities and the Public Library, that possibly large quantities of historical material might soon be lost or removed to Sydney or Melbourne, unless they turned their attention to old records of the colony.

"I now proceed to give some account of the blacks of West Australia, their numbers, and the steps taken for their welfare. Two years ago the blacks were under the charge of an Aborigines Board, but this has now become a regular Government department, and in 1899 the first Government report under the new management was published, Mr. Prinseps being the Protector of the aborigines. Last year nearly £11,000 was spent by the Government on the natives, chiefly in the distribution of food to the aged and infirm, and in their own camps, blankets also forming a large item. There is a travelling inspector, who understands the dispensing of simple medicines. As to the numbers of natives in the colony, the following is the latest calculation:—Employed by settlers, 4,740; in receipt of relief, 868; self-supporting, 6,690. This makes a total of 12,300, exclusive of what may be called wild blacks, chiefly in the Kimberley district. They are numerous there, and of fine physique. The total number of blacks now in the colony of West Australia is computed to be 30,000. It will be of interest also to note what is the number in other colonies. Apparently the following are the latest figures:—New South Wales, pure blacks, 3,230; New South Wales, half-castes, 3,661; Queensland, computed, 20,000; Victoria computed, 479; South Australia (in the Northern Territory chiefly), 20,000; in all, 80,000 in the continent of Australia.

"It will be noted that the colony which has the largest number of this interesting race has still its scientific work to do among them. Indeed, up to the present there has been no regular system for photographing or measuring the natives at the prison at Rottnest, although for years blacks have been kept in confinement here, brought from all parts of the colony. I believe this first step is now to be taken. With regard to areas of land reserved for blacks, I note that 890,000 acres are put aside for this purpose, one block in Kimberley being 700,000 acres. By far the largest portion of this reserved ground is simply left for the blacks to roam over, and they are undisturbed in it. There are, of course, a good many questions of extreme interest which have to be faced by the Government.

"I believe there is no doubt that public opinion is becoming more and more directed to the welfare of the native population. There is much less chance of their ill-treatment, and cases of injury are more quickly detected, and the offenders punished. A great many of the blacks, chiefly in the proximity of a white population are becoming dreadfully and distressingly diseased, and owing to their nomadic habits and their impatience of regular control in hospital, it is hard to know how to grapple with some of the worst forms of mischief. Even the distribution of blankets has its evil side by inducing the blacks to give up their native habits, which were better suited to their condition. Again, when a district becomes settled by white men some of the wisest of the settlers have come to see that it is their duty to provide work and food for all the blacks in that district, since the game has begun to disappear, and it is a fact, I believe, in some places that work is found for all the blacks, whether their aid is really needed or not. There is a conflict of opinion also whether the system of contract labour is the best. In this case, the native is bound to the settler for a certain period, and may not leave him, whilst the employer is bound to treat his black servants kindly. But it is also found that if a boy does run away, he is never any good afterwards if he is forcibly brought back, and if a simpler form of contract were possible with this nomadic race some think it might be better for both parties.

"It is well-known that there are several establishments under more than one religious denomination where the natives are cared for; New Norcia, under the Roman Catholics, is well known throughout Australia. The Swan River settlements, under the Anglican Church, are also doing good work; and there are others. Two questions of general interest are worth mentioning. First, the problem of the half-caste population. In some districts this class is increasing, and is at present uncared for to any great extent. The other problem is a very perplexing one, namely, what to do with native girls, brought up from childhood in such a mission as that on the Swan River. At present they are sent into the world, at 16, with only often very sad results, indeed. It looks as if native young women of this age are quite unfit to be turned loose on society, and really need another establishment, where they could be usefully employed till 25 at least. Enough has been said, I think, to show what a large field of work presses for workers in West Australia.

"One request I pass on to Mr. Morton from the Curator at the Perth Museum, namely, that the Perth Museum may be permitted to get a cast of a Tasmanian native's skull.

ADELAIDE MUSEUM.

"The change to the Museum in Adelaide, as regards the study of the natives, was great, indeed. Probably there is no such collection of native weapons and properties as in the Museum there. A very large room is filled with cases in double and treble rows, illustrating every department of their life; and what is still more striking is the classification of objects. Each district in Australia, and sub-district, has its own cabinet. Yet wonderful as this collection is, Dr. Stirling was of opinion that it could still be equalled, if not surpassed, by those who could afford to conduct expeditions into the interior; but it would be at great cost. Dr. Stirling told me that he would be glad to furnish us with a collection of certain number of aboriginal weapons and properties, if Mr. Morton would apply for them.

In conclusion, I beg to state that I put myself into communication with two gentlemen who could aid us in the scientific study of the natives, Mr. Campbell, of the Geological Survey Department of West Australia, one of the few gentlemen who has taken a deep interest in native habits and customs. He has promised us a paper ere long. Mr. Foelsche, Inspector of Police at Palmerston, Northern Territory, has taken photographs during a course of years of all types of natives in the North. I ventured to write to him to ask if he could supply the Museum with a representative set.

"I heard a curious story at Albany, fuller details of which I hope, in due time, to receive from Mr. Wright, the magistrate at Albany. This gentleman says that a party of six blacks were brought into Albany about four years ago from the Frazer Range, charged with murder. They were very small — not much over 4ft. high, and they all had six fingers and six toes. No one could talk their language, and after some days they were dismissed, and I regret to say that no one thought of photographing them. I gather from a Government report that the blacks in the Frazer Range do not number more than 100 now, but it is clear that there is a great deal yet to learn about the natives in the Western regions of the Australian continent."

CHEMISTRY AND MINERALOGY.

Mr. W. A. McLeod, B.A., B.Sc., Lecturer on Chemistry and Mineralogy at the Tasmanian University and the Hobart Technical School, read some notes, giving a description of some interesting rocks collected at Cape Adare during the recent Antarctic expedition.

LIGHT RAILWAYS FOR TASMANIA.

Mr. G. E. Moore, M. Inst. C.E., read a paper entitled "A System of Light Railways for Tasmania." He strongly recommended the more extended use of light railways in Tasmania to open up the country, especially in view of the success of the working of the Dundas light line. Considering the rough nature of the country on the West Coast, it might be fairly conceded that in other parts of the country a 2ft. 6in. gauge light line (which he most favoured), might be constructed at about £2,000 per mile. Such lines would be very useful in serving country districts; a light or narrow-gauge line would pay interest on capital, whilst a standard-gauge line would never pay expenses. Adjacent land benefiting by a light line, and increased in value, should be assessed accordingly to assist in paying for the same. A light 2ft. 6in. gauge railway would be a great boon in bringing about better communication between the East Coast and the capital.

Hon. A. Murray, M. Inst. C.E., M.L.C. (Surveyor-General of the Straits Settlements), made some observations on the paper read by the Bishop of Tasmania, especially in regard to the natives of Ceylon and the ruins of the ancient cities, and Tanks, of Anuradhapura and Pollonarua, in the North Central Province, where a teeming population once existed, but which had disappeared owing to hostile incursions of the Tamils from Southern India, who drove the Singhalese from their homes and fields, and destroyed their magnificent network of irrigation reservoirs or tanks. Mr. Murray also spoke of the great benefit light railways would be to the colony, if more generally availed of, and he had been over every part of it. Tasmania, from what he had observed, had reason to be proud of her railways, and their management. (Applause.) Notwithstanding the annual losses sustained in the working of some of the lines, he believed they would ultimately prove to be a splendid asset as the country became more opened up and settled upon. Mr. Moore had stated that the narrow gauge line from Williamsford to Zeehan had only cost £2.800 a mile. Here was a line that in 1899 earned approximately £6,000. Out of this £4,000 went for working expenses, leaving a profit of £2,000, or about 3.20 per cent. on the capital expended in construction. That was a very satisfactory result, reflecting credit on the able General Manager and his staff. He expressed regret at having to leave the colony, which he admired so much, and where he had been so very kindly treated. He hoped to return to it some day. He wished the colony every success. (Hearty applause.)

Votes of thanks to the readers of the papers concluded the meeting.

Mr. Nat. Oldham rendered valuable assistance in manipulating the lantern for the exhibition of the slides.

SEPTEMBER, 1900.

The usual monthly meeting of the Royal Society of Tasmania was held on Monday at the Museum, Argyle-street. The Administrator of the Government, Sir John Dodds, presided.

LIGHT RAILWAYS FOR TASMANIA.

A discussion took place on a paper previously read by Mr. G. E. Moore, M.I. C.E., on "A system of light railways for Tasmania."

Hon. C. H. Grant, M.L.C., said he did not quite agree with all Mr. Moore's views. With regard to his classification, he thought it was somewhat artificial. He thought the classification ought to be one of railways, irrespective of the gauge, and that the term "standard" should not be used. In Spain, the gauge, was 9ft. 9in., and in Canada it was 5ft. 6in., and these were the standards in those countries; 3ft. 6in. was the gauge in South Africa, and in several of the Australian colonies, including Tasmania. There was a 3ft. 3in. gauge prevalent on the Continent of Europe, and it was also in use in India. The term "standard" was only applicable to localities. Steam tramways, he thought, ought to be dealt with apart from railways. There were several steam tramways on the West Coast, though Mr. Moore seemed to say there were none in this colony. Light railways could be made important feeders of main lines, and he preferred them to steam tramways (which were not much cheaper) because they saved break of gauge. Mr. Moore surprised him by his estimate of the cost of transhipment. In France it was 4d. a ton, and here it would be 6d. or 7d. Light railways recommended themselves if managers were not afraid to manage them. The gradients and curves, of course, ought to fit the nature of the country, and they ought to be worked with light engines, and at low speed. The maintenance ought to be in proportion to its capital cost. He should very much prefer to see the railway system of this colony extended by light railways, and these improved as time went on, and necessity arose. Engineers had acted on this principle, but the managers, influenced by the public, made the lines do more work than the engineers had intended. Mr. Moore spoke of people being rated along the line. That was tried in the Western railway, but no politician would revert to such a system. He preferred private to State ownership of railways. In other countries private enterprise had done more for the community in the matter of railways than the State. Tramways should be devoted to special objects, and the North-East Dundas "tramway" he regarded as a railway. He urged that special attention should be paid to surveys, and thus months of construction might be saved.

Mr. J. Fincham agreed with much that Mr. Grant had said. The term "light" railway was one of relative significance. He did not like the word "light," because it suggested flimsiness. "Light traffic railway" would, perhaps, be more accurate. The total cost of the Tasmanian railways compared favourably with the cost of the railways on the mainland of a corresponding character. To Mr. Nicholas Brown was due the credit of having first suggested the making of light railways in Tasmania. But the system was opposed by managers and others, and railways of a normal character were made. He spoke disapprovingly of over-building for a limited traffic, and warmly advocated the making of light pioneer and feeder lines (not suckers) at a minimum cost. He spoke of the conditions under which a break of gauge might be made, and suggested how expense on stations might be reduced. He estimated the light lines, such as he advocated, could be made at half the cost of normal lines. All future developments of the railway system here ought to be made with single goods lines, such as he had spoken of.

Mr. C. B. Target said there was the question of making a railway by Government agency, instead of by a company, involving a saving in directors' fees and in the superior staff; also a Government could obtain money at a lower rate than a company, and by employing small contractors, who would be paid only for what they did, the speculative profits, on risks, of a large contractor would be eliminated. He gave examples of the cost of companies' work compared with Government work in India.

Mr. G. E. Moore replied to some of the comments made. He said he was glad that, in the main, the speakers agreed with him, and therefore what he said in reply was wholly as to details.

The Chairman said he thought the present system of setting off the increased value of land against the claim made by the owner for compensation was an equitable and intelligible one.

The discussion was then closed.

RESERVOIRS.

Mr. C. B. Target read a paper on "Reservoirs—Irrigation in India, and Deductions with special reference to the Hobart Reservoirs," illustrated by lantern views. Speaking of waste weirs, he said that "one of the important subsidiary works is the waste weir. I give sections, showing the growth of what was finally adopted as the best. These weirs were originally a piece of ground levelled at the end of the dam; this was found to wear away, then stone pitching was used, afterwards a wall was put to preserve the level, and avoid leakage between the stones, then a wall at the bottom to prevent the stones from slipping. You will find this idea adopted by Mr. Thwaites at the upper reservoirs. Now, although these aprons were carefully made, hardly any answered; there was always settlement, so the upper wall had to be made strong enough to stand unsupported by the apron; so I first tried rows of slabstone to bind the work together, and localise settlement; the success was partial only, as extra scour was created under the slabstones, so concrete was put under 2ft. deep. This, although an improvement, was not sufficient; so I built walls above the concrete to a level with the apron, the wall being coped with slabstones, the horizontal distance of these walls being the thickness of the apron multiplied by the slope. This system has proved thoroughly successful, and the flow of water being intercepted by these walls, the result is that the space above gets grouted in with silt, making the work stronger year by year." Speaking of the trouble at the Hobart upper reservoir and Mr. Thwaites's proposals, he said: "The Director of Waterworks very properly objects to building a retaining wall on a bad foundation, and proposes to go down to firm ground for the foundation, but with piers only; one of the objections to this is, letting the water further into the dam to destroy its stability. I consider there is no danger from filling this reservoir in the state it was in before the repairs were commenced, provided there has been no percolation, of which I am doubtful, and that the water be not suddenly lowered to allow a large quantity of soil in a half-sodden condition to slide down above water-level; but should it be assumed that there is danger on the water side, the way to prevent it is by not allowing the water to alter the angle of repose ; this is not done by the proposals of Mr. Thwaites, who increases the danger by letting the water further into the dam, and increases the weight on the wet soil, so as to force out the toe or overturn the proposed retaining walls. To keep out the water, I would cut into the dam at the toe till fairly good stuff is found, and relay the soil taken out, mixed with good stuff to an extra width of say 30ft., in 3in. layers, well rammed with iron rammers, weighing not less than 18lb., and not more than 6in. in diameter; at one foot in height cut in again for another step one foot thick, and so on. The opportunity of the pitching being removed may be taken to increase the capacity of the reservoir, as we have seen that there would be an element of danger in putting the extra soil behind."

Discussion on the paper was postponed till next monthly meeting.

Votes of thanks were passed to Mr. Moore and Mr. Target for their papers.

The proceedings then terminated.

OCTOBER, 1900.

The monthly meeting of the Royal Society was held on Monday evening, the 8th inst. The Bishop of Tasmania, V.P., presided. The Secretary read an apology from the Acting-President (His Excellency Sir John Dodds), regretting that, owing to important official business, he was unable to preside.

The Hon. Sir James Agnew forwarded the following letter:—

October 8, 1900.

My Dear Mr. Morton,—Please convey to the Council of the Royal Society and to the Trustees of the Tasmanian Museum and Botanical Gardens my cordial and grateful thanks for their very kind wishes on the occasion of my birthday. I value these pleasant greetings more especially as coming from a body of friends who take a practical interest in the welfare and management of those two national institutions, which alone keep Tasmania in touch (as she ought to be) with similar institutions, not only in our neighbouring colonies, but in the world at large.—Very sincerely yours,

J. W. AGNEW.

A. Morton, Esq., Secretary R.S.

"VALUABLE WORKS OF ART."

The Chairman said, before the business of reading papers commenced, he wished to read a letter that had reached him since the last meeting. from Mr. F. G. Simpkinson De Wesselow, Grosvenor-mansions, Victoria-street, S.W., July 10, 1900:—My Dear Bishop,—My nephew at Millicent, South Australia, has forwarded to me a letter you wrote to him in April last, concerning the society you have formed at Hobart, and you desire to possess for it any relics of the past history of Tasmania. I happen to have several volumes of drawings and sketches made during the years I passed there, 1844 to 1849, which have been lying packed away almost ever since my return. I am exceedingly glad there is now a chance of their being of some use or interest, and I forward them to you with much pleasure. They are packed in a zinc-lined case, and I trust will reach you safely. Amongst them is a panorama of Hobart in 1848, taken from a spot just outside the Domain, probably now covered with buildings. There are, also, some sketches of the aborigines of Tasmania (then Van Diemen's Land), located at that time on Flinders Island, which I visited in 1845, in company with the artist, Prout, where we were hospitably entertained by the Superintendent, Dr. Milligan. Some sketches, too, of Melbourne in 1846-47, then in its infancy, may be interesting. Most of my time was passed at Hobart, where I had an appointment under the Admiralty at the Magnetic Observatory. This was situated in the Domain, close to the Botanical Gardens; and, as you will know, a lovely situation. In looking at the sketches again, I am forcibly reminded of the beauty of the Derwent and its surroundings, and of the many happy days passed in delightful Tasmania. I had many friends there, now all departed. Bishop Nixon, Bicheno, the genial Colonial Secretary, Charles Stanley, and others. The Bishop often joined our sketching parties, and I am glad you have some of his drawings. Charles Stanley was my dearest friend. I often visit his widow, and only a few days ago she showed me a book of drawings by Owen Stanley that she was about to send you. You will see by the sketches that I visited a good many parts of the island. Lake St. Clair was but little known, and our party explored it, sending up a boat from Hobart through the bush for the purpose. Also, the falls on Mount Wellington, now, probably, a regular place for picnics, were discovered by us. During our stay the convict system was at its height. All our servants were convicts. It was a sad moral stain on the community. "Out of evil cometh good," inasmuch as the beautiful roads and bridges could never have been made without the convicts. Port Arthur was the headquarters, and, in a sketch of Eagle Hawk Neck, I show the now historical savage dogs that guarded the peninsula."

The Bishop said he now had very great pleasure in handing over this valuable gift to the Royal Society, as also the volume of sketches presented by Mrs. Charles Stanley.

The Hon. N. J. Brown (Speaker of the House of Assembly) moved a special vote of thanks to the donors of this priceless gift of works of art, and also to His Lordship for securing such a gift to the Royal Society. The resolution was carried by acclamation.

PAPERS.

The Hon. N. J. Brown read a paper on "Federal Finance."

The Treasurer (the Hon. B. S. Bird), by request, moved that a special meeting be called for discussion of the paper next Monday week, "Further Observation on some Obsidian Buttons," by Mr. Thos. Stephens, M.A., F.G.S.

"Observations on further regulations made by the Government for the protection of mutton birds and their eggs" was the title of a paper read by the Bishop of Tasmania.

Mr. Geo. M. Thomson, F.L.S., of Dunedin, contributed a paper, giving a description of some interesting crustaceans obtained at Cape Adare during the recent visit of the Southern Cross.

THE HOBART RESERVOIR.

Messrs. C. H. Grant, T. Stephens, and the writer of the paper, Mr. C. B. Target, gave some further observations on the subject. By the aid of a diagram Mr. Thos. Stephens showed the different parts of the reservoirs, and the formation of the surroundings.

A vote of thanks to the authors of papers having been passed, the meeting adjourned till Monday, the 22nd inst.

OCTOBER 22, 1900.

Exhibits.—The president said before the business of the meeting was taken he wished to draw the members' attention to a valuable gift that had lately been forwarded to him from England as a presentation to the society; the gift consisted of over 200 sketches, mostly water-colour paintings of Tasmanian scenery, Tasmanian aboriginals, and a number of water-colour sketches of Melbourne and Victorian views, also a water-colour drawing of a panorama of Hobart in 1848. All of the views were done by a gentleman now a resident in London, Mr. F. G. Simpkinson De Wesselow. This gentleman resided in Hobart during the years 1844 to 1849 At that time Mr. De Wesselow had an appointment under the Admiralty at the Magnetic Observatory, then situated near the Botanical Gardens. Another volume containing a number of sketches, the work of the late Captain Owen-Stanley, R.N., also a gift to the society from Mrs. Charles Stanley, whose husband was at one time Private Secretary to Sir William Denison, was exhibited. This collection is, without doubt, one of the most valuable gifts yet received by the society. Mr. J. W. Beattie exhibited some interesting photographs. Among them was a photograph taken from a cast of the Rev. Robert Knopwood's face, also a photograph of the Rev. Dr. Bedford, who succeeded the former gentleman at St. David's, and several others.

Mr. A. Mault read an interesting paper, entitled "Hobart Society in 1845." The account, Mr. Mault said, was taken from among the least known of the elder Dumas's tales, called "The Journal of Madame Giovanni." This journal is professedly written by a French lady, who married a Venetian merchant, and who adopts the nom de plume of Giovanni. Though the hand of Dumas is very evident, the reader will soon see that the work is based upon the account of some lady who must have really visited the places that Madame Giovanni describes.

A hearty vote of thanks was accorded to Mr. Mault for his interesting paper.

Mr. Thos. Stephens, M.A., F.G.S., submitted the following notes :—

November, 1836. — Captain Lonsdale selected the original settlement, formed by Mr. Batman on the Yara Yara, as the scite (sic) of the infant metropolis at Port Philip. The Government had commenced building a gaol, and a commissariat store, and the town was named Glenelg, in honour of the Right Honourable the Secretary of State for the Colonies.

January, 1835.—Mr. G. A. Robinson succeeded in bringing in the whole of the aborigines remaining at large in the colony, eight in number, who joined their relatives at Flinders Island. — Elliston's Hobart Town Almanack, and Dr. Ross's Van Diemen's Land Annual for 1837.

The meeting then closed.

NOVEMBER, 1900.

The last monthly meeting of the Royal Society (for the 1900 session) was held at the Museum last evening, the President, His Excellency Sir John Dodds, presiding. There was a large attendance of members present. The chairman of the Council, the Hon. Sir James Agnew, K.C.M.G., forwarded an apology, regretting that owing to the state of his health he was unable to be present.

The Secretary (Mr. Alex. Morton) read an interesting letter that had been forwarded to the Society by Mr. Malcolm Harrison, of New Town, stating that on the 4th of this month he had found a goldfinch's nest, containing two eggs of the rightful owner and one of the pallid cuckoo.

Papers.

The Secretary, in the absence of the authors, read the following papers:—One by Mr. W. F. Petterd, F.Z.S.L., of Launceston, entitled "On some additions to the list of Minerals known to occur in Tasmania." The writer said the catalogue of the minerals known to occur in this island enumerates considerably over 250 distinct elementary substances and chemical combinations. In addition to this remarkably large number, subsequent research has brought to light several interesting examples, and now the author has been enabled to still further increase this number. The paper briefly enumerates 18 substances, to which mineralogists have applied specific terms, all of which were apparently previously unknown in Tasmania. It might reasonably be expected that from time to time, as geological and mining investigation proceeded, and the field of observation extended, occasional additions of rare or obscure minerals might be brought to light, but it could scarcely be anticipated that the restricted area of the island would afford such a prolific field in this department of scientific investigation, as is forcibly illustrated by the writer's comparatively numerous discoveries. The more recent careful examination and determination of a long series of igneous rocks has revealed several unusual rock-forming primary and accesory minerals, the occurrence of which in this island, the writer says, was previously unsuspected, and, doubtless, as this petrographical work is continued other forms of equal interest will be discovered.

The other paper was also by a Launceston member, Mr. F. E. Burbury, and constitutes the first part of a series of papers on the Diatomaceæ, and was entitled "Contributions towards a systematic catalogue of Tasmanian Diatomaceæ."

Professor E. G. Hogg, M.A., read a paper illustrated with specimens of the rock entitled "The Glacial Beds of Peppermint Bay."

A carefully prepared paper was read by Mr. A. Morton, giving an exhaustive account of the work done by the Society from the year 1840 to the present time, and showing how valuable had been the contributions of the Society to the world of science. To persons interested in the welfare of the Society the paper was of special interest, dealing as it did with the chief events that have transpired during the last 60 years. In limited space it is impossible to do more than mention the variety of subjects that were treated by Mr. Morton. The four departments of zoology, botany, geology, and meteorology were the first that received attention from the Society, and geography was not long overlooked. Interesting mention was made of the detailed work of the Society and its volumes of records. Important discoveries were also referred to, and a quantity of statistical information given Attention was directed to a long list of valuable papers that were from time to time read, and prominent mention made of the active part taken by the Society in various expeditions of research. Among other matters referred to were some of the minerals of Tasmania, and the advancement of the colony generally. The paper is one that entailed considerable labour and research in its preparation, and as a historical sketch will form a valuable acquisition to the records of the Society.

Mr. Morton's paper was illustrated with over 40 specially prepared lantern slides.

The Chairman complimented Mr. Morton on the class of paper he had read. He said that Mr. Hogg's paper was also of an interesting character.

ABSTRACT OF PROCEEDINGS, APRIL, 1901.

The monthly evening meeting (the first of the 1901 session) was held on Monday, April 29th, in the Tasmanian Art Gallery, the President (His Excellency the Administrator, Sir John Dodds) presided.

Apologies.

The senior vice-president, the Hon. Sir James Agnew, K.C.M.G., M.D., etc., and the Hon. C. H. Grant, M.E.C., sent an apology regretting their inability to be present.

New Members.

Mr. F. G. Simpkinson-De Wessellow, R.N., who, since the last session, had presented a number of water colour sketches to the Society, was unanimously elected an honorary member of the Society. Messrs. Frank Allwork, L.S.A., of New Norfolk, and P. J. McLeod, B.Sc., were elected Fellows of the Society.

Her Late Majesty.

Sir John Dodds, who was received with applause, said that this was the first occasion this year of the Society's meeting. They were all aware that Her late Majesty was the patron of their Society, and they were all honoured in the person of that patron. It was, therefore, fitting that on this occasion they should record their sense of the loss which the nation and this Society had sustained by the death of Queen Victoria. For more than 60 years Her late Majesty had exercised a personal influence for good which had made itself felt throughout the whole of the Empire. There was no feeling comparable in intensity with the feeling which Her late Majesty had engendered in the hearts of her subjects, and it would be idle for him to attempt in any way to describe the loss which the nation had sustained, and he thought it right to invite them to agree in expressing their deep sorrow for the loss of a sovereign, perhaps the greatest one they had ever known in their history. Let the example of her noble life abide with them as a people, and stimulate them to greater efforts. (Applause.)

Mr. Alex. Morton said an address to the Duke of Cornwall and York had been prepared on behalf of the Society.

Mr. Osborne Greene suggested that the use of the Society's rooms might be extended for the presentation to be made to Her late Majesty's grandson. Sir John Dodds thought that the suggestion might be conveniently referred to the Council of the Society for consideration, but pointed out that Government House had been fixed as the place for the presentation of addresses to the Royal visitors, and he ventured to think that that would be more acceptable.

Papers.

Sir John Dodds then said he had much pleasure in introducing to the Society Mr. Wm. Heyn, of the Timber Department Admiralty — Harbour Contract Works, Dover, England.

In the absence of the authors, the secretary read the following papers. (a) Description and analysis of a new species of mineral, "Petterdite," a new oxychloride of lead, by Mr. W. H. Twelvetrees, F.G.S., Government Geologist. The author said this apparently absolutely new chemical combination occurs in attached crystal groups in a quartz gangue containing disseminated pyrites, in the form of somewhat thin hexagonal plates, which are usually minute in size (about 5 millimetres in diameter), but occasionally reach 9 min. dia., and still more rarely a larger size. It was, says the writer, evidently rare, and, so far as known, confined to the locality mentioned. The specimen, of which a slide was thrown on the screen, was remarkably fine, containing about 200 perfectly-formed implanted crystals. Mr. Twelvetrees said the mineral was a very attractive specimen, and was easily distinguishable from the more abundant sulphate and carbonate of lead, and was occasionally associated with fine groups of campylite. He had great pleasure in dedicating it to Mr. W. F. Petterd, of Launceston, who had done so much in the work of Tasmanian minerals.

The next paper was by Mr. W. F. Petterd, who gave a description of a meteorite from the Castray River, Tasmania. The writer said that considerable interest invariably attached to the discovery of meteoric substances, and he therefore assumed that a few remarks concerning the recent acquisition of a small but reliable meteoric stone, fully authenticated as having been unearthed in this State, would be of interest. The specimen, of which a lantern slide was shown on the screen, displayed the second of these stones which have been discovered in Tasmania, bringing the total number recorded up to date as having been found in Australasia to about 33 examples. Those recorded from Australasia weighed from three to four tons, to that now described, which was the smallest so far obtained. Mr. Petterd said it was beyond doubt that many had been overlooked. To the average observer they were very unattractive, and it was only when they fell into the hands of mineralogists that their nature was revealed. The description of the Castray meteorite was:—Type, siderite; weight, 51 grains; size, length, 18 m.m.; greatest breadth, 10 m.m.; locality, Castray River, N.W. Tasmania. It was originally obtained, with two others of like size and character, by a miner in 1899, when ground-sluicing the auriferous drift on the banks of the Castray, and afterwards, direct from the discoverer, came into the possession of Mr. T. Birkett, the well-known mine manager, by whom it was presented to the mineral collection of Mr. Petterd.

Mr. Heyn, before reading his paper, thanked the Administrator (Sir John Dodds) and the Premier (Hon. N. E. Lewis) for the help afforded him in his work here, and forgave Mr. Alex. Morton for his indefatigable importunity to induce him (Mr. Heyn) to come before them that night. The people of Hobart, possessing one of, if not the finest harbour in the world, could scarcely conceive what the want of it meant in the English Channel. It was to find the piles necessary for the temporary staging used at Dover (England) harbour construction, to enable the laying of 42-ton concrete blocks, that he had come to Tasmania, where he had succeeded in getting magnificent blue gum piles, ranging up to 100ft. in length, and 20 inches square, at Norfolk Bay and Port Esperance. Oregon timber of the same dimensions could have been procured, but the best blue gum suited the submarine works at Dover better, on account of its greater specific gravity, durability, and comparative imperviousness to ravages of the "terrida navalis," or common sea-worm. From a cargo sent them by Messrs. Gray Bros. they had seen at Dover that this was the most suitable. The process of utilising the logs was illustrated by lantern slides, prepared by Mr. Beattie. Mr. Heyn congratulated Tasmania on having thus additionally contributed towards the defences of the Mother-Country. He strongly recommended the use of blue gum or stringly bark to pave a street as a specimen of what could be done with it. He emphasised the necessity of all timber being cut at the proper time of the year, and properly seasoned, before exportation or use, as he preferred natural to artificial seasoning. He doubted whether our blackwood and Huon pine could be profitably exported to England, as equally good wood in black walnut or bird's-eye maple could be purchased there at very much lower prices. On entering the bush here he had felt indignation and sorrow at the wanton waste and ruin which ignorance and recklessness had caused in destroying thousands of splendid trees. He attributed this to ignorance of the first principles of forestry, and his remedy for that would be a School of Forestry and Agriculture, modelled on the plan of the most successful ones on the Continent. Our youth could attend them at the same time as the ordinary schools. He dwelt upon the necessity of reserving Crown lands, and, where young trees were coming up, the desirability of planting firs, and finally insisted upon the urgent necessity of acting at once. Otherwise, in a few years, our timber would be exhausted, and our fruit trade perhaps lost. Norwegian timber which he saw was being imported into Tasmania would grow to perfection in its own soil. When back in England it would always be a pleasure to him to do anything he could in the interests of Tasmania. (Applause.)

In the discussion that followed,

Hon. E. Mulcahy remarked that Mr. Heyn seemed to know more about our local timber than many of our local men did. Tasmania had had to face the fact of the important market of Victoria being closed against her by duties, which practically shut her out; but that obstacle would be removed. It was, no doubt, a sin the way timber was destroyed, but to avoid it there was no choice unless the farmers had not only a market open, but means of transit to get the timber to it. The Government had not lost sight of the necessity of planting trees, and already had an order given for samples of seeds of certain trees. He moved a vote of thanks to the lecturer.

Mr. Heyn, in reply to Mr. Target, promised to send particulars of what some Governments made out of forestry.

Mr. Thomas Stephens, M.A., said that some two years ago, when in England, he inquired as to the chances of an export trade from the colony, and was told that some shipments previously had arrived so twisted and warped that no one would look at them. The West Australian woods were then coming into repute there. All competent judges said there was an opening for our timber in England, but it must be taken up by people with a proper knowledge and sufficient capital. He hoped that what Mr. Heyn had said would stimulate people to get the knowledge that would develop the trade.

Mr. Bernard Shaw differed from the lecturer in regard to what the pioneers had had to do to clear land for homesteads.

Mr. E. A. Counsel (Surveyor-General) agreed that timber destruction was unavoidable in the past, but now was the time to take steps against it.

Mr. Heyn replied that he had seen large quantities of land where, for want of knowledge of forestry, the only thing it could produce had been destroyed. He had not alluded to where homesteads with cereals had replaced the trees. He had seen blue gum trees destroyed where the soil would produce nothing else, and that it could not do so should have been ascertained before destroying. It had been done in the last few years.

Sir John Dodds could not help agreeing with a good deal that Mr. Heyn had said regarding clearing; but it must be remembered that if settlements were to be made, and population spread over the country, there must be a destruction of timber. It would be a good thing if the attention of Ministers were given to the matter of bush fires, with a view to the conservation of what, in the future, might prove a very large asset.

Votes of thanks to the authors of the papers were carried.

MAY, 1901.

The monthly meeting of the Royal Society of Tasmania was held in the Art Gallery at the Museum on Monday evening, May 27th. His Excellency the Administrator, who was to have presided, was prevented from attending by slight indisposition, and the Bishop of Tasmania occupied the chair.

Congratulatory reference was made to the honour recently conferred upon His Excellency the Administrator.

Timber in Tasmania.

A discussion took place on a paper written by Mr. W. Heyn, of the Timber Department, Admiralty Harbour Works, Dover, on "The present and future prospects of timber in Tasmania."

Mr. E. A. Counsel said he was of opinion that some points in Mr. Heyn's paper were likely to lead to erroneous impressions without further explanation. With regard to ring-barking, he was unaware of that process being carried on to the extent mentioned. There was no large extent of marketable timber of value in Tasmania that was wantonly destroyed by the selectors; they were too anxious to benefit by its proper treatment. Although quantities of blackwood and pine timber had been destroyed in the north-east of the State, it was too far from a market to pay for cartage, valuable as some of it was. The best land produced the best timber, and especially was this the case in the matter of blackwood. Mr. Heyn's limited experience in Tasmania had misled him into making the statement that very large quantities of timber were, at times, destroyed by bush fires. This was not so, for, although the fires traversed bush country, the timber of large growth was, at times, only blackened. The time was opportune for initiating an experimental plot, in order to propagate a number of the most suitable kinds of timber.

Mr. L. Rodway said he took great interest in the matter of planting forest lands in Tasmania. A country could not be denuded of its timber without affecting the climate. This was the experience of all countries. In Australia, the vegetation was not well suited for the purpose of retaining water on the land. If planting were indulged in to any extent, exotics must be chosen, and it would be necessary to import. This could not be done, however, unless a State nursery was established. To establish a State nursery was a matter that required caution, as there would be no apparent return for some years to come; but the expense would not be great. If we had a State nursery, seeds and plants could be obtained from all parts of the world, but special attention must be given to the varieties that gave the best results. He had passed through the Huon district some time ago, and was astonished at the neglected appearance of the orchards. If a State nursery was established, the matter of orchard growth must be taken into consideration, and all useful information given to orchardists.

Mr. R. E. Macnaghten said he had lived for five or six years in the district referred to by Mr. Heyn. He did not think the damage done by ring-barking was extensive, but the injury done by bush fires was enormous. He thought that Mr. Heyn's advice and suggestions should receive careful consideration, and he did not think such a valuable paper should be confined to Tasmania, but that it should, if possible, be produced in some of the English magazines.

Mr. R. M. Johnston said he had stated many years ago that the waste of valuable timber in Tasmania was too great, but he realised that the cost of sending the timber to a market was excessive. That was a position many settlers had to face, and was one of the causes of so much waste. He would like to know if areas could not be planted with some of the foreign soft woods plants, that would eventually obviate the necessity of importing such timbers. Although there was plenty of certain varieties of timber at present, it was essential that the future should be studied.

Discussion of the subject was adjourned until a future meeting.

JUNE, 1901.

At an adjourned meeting of the Royal Society of Tasmania on Thursday evening, June 6th, the discussion on Mr. W. Heyn's paper on "The present and future prospects of timber in Tasmania," was resumed. His Excellency the Administrator (Sir John Dodds, K.C.M.G.), presiding.

TASMANIAN TIMBER.

(By A. O. Greene).

up the forestry question, now much neglected.

Mr. A. O. Green, of the Railway Department, read an additional and able paper on the subject, and brought to the meeting 27 specimens of Tasmanian timbers labelled with the common and scientific names, weight per cubic foot, specific gravity, etc.; also some other specimens of timber that had been in use up to 70 years in the State. He said:—The subject that has brought us together this evening is one of the very highest importance for Tasmania as a whole, and worthy of this society, which has for its object the study of the natural products of Tasmania to the end that science in general, and the good of Tasmania, may be advanced. This country has been like England, and many other countries in the past, when forests were looked on as a bar to progress, and as stifling the energies of the inhabitants of the country. It is a phase through which all countries pass, or have passed, where there is luxuriant vegetation. But all countries in time are forced to recognise the value of the timber products which a beneficent nature forms for us, from the atmosphere we breathe. The first feeling of mankind about the forest is that of being overwhelmed by it, and trees are looked upon as encroachers upon the domain of man, to be got rid of at all costs. But in every country of which we have records, as time has passed, the forest has come to be looked upon as an indispensable adjunct to the life of man in the country, in that it tempers the wind and heat, moderates hail and storm, conserves water against periods of drought, forms and prevents the dispersal of that fertilising "humus," without which soils become barren, and when rightly used, is a prolific source of revenue for all time.

We are greatly indebted to Mr. Heyn for his valuable paper, in which he has reminded us of the advantages that Nature has given us, and in which he has not feared to place before us the small appreciation, in which they appear to him as a visitor to be held by the inhabitants generally. We can, I am sure, quite feel for him in his diffidence, after so short a sojourn, in speaking upon a subject authoritatively, which so nearly concerns us as Tasmanians; but I am confident that every member of the Royal Society of Tasmania will feel indebted to Mr. Heyn for sinking his personal feelings in this matter, and giving us his impression of our great national asset, and the manner in which it seems to him to have been treated.

With regard to the practical recommendation that is before us, i.e., the establishment of a nursery of forest trees with the view of encouraging planting for the purpose of shelter, water conservation, beauty and profit, it is one that eminently deserves the whole-hearted support of this society, and I trust that the proposition will be endorsed by us with such unanimity that the hands of the Government, and others interested, may be strengthened to help forward the project as it deserves.

It is a matter which has, on several occasions, been discussed in this room, and I myself had the honour in 1893 of reading a paper upon the advantages of planting coniferæ, giving a list of suitable trees, and a light resume of what has been done in other countries; also another paper in 1894, more especially devoted to the economic preparation and uses of our timbers, but incidentally bearing on the subject in hand.

At the present time, in many parts of the island, sand-blows, wind, the failure of springs, and the impoverishment of the soil, are compelling people to recognise the beneficial influence of trees upon a country.

In some parts of the island, even now, after our short occupation, timber has to be brought from comparatively long distances for structural and other economic purposes. To those conversant with the subject it is painfully apparent that in the near future most of our forests within a working distance of railways and centres of population will be rendered absolutely barren, as far as production of timber is concerned. And this period, I may say, taken with regard to the unit of the life of the nation, is so short as to be almost the actual present. This is a matter which intimately concerns every inhabitant as well as the Government; but under our form of rule, the Government in railways, bridges, and jetties is far and away the largest consumer of timber, therefore is more interested than any individual in the conservation of the timber resources of the State; as one instance there is every prospect that within a short period the sleepering of our railways alone will become a question of grave anxiety, from the failure of the forests near the lines to produce timber suitable for this purpose.

As it is well to approach a subject such as this from its beginning, I may be pardoned for offering for consideration some propositions that have passed into axioms:—

A well managed forest produces a large amount of timber, not for this year only, or next, or even for a generation, but for all time. A constant output of timber of the best quality of its kind is ensured for ever by methods that have been usual for centuries, in many countries where forestry has been a profession. In all newly-inhabited countries, and in barbarous countries, the wants of the moment are supreme, the trees are abundant, each man takes what he wishes for use, and destroys wholesale, without let or hindrance. After a time it comes to be recognised that a tree that is the product of the State soil for a century belongs, in some measure to the Government, and without any view to the future, the State, for the purpose of present revenue, licenses companies, or individuals, to cut down for their own profit, and to destroy the forest, so long as they pay the fee demanded by the State for that right. Then with regard to fire, it is generally looked upon as impolitic, in new countries, to restrict too harshly, either its use, or its abuse. In forestry, the two greatest enemies are fire and the license-holder.

State forests should be defined by marked bounds, and defended from the ravages of thieves and fire by forest officers, and by fireguards. In a new country statistics should be gathered to fix the best season for felling each kind of tree, the proper method for seasoning the timber, the period required for the various trees to reach a growth suitable for the purposes for which they may be wanted, and for the trees to reach maturity; also to obtain information as to the uses for which each timber is best suited, the defects it is subject to, and the diseases to which the trees are liable. Roads suitable for the removal of timber should be made, and the forest divided into blocks, of which one at a time is open for felling. After these preliminaries the trees in a block should be marked in consecutive numbers, and the issue of licenses to enter the forest to cut tracks and to fell indiscriminately is stopped. Trees are only allowed to be felled in their season. Applicants for timber are taken by a ranger to a tree or trees of the kind they require, and told the price, say, 1s. 4d., or 3d. a cubic foot, or trees are sold by auction, as they stand, at the estimated quantity of timber in them. After the purchase, it is to the interest of the purchaser to use up the whole of the tree, and not to buy a tree with 500ft. of useful timber in it for the purpose of cutting 10ft. out of the middle.

Under the licence system a man will wander for miles through the forest in search of timber, cutting tracks, trying, and even felling, trees and leaving them until his fancy is suited, thus damaging ten or a hundred times as much of the property of the State as the timber he uses is worth; besides leaving behind him the rest of the trunk, and all the branches and tops to cumber the ground and prevent the growth of young trees, to form a harbour and breeding ground for insects and fungi that are enemies of the forest, and to add greatly to the destructiveness of any fire that may occur. At first, a systematic treatment of the forest is looked upon by all concerned in the timber industry as fatal to their interests, but in every country in which it has been tried, it has been found to convert an evanescent industry into a permanent one, to improve the status and profits of the worker, and to form the source of a very large State revenue. This paper is written without works of reference, but quoting from my paper of 1893:—

"Norway, at that time, exported timber to the value of £2,000,000 annually, while the profits from some of the European State forests were, annually: — Sweden, £21,000; Austria, £90,000; France, £1,000,000; Prussia, £1,500,000."

Further details of methodical forestry are, that the forests should be worked in blocks of such dimensions as are suited to the rate of growth of the timber, and in such a way that the trees that are left shelter the young growth, and that the prevailing winds shall scatter the seeds from the standing portions on to the cleared parts. This is supplemented by hand-sowing and planting—a part of the pay of the ranger or bailiff being for trees successfully planted out from the nursery at his cottage. As the trees grow, if necessary, they are cut out as poles, and the whole of the new part of the forest is kept growing at the greatest speed possible, and from the same influences, producing superior timber. When the end of the forest is reached, the trees on the first section will have arrived at maturity, and thus the profits are kept always at the highest state. On the other hand, under the licence system, every man who goes into the forest destroys many, many times as much as he uses, the tops and refuse, and the cutting of tracks destroy saplings, and make an entry for fire and cattle, which still farther increase the damage done by the timber getter, and in a very short time, perhaps 50, say 60 to a 100 years, not a marketable tree is left, and beyond that, the point on which I wish to lay especial stress is this, that in most cases in inhabited countries, no first rate tree will ever grow in that forest again. What is called rubbish will grow, and that, with the debris of the tops, will so smother the young growth, that those plants that force their way through will be permanently injured, will tend to branch instead of forming straight trunks, and, roughly speaking, will never again form good timber-producing trees of their class. This is not theory, but fact, that has been proved over and over again in every part of the world where civilised man has come. In new countries where the licence system obtains, the destruction of the forest is brought about very rapidly, and in older countries the effect is kept up by similar systems, and by rights of commonage, and the task of converting the forest again to a productive state is one that requires considerable expenditure, and a length of time that must be measured by generations.

The project before us is a modest one, i.e., that a small piece of land shall be taken whereon to raise trees, for the planting of denuded tracts, watercourses, and sandblows, and, incidentally, to spread abroad the meaning of the old saying that "He who plants a tree is an unselfish man, in that he benefits not only himself, but also his neighbour and posterity." I must beg your forbearance if I have appeared in what has gone before, to have wandered from my subject, but in all works that are undertaken, no matter how limited the present means may be, it is well to begin with a plan that is complete in every respect, instead of providing for the apparent needs of the present moment only. It is the especial object of this society, by its discussions, to bring before its members, and through them the Government, and the inhabitants of Tasmania, the advantages to be derived from a right knowledge of the natural products of the State, and I think that every one of us has realised the immense latent value that there is in our forests. The trees produce fuel, both wood and charcoal, structural material, fibre for the purpose of making paper, acetic acid, tar, potash, and various essential oils, all of them valuable in commerce, and when worked in conjunction, one with another, adding very largely to the profits of forest property.

It is well known that by one method we may exhaust the whole of the commercial value of the source of these natural products in one or two generations, and by the other, that the output may be considerably increased, and kept at that increased rate for all time. It is, therefore, from a national point of view, well worth while to launch this scheme with an eye to the future, and upon the most perfect lines of which we are capable. A beginning is valuable as a beginning—the planting of trees for shelter and ornament will be advantageous in many ways, as well as commercially. Every man who plants a tree values trees more highly, and an adherent to the cause of forest conservation is gained. I would beg of you not to treat this scheme that I have outlined as chimerical, because it is not immediately attainable, but so to use your influence that the proposed nursery of forest trees shall, in the future, develop into a complete and profitable system of forest conservation for Tasmania.

Mr. Targett said that afforestation would, if started in Tasmania, give employment to a number of people, prove an immense boon in the immediate future, and help to preserve the beauty spots.

Mr. Counsel wished it to be understood that he criticised Mr. Heyn's paper in the very best spirit. They all owed Mr. Heyn a debt of gratitude. Mr. Green's paper contained sound thought, but many of his recommendations were not practicable; no country could carry them out. In a district suited for agricultural settlement the timber had to be cleared; a country could not be opened up by the timber trade alone. In West Australia, as in Tasmania, they had no State forest, but the agriculturist worked hand in hand with the timber-getter. Good land in this State is too good to be utilised as timber land. (Hear, hear.)

Hon. John Henry thought it would be a good thing to, at an early date, re-initiate a system of State forestry. Mr. Green's paper was excellent in many respects, but was not sound on the practical side, in this country, the circumstances of which had to be first considered. On the rich lands of the North-West Coast, it would be, for instance, impracticable; it would mean delaying the opening up of good country for settlement for a remote period. There the settlers must get rid of the timber, and that was their difficulty; if only used for forestry purposes, that land would only support a few. He agreed with Mr. Counsel that good land was too valuable to maintain as forests, whilst there were considerable areas that would grow useful timber, such as the stringy bark, that were not suitable for cultivation, hence the necessity for re-introducing the State forest system.

Mr. Macnaghten, in an interesting

speech, thought Mr. Heyn's paper indicated how population and immigration would increase by increasing the utilisation of our resources.

Mr. T. Stephens spoke on the question of instruction in forestry.

His Excellency thought several of the speakers had not properly caughth the meaning of Mr. Heyn's paper. His propositions amounted to this—"You have some excellent land, which you are right in endeavouring to settle people upon; but you also have a large amount of land that will not pay to cultivate, as far as ordinary farm products are concerned, and on that you may profitably produce timber. (Hear, hear.) You have a valuable asset indeed in the shape of splendid forests, which will prove a splendid asset in time to come, if you properly conserve them, and they occupy land that cannot be turned to other profitable uses. The good lands suitable for cultivation of other products, of course, are not included." (Hear, hear.)

Mr. Heyn thanked His Excellency for putting speakers right as to the purport of his paper. He complained of Mr. Counsel's attitude, and maintained that valuable forests were being shamefully destroyed in Tasmania, and told him that the best blue gum did not grow on the best ground, as he had stated, but on poor and rocky land, on which nothing else would grow. (Hear, hear.) Replying to Mr. Counsel at considerable length, he claimed that his paper put the correct phase of the matter forward, and advocated the establishment of a good school of forestry. (Applause.)

The meeting terminated with the usual votes of thanks.

JULY, 1901.

The monthly meeting of the society was held at Hobart on Tuesday, July 30th, the Bishop of Tasmania presiding. There was a good attendance.

Three new members were elected—Dr. P. C. Boyd, Mr. Russell, E. Macnaghten, B.A., and Mr. Henry J. Wise.

Apologies for inability to attend from the president of the society, Sir John Dodds, from the senior vice-president, Sir James Agnew, and from the Hon. N. J. Brown, were received.

Mr. Alex. Morton, in the absence of Mr. W. F. Petterd said that that gentleman had prepared two papers of interest They would be printed for the use of members. The first of these papers was on the "Microscopic Structure of Some Tasmanian Rocks." It described some aberrant members of the basalt family, which, although not common in Tasmania, are occasionally met with. Tachylyte was a glassy form of basalt, originating from the rapid cooling of the magma by contact with a cooler substance. It was commonly found in thin layers, but sometimes is met with, as at Bothwell, in comparatively large lumps. It also occurs at Fernhill, near Deddington, and, in a lesser quantity, at Burnie. Limburgite (from the Burnie-Waratah railway) was a dense, hard, and extremely tough rock, so much so that it became notorious during the construction of the Burnie and Waratah railway. It is dark, almost black in colour, and very fine grained in texture. Basalt-vitrophyre (from Sheffield was microscopically one of the most attractive rocks in Tasmania. It was usually intensely black, extremely brittle, and easily reduced to fragments. Hydrated olivine basalt (Native Point, Perth) was a rock of abnormal physical character, invariably heavy from the absorbed moisture, and soft to a degree. It fractures on exposure to atmospheric action. It closely resembles palagonite, and was obtained in sinking holes in the locality mentioned.

Mr. Petterd's other paper was on some land shells from Maria Island, Tasmania.

Coal Discovery at Wynyard.

Mr. R. M. Johnston, Government Statistician, read the following note on the Wynyard discovery:—

"I had read with much interest of the discovery of coal on the north-western part of Tasmania, near Wynyard, a few weeks ago. Hitherto the existence of members belonging either to the mesozoic or upper coal measures, or to the permo-carbon or lower coal measures, of Tasmania, was unknown to geologists, in all that region of the North-West Coast lying between the Mersey Coal Basin and Cape Grim. A few days ago, I was fortunate in receiving from Mr. Victor West, of Wynyard, a specimen of the bituminous shale associated with the newly-discovered coal seam exposed on the Inglis River, about 16 miles south of Wynyard. Fortunately, Mr. West selected a piece of the shale bearing a clear impression of a portion of the frond of a fossil fern. The typical plant remains of this period are two species of a genus of the Coniferæ (Noggerathopsis); characteristic net-veined ferns of the Genera, Gangamopteris and Glossopteris; and lycopods of the Genera Tasmanites and Schizoneura. The following are the localities where the lower coal measures were known hitherto to occur in Tasmania, viz., Mersey, Tippagory Range, Tamar, Mount Pelion, Henty River, Fingal, Ben Lomond, Harefield, Adventure Bay, and Mount Cygnet. As a rule, when coal seams occur in these lower coal measures, they are found to be purer, more bitumenous, and freer from ash than the cool seams of misozoicage? They are, therefore, better adapted for steam purposes and for the production of gas, than the coal seams of the later age, which alone hitherto have been worked to any extent in Tasmania. It is to be hoped that the discovery at Wynyard may turn out to be a good working seam, or seams. If so, it will be of untold value to the district of Wynyard, as well as to the colony generally. Mr. West has kindly promised to give me further particulars regarding the general geology of this district at an early date, which I shall be pleased to communicate to the fellows of this society."

Replying to questions, Mr. Johnston said he had not sufficient particulars yet to say whether the seam or seams were of sufficient size for favourable working.

Mr. T. Stephens said that at a meeting of the society in 1869, he exhibited a pebble of hard and compact kerosene shale, found with many others near the mouth of the River Inglis, and expressed the opinion that portions of the carboniferous series from which it had come, though removed by denudition near the coast line, would one day be found at no great distance inland. This shale is practically identical with the so-called "cannel coal," discovered a few years ago near Barn Bluff.

Astronomical Observations at Capetown Observatory.

Mr. Kingsmill began by referring to the kindness of Sir David Gill, the Government Astronomer at Capetown, who gave him opportunities of seeing the work of his observatory, and made him a present of some beautiful photographic slides, showing some of the most remarkable results. These slides were supplemented by others obtained from the Royal Astronomical Society. The lecturer first gave a description of the Capetown Observatory. It is an Imperial institution, provided for and controlled by the Admiralty, and it is liberally endowed for astronomical research, having a staff of 30 observers. It resembles a village, having a number of buildinges for the instruments, and for the observers' residences. The site chosen was as near the bay as possible, for the sake of the shipping. Formerly, a gigantic time - ball was dropped at the observatory, which was visible to the ships four miles off in Table Bay; now a smaller time-ball is dropped electrically close to the docks by means of a wire from the Observatory.

The accurate determination of time is a very small part of the Observatory work; the position of stars is determined for the use of mariners; in fact, most of the Southern stars whose position is given in the "Nautical Almanac" are recorded there from observations taken at the Capetown Observatory. The most interesting work, however, to the general public is that which simply satisfies the thirst of the human mind for knowledge of what is observed in the heavens without any reference to commercial utility.

The lantern slides shown illustrated in a most interesting manner the methods by which the actual materials of the stars were ascertained. It was shown how iron was proved to exist in form of vapour in the sun's atmosphere, in the atmosphere of the bright star Canopas, and in that of Alpha Centauri. Hydrogen was also shown to be an element as abundant in the stars as it is on the earth. These wonderful revelations are due to the spectroscope. That instrument not only enables us to ascertain the materials of which a star is composed, but it actually can be made to reveal the motion of a star along the line of sight, to show whether it is aproaching to or receding from the earth, and the rate at which this takes place.

Three beautiful photographs were shown on the screen of the star Argus, and the portion of sky around it. This, the lecturer said, would, no doubt, be specially interesting to members of the Royal Society here from the fact that its records contain several papers read on the nebula of Argus by the late Mr. Francis Abbott, whose observations of the star and of its nebula extended from the years 1867 to 1872. This star has gone through the most extraordinary variations in brightness during the last 200 years. It was first observed at St. Helena by Halley; then at the Cape of Good Hope by Sir John Herschel. It increased in brightness, until it became the second star in the sky in 1843. During the 25 years following it steadily but slowly diminished. In 1867 it was barely visible to the naked eye, and the year following it vanished entirely from the unassisted view, and has not yet begun to renew its brightness. The time it was observed by Mr. Abbott it was a faint telescopic object, surrounded, however, by a remarkable nebula. A photograph of this was shown by the lantern, taken during an exposure of 45 minutes. A second photograph was shown of the same object from exposure of over three hours, and a third photograph from a 25 hours' exposure. In the first of these a considerable number of stars appeared in th field of view; in the second the number of stars was greatly increased; in the third (the 25 hours' exposure) revealed an absolutely countless multitude of stars surrounding the nebula. Many of these are too faint to be detected by the human eye. even when aided by the most powerful telescope.

Some groups of star clusters in other parts of the sky were shown, and it seemed as if there was no limit to the number of stars that could be revealed in a single telescopic field by photography. The star clusters were, in some cases, so dense as to appear like a continuous mass of light. Slides of nebulæ were next shown, and it was pointed out by the lecturer that at first nebulæ were supposed to be simply star clusters, the diffused light of which could be resolved into separate stars if we had a sufficient magnifying power; but modern observations, with the aid of the spectroscope and photography, show that this hypothesis is incorrect. The nebulæ have been proved to consist of vast spaces filled with glowing gas, which sometimes envelopes stars. These masses of gas generally have definite forms, the spiral being the most common.

The systematic study of nebulæ may be said to have commenced through the labours of Sir William Herschel at Slough. The discoveries that Herschel made were reckoned not by tens, nor by hundreds, nor by thousands. It was left to Sir John

Herschel, the only son of Sir William, to complete his father's labour of extending the survey to the southern heavens. He undertook, with this object, a journey to the Cape of Good Hope, and sojourned there for the years necessary to complete the great work. As the result of the labours thus inaugurated, there are now 3,000 or 4,000 nebulæ known to us, and with every improvement of the telescope fresh additions are made to the list.

Comets formed the next subject illustrated. Photographic slides were shown of Swift's comet of 1892. In the photographs of comets the stars had a remarkable appearance. Instead of being round dots, as in other photographs, they all appeared like a number of short arrows pointing in one direction. The reason of this was the rapid motion of the comet among the stars, which compelled the photographer, in order to keep the comet still, to represent the stars as moving. The length of each streak representing a star indicates the distance and direction of the comet's motion.

The process by which a comet's tail was developed, and the materials of which it is composed, were next discussed.

Some further photographs were shown of the sun and of the spots on his surface, and the lecturer concluded by remarking on the fascinating character of the study of astronomy, and the labour which had been expended upon it from the earliest ages.

The student of this subject finds an answer to many questions, but as he studies he finds that many more questions arise, which remain unanswered. Whence comes the fascination? Why is it that we, who are of yesterday, delight in the contemplation of such vast periods of time, of number, and of distance—such a boundless exhibition of force and grandeur? Surely, the answer must be "The heavens declare the glory of God."

A hearty vote of thanks was accorded to the lecturer.

The Chairman announced that at the next meeting Mr. J. W. Beattie would give a lecture, illustrated, on the East Coast of Tasmania, as visited by Tasman. At the September meeting Mr. A. Mault would read a paper on the timber industry. At the October meeting the secretary (Mr. A. Morton) would probably have some notes of his visit to Canada. That would be after his return from Vancouver, and, no doubt, he would have something interesting to say with regard to his visit.

Mr. Nat. Oldham operated with the lantern slides illustrating Mr. Kingsmill's lecture.

AUGUST 26.

Owing to the inclemency of the weather the meeting to be held this evening was postponed to September 9th.

SEPTEMBER, 1901

The monthly evening meeting was held on September the 9th, the President, His Excellency the Administrator, presiding, when the following paper, illustrated with lantern slides, was read:—

NOTES ON A TRIP TO THE BARN BLUFF COUNTRY.

(By Mr. J. W. Beattie.)

The greater part of the following notes on the Barn Bluff country were written under the most distressing conditions imaginable, both from the tourist and photographic aspects—the latter especially, as it was in the interests of photography that I made the journey. Sitting in a little hut, in the midst of wildly beautiful country, made still more wild, and also dismal, by the awful strife of the elements outside, which, day after day, raged with a fury scarcely imaginable to a lowlander, and, to my way of thinking, certainly worthy of a better cause

If long-continued pleasure brings weariness, it can be imagined into what mental state one is driven when the opposite cause is in operation, and day succeeded day in furious wind and rain (the roaring of the wind in the big trees around keeping me awake at night), to be succeeded by heavy snowfalls, and thunder and lightning, making every living and dead thing around in such condition that it was, to say the least, misery to walk outside the hut, the tension became so acute that I could scarcely sleep at all. How I wished the Barn Bluff country elsewhere, and called myself names for undertaking the trip at this late time of the year, and the only sympathy I usually got would be from the extra hearty wind gust outside, sending a cloud of fine snow through the cracks in the weather-boards of the hut, down my neck, a process cooling, if not comforting. At last came the crisis—I could bear it no longer. The packer had been expected night after night, and he never came, and each successive disappointment became more acute. Tucker was running low, and if more snow came, the consequences might prove serious, so I decided to clear out, and one Sunday morning saw me plodding through the February Plain, swag on back and camera in hand, and the following day (Monday) found me at Mr. Howe's comfortable house at Mole Creek—42 miles from Pelion—tired, but thankful at being out of the storm region, and within reasonable distance of home, after an absence of nearly three weeks.

I left Hobart on April 4, by express, in company with Messrs. E. Hawson and Boxall, who, with myself, formed the party bound for the Barn Bluff country. The route lay via Mole Creek, then to Liena, on the Mersey River, 12 miles further on southerly; then via Innes's Track to Pelion Huts, 28 miles ahead, through Gad's Hill and February Plains, still heading southerly, then away to Barn Bluff, 14 miles further on in a N.W. and north-easterly direction. The weather in Hobart, on leaving, was very wet—southerly—which continued nearly to Evandale, where we left it, hugging the Great Western Tiers right on to Mole Creek, although there was an occasional shower before the terminus was reached. We arrived at Mole Creek about 5.20 p.m., and carried our baggage on to Mr. Howe's store, where we also cast aside the garments of city wear, and assumed those suited to the rough, wild country which lay ahead of us. We were joined here by Mr. W. J. Lloyd, head teacher of the Mole Creek State School, who completed our party.

After refreshment, we started for Liena (Mersey River) at about 7.30, on riding horses, the swags coming on in a chaise cart, and we progressed admirably, the road all the way being exceedingly good, and with the moon at the full it was a very pleasant journey. The Western Tiers end somewhat abruptly their western trend at Mole Creek, their grand, wall-like formation running southerly from there, and it is this bold terminal headland that we can see from Pelion, 40 odd miles south, standing out finely, and retaining almost the same form that it presents to the Mole Creekers on its northern side. From Mole Creek we keep along the main road westerly for a mile or so, turning sharply south after crossing the Sassafras Creek, and keeping on the Circular Ponds and Liena-road. We fall in with some good farms midway on the journey, the Circular Ponds district representing a patch of good agricultural flat land under the Western Tiers, so-called from the prevalence of "pot holes" or depressions, peculiar to limestone country; but the country generally right through to the Mersey is barren, hungry-looking, and unsuitable for agriculture. On the west side the road is bounded all the way through by the Barren Tier, and when the fine form of the Western Tier is lost, on the east, steep, rough, timber-clad hills and gullies prevail, in which a couple of sawmills do business. It was with some satisfaction that at last we found ourselves above the great valley of the Mersey River, whose waters, in the wonderful stillness of the beautiful night, we could hear rushing on a thousand feet below, and, leaving the road, which zig-zags down the great depth, we lead our horses down a "short cut," picking up the road again lower down, and soon we reach the Mersey Bridge, across which lies the incipient township of Liena. The Mersey River here is small, somewhat similar in size to the Meander at the bridge, Deloraine, but differing widely in feature, in that it flows through steep, "gorgy" country, the abrupt head of the Barren Tier, north-westerly, being rather imposing. There is a clear, grassy, flat on the western side, with a couple of cottages and a hut, comprising the township. The latter building we took possession of, stowing our luggage and fodder for the night, we ourselves camping about three-quarters of a mile further south in a house belonging to a settler, who, at the time, was absent. We arrived at the Mersey at about 11 o'clock, and by the time we got settled in our rugs for the night it was cnsiderably after 12. As the orders were to be up at 5 and make an early morning start direct for Pelion, we had rather a small margin left for sleep, and we, unfortunately, rather overdid it by getting up at 5.30. Breakfast and packing up take time, and it was 8.10 before we got fairly on the road. This was the mistake of the day, which caused us so much trouble and discomfort later on, and it is one which all travellers in bush country try to avoid—starting late on a long journey. It's bad policy, and generally ends in trouble. Had we got away at 6 o'clock, as we ought, we would have come out of it with comfort all round. We started with a smiling morning, nice sunshine,, and a south-westerly breeze, but as we got upwards and onwards our evil genius met us, and never left us during the whole of our stay in the locality; the wind went round to the nor'-west, and it blew and rained dismally. Our track lay for a short distance along the banks of the Mersey, when we strike southerly into a road running up Gad's Hill a distance of four miles, with a rise of something like 2,000ft., through fine land generally, heavily timbered, and prettily clothed in fern, sassafras, and myrtle. It is a long, weary pull up this hill, well-graded as it is, much of it being in wretched condition, and the wonder was how, in some places, the patient pack horses, heavily laden as they were ,came through it without accident.

The summit of this hill once gained, we stand on the northern end of a great plateau. a divide between the Mersey and Forth Rivers, and the track runs southerly along this elevation, ultimately bringing us to the head waters of both these rivers, the distance being between 20 and 25 miles. Geologically considered, the plateau has a belt of granite passing over its northern end; then an overlay of basalt, with about four miles of a fucoid sandstone country, the balance of the distance having a capping of dolorite.

At the top of the hill we pass through a cattle station belonging to a member of the Field family, known as "Gad's Hill Station," nicely grassed, where we noted numbers of horses and cattle enjoying themselves amidst the plenty around. Through the finely - grassed and wooded plains of this station the track, made by Mr. Surveyor Innes in 1896, really commences, and runs in a more or less southerly direction right out to Pelion, and as the going here is good we make full progress towards our destination.

About eight miles further we come to the Berriedale Plain — another of Messrs. Fields' possessions—a large, open mixture of button rush and grass, rather poor, and very wet, and by the time we reached the stockkeeper's house we were rather damp, and feeling sorry for ourselves. However, we made a halt here, under the spreading shelter of a "gum top," slung the billy, and gave the horses a rest and something to eat, and, in an hour's time, we were off again. The prevailing timber of the Gad's Hill country seems to be swamp gum (E. amygdalina), gum-top (E. sieberiana), and stringy bark (E. obliqua), of good quality, while further south no good timber of any account is met with, a very stunted peppermint (E. amygdalina) chiefly prevailing. I am told there are also extensive patches of fine wattle country on Gad's Hill.

Passing over to Berriedale Plain, keeping southerly, and rising through dense forest, we break out into what is known as February or Mackenzie Plain. This is a large extent of open button-rush country, broken up into timber patches, rises, valleys, and tarns, and our route runs through it for a distance of eight miles or more, and it is one of the most trying and dangerous parts of the journey. Exposed for the whole of the distance to the caprices of a cruel climate, the traveller may readily be caught in a dense fog or snowstorm, and so be in peril of losing his way, before he can get clear of the plain ,as the track is ill-defined, and the staking infrequent, and only those possessing a very intimate knowledge of the country would be able to find their way out in safety. In spite of all the associated perils of this great plain, however, it appears, in fine weather, very beautiful, the clumps of timber splashed and dotted over its expanse, giving it a pretty, park-like appearance, and the uninitiated would naturally imagine the country to be quite the reverse of what it really is—a veritable barren, howling wilderness, the "Terra del Fuego" of Tasmania. From the highest part of this plain, called the Divide, which is also the highest part of the plateau, a very fine panorama of the mountains ahead, from west to south, can be obtained. The Cradle Mountain, away to the north, Mount Oakley Range and West Pelion, to the west; while between west and south we can see the Pelion, Du Cane, Rugged, and Pillinger groups, all fine, bold mountain ranges, while on the plains below us two or three big tarns break up what would otherwise be rather a monotonous foreground, completing a finely picturesque panorama. I have, unfortunately, to give these picturesque details somewhat prematurely, as they were obtained during the return journey only, the whole features of the country, from the February to Pelion Huts, being "wiped out" during the journey out by the dreadful state of the weather. When our party fairly entered upon the wilds of the February Plain the weather turned downright cruel, a heavy, cold, cutting wind, with driving rain, setting in, and making things particularly miserable. How we wished to be within sight of the huts! Riding became out oc the question, so we dismounted, and plunged through the boggy ground, leading our horses, which was hard work, in addition to the heavy walking, for the poor beatsts were, by this time, tired out on account of the wet and thoroughly bad state of the track. The lateness of the hour, also, began to make us feel anxious, travelling being so slow under such adverse conditions, and our guides were frightened at the prospect of darkness overtaking us while on the plain, the track being so indefinite and easily lost, so we had to exert ourselves to the utmost, splashing through it, and just succeeded in gaining the end of the plain as the daylight almost faded out.

Towards the end of the plain, and where it narrows down into a gully-like form, collecting and concentrating its drainage, as one of the great feeders of the Mersey, and delivering its waters down into the great river gorge far below,we get a fine and bold angular aspect of Mount Pillinger — or Mag's Mountain—which very picturesquely terminates this end of February Plain. Crossing the narrow valley of this part of the plain, rising quickly and turning westerly, we stand on the eastern trend of the Oakley Range, and our track runs, well-defined, down its sides, bringing us into the Pelion Plains at Lake Ayr. At the head of this track we are confronted with an impressive scene, a vast mountain amphitheatre, formed by the Pillinger, Rugged, Du Cane, East Pelion, and Oakley Ranges. This is the birthplace of the Mersey River. It is a grand picture, full of food, both for the artist and the philosopher. The one would revel in material for his canvases, and the other would find his soul lifted up towards the One whose presence under such conditions comes so near, and is made so manifest by His wonderful works around.

But our party, at this time, saw none of this beauty. Mist, rain, and the gloom of night, blotted it almost all out, showing only just enough of an indefinite space to leave a vague impression on our minds that there was something grand beyond, if we could only see it.

The Oakley Range, where we stand, is about 1,800ft. above the plain below, and the distance to the Pelion Huts, our destination for the night, is five miles. The made road down this range is rough enough to negotiate ordinarily, and the boggy plains still worse; but can anyone conceive what a five-mile tramp through them in the dark would be like? None of our party had ever had such an experience, and certainly don't wish for a repetition. How we got through it so well is a wonder to me, and I can only attribute this to the ability of the packers, in some measure, and, most of all, to the sagacity of the pack horses, who had been there before. Speaking for myself, it was a most peculiar experience, for, in the semi-darkness, everything on either side presented the most grotesque and puzzling shapes and appearances, and when we got on the plains, the wavy, white grass, of which I had no previous experience, gave the surroundings the appearance of vast lake-like stretches, and made things look most uncanny. On we went, however, stumbling and splashing, moving slowly in single file. Sometimes down would go one of the pack horses, and the procession would stop until the order was passed along to move on again, then more stumblings, shoutings, boggings right up to the knees, complete collapses over the wretched grass clumps, wringing wet, and still on we had to move. The distance seemed interminable, but at last the sagacious horses turned off the track, and headed right up the hill, and the joyful news came back along the line that we were at the huts. It was a tough scramble up the hill, but the comfort ahead lent additional strength to our already overtaxed stock, and the shouts that came back from the huts above us, in answer to our yellings, were as balm to our troubled spirits. "Get the 'billy' on," we shout as we climb, and in a few minutes more we can see the lights inside the huts, and are soon alongside, and our troubles for the time being are ended; just at half past 8 p.m. There are two huts on the hill, in the timber, one being higher on the hill than the other, and from the higher one came an old friend—Mr. G. Renison Bell—to meet us, and we introduced ourselves, to his utmost astonishment. Although heartily pleased to see us, yet he thought it savoured somewhat of lunacy to come into this country in such weather, more particularly did he apply this to myself, with all my photographic baggage; and I believe he was right.

Mr. Bell is here, I understand, in the interests of the Great Western Railway Co., prospecting the country. However, here we were, right in the heart of the Pelion country, and, wet or fine, we would have to make the best of it, and so we really did. With a splendid fire, a change of dry clothing, plenty of "tucker" and hot tea, we soon regained our normal condition, and felt comfortable, and even happy, although the wind and rain roared and splashed outside. Next morning (Saturday, 6th inst.), at daybreak, we were roused up by the packers to know our intentions, and, considering our struggles of the previous day, and the fact of the weather still continuing very wet, and no prospect of change, we decided to put in the day at Pelion, and hope for the best. The weather was south-westerly, plenty of wind, with heavy rain squalls, and a low scud driving across the sky at a tremendous pace. However, about mid-day it began to improve, and by 1 o'clock it stopped raining, and cleared enough to allow us to get outside and look around. The two huts are rather snugly situated in the timber, on the hill above the track, but a much more convenient situation might have been chosen for them. They are acceptable, however, in any situation in such a country, and especially under present circumstances. They were erected by a Northern company holding some mineral concessions in the vicinity, which I shall refer to later, and are at present only used as rest houses by tramps, like ourselves. Under the able guidance of Mr. Renison Bell, we set out to climb into the country lying behind the huts—to the south-east—and, passing through a belt of dense myrtle scrub, rising rapidly, we soon gained an open plateau, under the Pelion Range, from which we could pick up our last night's course, and view our prospective one to Barn Bluff as well. We found ourselves surrounded by a chain of high mountains forming a basin, and having a radius of something like four or five miles, with an opening to the north and north-west of, perhaps, a couple of miles, where, stretching away in the distance, are open button-rush plains, rises, and timber patches, with an impressive background of Barn Bluff and Cradle Mountains towering up against the sky. This great basin, in which we stand, forms the head waters of the Forth River, and a vast and magnificent gorge, into which the contributions from this basin empties, is formed on the open, northern side already noted, running outwards, as far as can be seen, in a north-easterly direction. The gateway, if I may so term it, of this great Forth gorge, is in keeping with its grandeur, for, on the east, stands up boldly and fully from the plain, the western termination of Mount Oakley (whose range continues easterly for four or five miles, and forms the northern side of the basin), with its broken columnar greenstone formation, resembling, rather strikingly, our Cape Raoul; while on the west the fine proportions of Mount Pelion West, with a grand columnar greenstone capping, conical somewhat to the east, but resolving into a great wall facing north. Pelion West forms the western end of the great half-circular chain of mountains on which we were now standing, its eastern termination being a conical mount, with a sharp, natty, greenstone pinnacle top, called East Pelion, and between these two extremities of the chain are three finely-proportioned mountains, one on the west, called Mount Ossa, now named "Backhouse," after the great philantropist and scientist, and friend of J. B. Walker's father, after whom he named his son James, the remaining two being nameless. The Surveyor-General suggested this name as an association for the purpose of better identification of Mr. Walker. Here was a chance to perpetuate the memories of two of Tasmania's worthy sons, for what can be more graceful, and also sensible, than the keeping alive, topographically, the names of those who have nobly and unselfishly served their country? This form of nomenclature, in conjunction with native names ,is, I think, most desirable, and I cannot help again repeating what I have often said before, that it is a pity some authoritative system of nomenclature, undertaken by a recognised body, should not be established to deal with such important matters.

The two names chosen by us, and which have since been approved by the Surveyor-General, were Bonwick and Walker, men whose tastes and inclinations were so much alike, and whose sympathies and energies were always directed towards the advancement of the interests of Tasmania particularly, and also of Australia generally. Mr. James Bonwick still lives in London, and is well and kindly remembered by many here who have sat under him in past days as scholars, and whose works on Tasmanian history, relating particularly to the extinct native races, are valuable text books on that subject. Of the merits of Mr. James Backhouse Walker, so lately taken from amongst us, it is hardly necessary for me to remind you. I can safely and very feelingly say, that "he being dead yet speaketh." Not only are his valuable historical researches regarded as standards of our past, but the effects of his great activity in the cause of the higher education of this State bear testimony to-day to his ability and worth, with a freshness and power which appeals to us all.

Under Mount Oakley's eastern end is a long lake, about 1½ mile long, and rather narrow, called Lake Ayr, after, I presume, Mr. Bobbie Burns's "toon o' Ayr." From this lake, and also from a small though voluminous stream, "Bonwick's Rivulet," junctioning with the lake outfall ,the Forth River receives its primary impetus. The whole panorama was grand and fascinating, although the wind was bitterly cold, and from behind the kindly shelter of a great rock we drank it all in. Coming down from the higher levels of Bonwick, and turning towards its western trend, we visited one of the Pelion coal tunnels. The work done here represented a tunnel of over half a chain long, with heaps of coal lying at its entrance on either side Two seams. have been discovered, one 17in. in thickness, the other 26in. Considerable exploratory work has been done towards testing these deposits, three tunnels in all having been put in, and much trenching done. The results seem as yet to be only moderately valuable, analysis showing, according to the Assistant Government Geologist, a low quality of coal, with a value dependent on the success of the Barn Bluff mining field. The Launceston people seem to have a much better opinion of the coal, their analysis proving, they say, one sample to be a splendid steaming coal, and another sample was admirable for coking purposes. It is also alleged that the Pelion Copper Company used it at their forge, and considered it to be the best quality of coal in the colony. However, I think there can be no question as to the value of these great coal deposits, if the Barn Bluff country "pans out" well, timber all around being exceedingly scarce. Coming down towards the hut, and the weather still keeping fine, we crossed over the plain, northerly, towards Mount Oakley, where, on the high banks of the yet youthful Forth River, we come upon the Pelion Consolidated Copper Company's mineral show. There are four lodes uncovered on the property, and partly prospected. Those running from the north and south assay well for silver, and those east and west for gold, and all down the creek mineral indications are to be found in the country rock, a quartzite schist.

The company ceased work, I am told, after spending something approaching £1,200 on the property, on account of the utter isolation of its position precluding all possibility of getting their ore out. There are several tons of really good ore, bagged and at grass, awaiting means of transport. I heard that work was to be resumed as soon as the development of the field around is likely to secure a means of communicaion w th outside, and then their fine property must become of great value.

Towards evening the weather became again stormy and wet, and next morning (Sunday, April 7) it was as bad as ever, and we had to remain in the hut all day, Monday, 8th inst., broke fine with frost, so we made a start for Barn Bluff Camp, getting away from Pelion soon after 7 o'clock. From the "branch off" to the Pelion Huts, the track runs through a belt of forest ,clothing the southern bend of the Forth Gorge, and then sweeps round in a great bend, under the bases of Mounts Walker Ossa, and West Pelion, which tower up very grandly all round, and rising along the eastern side of West Pelion until the Forth Gorge is cleared, we turn sharply round north-westerly, and have a clear run in that fairection for eight miles or so, over button-rush plains and timber patches. Just as the track takes its north-westrly turn, it overlooks the Forth River Gorge, and it presents to us a scene of the wildest grandeur. Photography cannot convey anything like a corcorrect representation o fthe scene which I have not seen surpassed, in all my bush wanderings, for weird sublimity. Here it is that the whole of the drainage from the great Pelion Group, Lake Ayr, and the Oakley Range, form into one united stream, and pass on as the Forth River.

From here we can see the great formation of the Barn Bluff mine, the big knob, standing up finely on the west side of the gorge, not more than three or four miles distant as the crow flies, yet our windings make the distance eight miles, or more, before the camp is reached. The day turned out exceptionally fine, and we had ample opportunity to see the fine mountain scenery around, as we progressed. The Pelion Group, which we were leaving, looks very grand, the full proportions of the different members of the group becoming finely marked the further we kept to the north-west. Southerly just clear of West Pelion, the Eldon Range rolls out boldly in the distance, and coming further west, Murchison and Black, and other hills, which I did not recognise, all show up well, but too distant to photograph effectively. But the pictures are to the north-west, standing up with splendid effect, the two highest mountains in Tasmania, Barn Bluff and Cradle Mountain, According to Innes, Cradle Mountain is 5,085ft., and Barn Bluff 5,045ft. I was told that the name of "Cradle" originated from the shape of the mountain resembling a gold miner's cradle. Perhaps that is correct, although I cannot vouch for it. But concerning the christening of Barn Bluff I feel I can safely speak, and I do unhesitatingly denounce it as a vile slander on a noble mountain. No effort of the most fertile imagination can, in my opinion, resolve this mountain into anything approaching the resemblance of the most orthodox or unorthodox of barn of the past or present, and I would like so much to have a chance of giving it a really good name. (How would Beattie's Bluff do?!!!) After crossing a long stretch of plain, we enter rather broken country, leaving our north-westerly course, and coming round easterly, in the vicinity of Swallow's Camp. We find ourselves now in country bearing a melancholy interest, T. J. Connelly, the Rosebery resident, having recently perished in the snow somewhere in this vicinity, and the search parties were still actively engaged in searching for his remains. Coming down to Swallow's Camp, pitched above the shores of a lovely lake named "Windermere," we met one of the searchers, and from him we learned all of the pitiful details—few, certainly, but painfully significent — surrounding the disappearance of the poor man. It was sad to look back, only a couple of months when I met him in Rosebery looking well and cheerful, and romping with his two litle girls on the verandah of the hotel. Lake Windermere, just under Swallow's is a lovely lake, with an area of about 500 acres, and fringed with King William Pines, the shores making effective pictures, particularly with the bold head of Barn Bluff looking patronisingly over the rather steep north-western bank ofthe lake. We camped here for an hour, slung the billy and drank tea and scenery to our hearts' content. Swallow has a good mineral show, partly opened out here, and which is about to be thoroughly developed, and he has others in the vicinity. Now that we are within the Barn Bluff mineral field it may be of interest to briefly describe somewhat of its geological features. I will quote from Mr. Waller's recent report on the district, which I daresay many of my readers will not have teh opportunity of seeing:—"The country consists mainly of finely laminated schist. The whole country shows marked evidence of prolonged glacial action. Superficially it strongly resembles the Lake Dora district. The rock most frequently met with is a strongly foliated quartz schist. I think that quartz schist is a more appropriate name for the rock than quartzite, the name by which the rock is locally known, as it lays more emphasis on its schistose character. The rock occurs in long bare ridges all over the country, the intervening flats and hollows being covered with button-grass or scrub, or being occupied by small lakes. I think that it will be found that the softer schists are really in greater abundance than the quartz schist, but these being softer have been worn away by the erosive action of the glaciers, and, therefore, are now hidden from view beneath the button-grass and glacial debris of the low-lying ground.

Leaving Lake Windermere we rise over its western boundaries, and move across broken country, in a north-easterly direction, towards the Barn Bluff mining property, about three miles distant. Barn Bluff and Cradle Mountain are seen to advantage just above the dip down into the gully where the camp lies, but I had almost forgotten to mention passing another lake, lying in very fine bold surroundings midway between the camp and Lake Windermere. We called it Lake Andrews, after Mr. H. Andrews, who is the pioneer prospector of this part of the country. I was going to say Mr. Andrews' home was at Liena—he cerainly has a wife and family living there—but from what I saw and heard of him I should conclude his home was in the wild Pelion country, for there he is always to be found "badgering" about. He knows every "hole and corner" of it, and keeps a nice assortment of mineral shows "up his sleeve" for the convenience of any speculative traveller who may come along. May he "go in and win," I say, for he well deserves any success that may come to him! These two lakes — Windermere and Andrews—for beauty of form, are as nothing compared with the lovely lake situated just above the Barn Bluff property. About a mile in length, and broken up into beautiful bays and promontories, and magnificently backed by Cradle Mountain, it is a subject which I hardly think can be excelled in Tasmania for delightful composition. Possessing so much of the elements of the beautiful, and being nameless, our party unanimously decided to name it after one who possesses, we had always thought, in an eminent degree, elements of the beautiful of another and higher type, which we all so much admire and love. I refer to that benevolent, Christian gentleman, the Hon. Sir James Agnew. This lake, whose outflow junctions with the Forth River below, is to furnish the mining company with water-power to drive their machinery, and the enormous pressure obtainable, combined with the inexhaustible supply which the lake can furnish, will be an asset of incalculable value to the mine.

The Barn Bluff property, of which so much is heard now, is comprised of two 80-acre sections of a highly metalliferous character, the efforts of the proprietary, up to date, in their endeavour to determine the value and extent of their huge caperiferous outcrop, being represented by about 21 open cuts, or excavations, denoting a large expenditure of money and enterprise. Here are some assays from some of these excavations, obtained from our Government Analyst:—

No. 1 Face.—Copper, 4.5 per cent.; silver, 1oz. 17dwt. 16gr.; gold, trace.

No. 2 Face.—Copper, 9.5 per cent.; silver, 0oz. 19dwt. 19gr.

From across huge face.—Copper, 4.6 per cent.; silver, 2oz. 9dwt.

Assay by Mr. Stitt, of Zeehan.—Copper, 6.7 per cent.; silver, 14oz. 14dwt.

These assays will give some idea of the surface prospects. What depth will prove has yet to be decided, but indications point to greater values. Vigorous tests in the shape of tunnelling will soon be commenced, and the results will be awaited with much interest by a large section of the investing public. Mr. Murray, late Government Geologist of Victoria, who lately visited the property, makes some interesting remarks on its geological formation and probable value ,which, I think, is worth a brief quotation, coming, as it does, from such an authority. He says:—"A number of excavations show quartzitic schistose rocks, with a general east and west strike, highly impregnated with iron pyrites, and a considerable proportion of copper pyrites. It cannot be described as a lode, but as a great belt of schistose bands impregnated with ore, some rich, others poor, but, taken as a whole, I consider it to be a good, low to medium grade proposition. As to the downward extent of the great formation, the probabilities are that it extends as far as human skill can reach, and from a rough consideration of some 8 millions of tons of ore bearing rock in actual sight, 25 per cent. of which would prove payable, I should estimate the workable ore within 4 per cent. of copper, besides such gold and silver contents as may occur. Higher up the gully, above the Barn Bluff property, is another mine known as the North Barn Bluff. We did not visit it, but could see the workings, high up on the hillside, represented by a couple of tunnels, with the ubiquitous mullock heap at their entrance.

The Barn Bluff Camp is snugly situated in the timber by the Agnew Creek. We found it very comfortable, although at the time deserted, all the occupants being absent on their Easter holidays. Next morning (Easter Tuesday, April 8) found us on the move again, returning to Pelion, under, alas, the lamentable conditions of fog and mizzling rain. Fine weather here seems to be the exception, and as we crossed the open plains, where yesterday all around us Nature smiled in kindly welcome, not a vestige of surroundings could be seen; all was blotted out by mist and rain, and in many instances it was difficult to determine the run of the track, as it is not staked, and those who are not acquainted with the country have to be guided by the horse tracks, which are often easily missed. From the yawning valley of the Forth, up its great gullies and gaps, streamed the fog, wrapping up and soaking all Nature in its ghostly embrace, and as we filed along the plains, phantom-like through its envelopments, our situation was far from agreeable or comfortable. It was not until we got well on towards Pelion West that the sun began to break up the mist, and away to the south the mountains stood out bright and clear. Skirting the edge of the plain above the Forth Valley, the scene was grand in the extreme; the breaking mists, twisting, writhing, and swirling, from the great gulph beneath, looked like emanations from some gigantic witch cauldron, and we looked on in admiration. The Pelion Huts were soon reached, and preparations for the return journey home made by all but myself, I remaining to obtain the balance of photographs that time, and the weather had prevented me from securing. Wednesday, April 9, at 7 o'clock, Messrs. Hawson and Boxall left me, Mr. Lloyd having, I had forgotten to mention, gone home on Sunday. I did certainly have some misgivings at staying behind with such a lot of photographic baggage, in such a wild uncertain climate, and so far from outside help. Yet I felt I had not done my duty, and as the packer promised to return in a week's time, I thought it right to stay, and, of course, I had good company with Mr. Renison Bell. How I fared from the time I was left, until the day I was compelled to flee out of it, I have briefly indicated at the commencement of this article, and as I have already outrun the length of any decent paper I will fill in the time of my stay with brief extracts from my diary to reduce length as far as possible.

April 9.—Wind, S.W. Blowing and raining all day.

April 10:—Wind, S.W. Blowing and raining all day.

April 11:—Wind, west; cleared afternoon. Got photo. Mount Bonwick.

April 12:—Wind, west. Wet all day.

April 13:—Wind, changed to N.W., and cleared a little in the afternoon. Got photos in Forth Gorge.

April 14:—Fearful weather. Blowing living gale, with rain. Hailstorms during morning. Thunder about midday. Afternoon, snow. Rain at night.

April 15:—Rained and blew all night. Fearful weather all day. Wind, rain, and sleet.

April 16:—Fearful night of wind, snow, thunder, and lightning. Everything white. Snowed nearly all day.

April 17:—Snow about 8in. deep. Damp and misty.

April 18:—Turned frosty during night, and morning broke clear and bright. Cradle and Barn Bluff looked sublime, snow clad, with early sun streaming on them. Started off with camera to ascend East Pelion. Mr. Andrews assisted me,and we had a fearful struggle in the snow through the scrub, up the mountain side, and when we reached the top fog came down, and blotted all the landscape out. Came back to hut drenched and disgusted.

April 19:—Dull and threatening. Went with Andrews out to pine scrub, but weather turned wet from the west, and it rained heavily all day. Came back to the huts drenched.

April 20:—Dull, foggy, and showery. This is now the fifth day over the time packer promised to come for me. Decided to tramp in, and will start to-morrow.

April 21:—Quiet morning. Wind, S.E., looking fine. Started at 8.15 with H. Andrews for Berriedale Plains, 17 miles. Bid good-bye to friend Bell with a good deal of misgiving. He is all alone, and tucker none too plentiful, and no sign of the packer wit hhis fresh supply. Got to Berriedale, easy walk, at about 5 o'clock, and set to work to get in firewood for the night.

April 22:—Left Mark Shaw's at ten to 9, arriving Gad's Hill station at 11 o'clock. Went down old track into Liena, and camped an hour at Mr. C. Roden's, who kindly insisted on dinner. Weather, very bad, wind and rain in torrents. Got into Mole Creek, Mr. Howe's store at 4.15 p.m. tired, but glad I had escaped.

April 23:—Left by 6 a.m. train. Ran into Launceston, and came on to Hobart by afternoon express.

It only now remains for me, in conclusion, to say something regarding the prospects of this district as a whole, and the condition, both present and prospective, of the means of communication between it, Mole Creek, and also the West Coast. From those who are competent to give an opinion, those who have personally inspected and prospected the field, I find a general consensus of opinion most favourable to its future success as another addition to our copper producing centres. That, surely, is satisfactory; also we must not lose sight of the valuable coal deposits, already mentioned, which,in a country where timber is not abundant, and every year becoming scarcer, will form an invaluable substitute, and may, indeed, be largely utilised further afield. Another important factor in the future welfare of this field is the existence of splendid water facilities for the generation of power suitable for all mining operations. Such a field, so highly favoured by Nature, requires, to make it a success, a railway, and I suppose that will ultimately come, when results, which always speak louder than words and any amount of writing, demand it. At present, howevor, the means of communication is, to put it very mildly indeed, extremely unsatisfactory, and is deserving of the immediate attention of the Government. From Liena to the Barn Bluff copper mine, the distance by present track is 42 miles, while, taking it as the crow flies it cannot be more than 17 miles. Much of Gad's Hill is positively unsafe for pack and saddle horse traffic, and is really a menace, and shuld be immediately remedied. The track along the plains sadly wants attention in a great many places, a bit of corduroy here and there, and in exceptional boggy places, cutting out the turf altogether, and geting down to the solid gravel. Then I would strongly urge better staking of the plains, the stakes not to be so far apart. As it is at present this is a sad deficiency, and who knows but had this been properly arranged, as it most assuredly should be, poor Connelly would not have been lost, and without considering the irreparable loss sustained by the poor fellow's relatives, this State would have been saved much expense, and also alarm. Now let us glance at what Government propose doing towards the improvement of this route. It has been ascertained that the distance can be materially shortened, and this is to be accompanied by deviating in a south-westerly direction from Berriedale Plains to the Forth Valley, which will be gradually descended, making an easy grade, and ultimately reaching the high ground somewhere near the centre of the mineral area. Ths deviation, it is estimated, will effect a reduction in the distance of something like 15 miles, and will also avoid much of the high snowy country which occupies so much of the route of the present track. The West Coast outlet is the continuation of the Innes's Track, which we have already dealt with as far as Barn Bluff, and passing through Mount Farrell, terminates at the Emu Bay Railway at Pieman River, 36 miles further on.

One last word. I cannot close without expressing my heartiest thanks to those who so kindly assisted me during the trip. To my companions, Messrs. E. Hawson and Boxall, ever ready to lend a hand with the camera. To H. Andrews for his very kind help in this and other directions, and also to the Parson Brothers, the packers, so obliging at all times. Then last, but not least, to my friend G. Renison Bell, who, during my stay, did so much to make it comfortable and enjoyable. I shall not readily forget the yarns and songs, and best of all "soul chat" which we had during the evenings before that warm old fireplace of the Pelion Hut.

OCTOBER, 1901.

The monthly evening meeting was held on Monday, October 9th, His Lordship the Bishop of Tasmania (the Right Rev. Dr. Montgomery), vice-president, presiding.

PAPERS.

The following papers were read:—"Practicable Forestry in Tasmania and elsewhere," by Mr. A. Mault; "Note on Itacolumite, or flexible sandstone," by Professor E. G. Hogg, M.A.

NOVEMBER, 1901.

A meeting of the Royal Society of Tasmania was held on Tuesday evening, the 5th November, 1901, at the Museum, Argyle-street. Mr. T. Stephens, M.A., F.G.S., presided, and there was a large attendance of ladies and gentlemen.

Absent.

The Chairman said he was sorry they were deprived of the presence of His Excellency the Administrator of the Government (Sir John Dodds, K.C.M.G.), who was prevented from being present by serious illness in his family. His Excellency regretted his inability to be there to bid farewell to the Bishop of Tasmania.

Letters of apology for unavoidable absence were received from the Hon. Sir James Agnew, K.C.M.G., M.D., and the Very Rev. Dean Kite, and the Hon. N. J. Brown, M.E.C.

New Member.

Dr. Holden, Bellerive, was elected a Fellow of the Society.

The Bishop of Tasmania.

Mr. Alex. Morton, Secretary to the Society, read the following observations with reference to the connection with the Society of the Bishop of Tasmania, now about to leave for England, which had been forwarded by the Administrator of the Government: —

Fellows.—"The Right Rev. Dr. Montgomery, since his arrival in this State 12 years ago, has ever taken the deepest interest in all matters relating to the Royal Society of Tasmania. During these years, whether as an observant traveller in the more remote parts of the island, or as an enthusiastic contributor to the proceedings of the Royal Society, or again as a most valued helper as a councillor and vice-president, the Fellows of the Society owe him a debt of gratitude for the yeoman service, sympathy, and encouragement which he has ever been pleased to render to them. He has himself been an active worker in all matters of research which related to the early history of the State. With our late dear friend, Mr. James Backhouse Walker, he has contributed many valuable papers relating to the earlier explorations and explorers. He has also enriched our proceedings by valuable contributions to our knowledge on all matters touching the now extinct Tasmanian aborigines, and their half-caste descendants inhabiting the islands (Furneaux Group) of Bass Strait.

"As regards the half-castes, he has always taken the deepest interest in their well being, and in their industries, chiefly mutton-birding and fishing. As the Sooty Petrel, or 'mutton-bird' industry forms almost the sole means of support to these Tasmanian half-castes, it is not surprising that His Lordship should take more than usual interest in the natural history and general habits of this remarkable sea bird. In two of his papers read before the Royal Society he fascinated the members with his wonderful observing powers, and his vivid description of what he had witnessed during 'A night in a petrel rookery,' and also in his interesting 'Notes on the habits of the Cape Barren goose.' His Lordship's 'Notes on the mutton-bird industry' are by far the best and most complete that have yet been published.

"It is worthy of note that, owing largely to the representations made by His Lordship on the subject, certain islands have been reserved from use for the depasturing of cattle, a practice very destructive to the young birds; that the sale of eggs has been prohibited; and that adequate protection has been given to these birds, to seals, and to other members of the indigenous fauna of the islands in Bass Straits.

"It is also of interest to our Fellows to know that it is mainly owing to His Lordship that the Society possesses its special historical section. One of his best contributions to this section is his paper, 'A survey of two early journeys westward—Sharland's in 1832, and Sir John Franklin's in 1842.' But, perhaps, the Society owes most to him for his many valuable donations to its library and collections. Among these may be mentioned the very fine series of water-colour sketches from the brushes of Captain Stanley, R.N., and those of Lieut. Simpkinson de Wessellow, R.N. The latter are not only of the highest artistic merit, but as representing the scenery of Tasmania in the early thirties and forties, they now possess the greatest historical value. Besides the large and valuable collection of birds and other objects of interest, presented by His Lordship to our Museum, we have to thank Mrs. Montgomery and His Lordship for the magnificent and celebrated 'Milton Shield,' just presented by them to our National Art Gallery." (Applause.)

The Chairman then read the following address to the Bishop:—

"Dear Lord Bishop,—As members of the Council,and as representatives of the Fellows of the Royal Society, we desire to give expression to our feelings of regret at your approaching departure from among us. Of our personal esteem and regard for yourself you are well aware, but we may also testify to our appreciation of the services, which as a contributor to the Transactions, and as a promoter of early historical research you have rendered to the Society, and of the good offices to which we owe the acquisition of a unique and valuable series of artistic drawings commemorative of early colonial days. Though deeply sensible of the loss which must follow the severance of your direct and personal connection with the Royal Society, we are gratified to know that you are called to occupy a position of great importance and usefulness in the Mother-Country. Of the arduous character of the duties of that office it is not for us to speak; but we are well assured that they will be in entire consonance with your own aspirations, and we believe that their execution will be materially aided by the wide and varied experience gained during your episcopate in Tasmania. In bidding you farewell, we desire to associate Mrs. Montgomery with yourself in the good wishes which we now cordially offer." (Applause.)

The Chairman mentioned that the Council had nominated the Bishop of Tasmania as an honorary member of the Royal Society, and said he hoped they might count upon a continuance of his interest in the society. As an honorary member, he would take the place of the late Baron Von Mueller.

The election of the Bishop as honorary member was then agreed to. (Applause.)

The Bishop of Tasmania said that this was the last occasion of his appearance in public here. He felt deeply grateful to the Royal Society for their address. He was prouder of his membership and vice-presidency of the society than of any other secular office which he had held. It had been one of the traditions of the society that it had never been known that once a person was nominated for membership a black ball was put into the box. But there was one striking exception. He had never had a white ball given him. (Laughter.) When he was balloted for it was found that there was not a white ball in the box. (More laughter.) He was elected entirely in black balls. (Continued laughter.) He thanked the society very much, on his own behalf and Mrs. Montgomery's. They had tried to do their humble part in society during their stay in Tasmania. He had never had any scientific training, but he had a love of Nature and of birds, and his case ought to an encouragement to non-scientific people to join the society. In the future, he would have to carry on correspondence with every part of the world, and the training he had received in the Royal Society of Tasamnia would be of use to him. In obtaining treasures from distant lands, he owned first allegiance to his own society, but, in the second place, he would always remember Tasmania. (Applause.) The Bishop then read the following reply to the society's address:—Gentlemen, — I beg to offer you grateful thanks for your address to me. There is no body to which I have been so proud to belong in this land, as to the Royal Society of Tasmania. Indeed, it is an interesting fact that at a meeting at the Colonial Institution in London, just after my consecration in 1889, I referred to the Royal Society as one of the objects to which I ought to direct my attention. Ever since I came to Tasmania, it has been one of my greatest joys to take part in the meetings, and to work for our national collection in the Museum. I hold that all who have enjoyed the privileges of membership here, ought in some way to contribute to our treasures, either during their life-time or by bequest. So far as I have been able to do so, I have not forgotten this ideal. Nor is it anything but delight to obtain from others for the Museum those relics and treasures which are sure to be lost unless they find a home in a national collection. If in days to come, I can aid the Royal Society in any manner, I shall be eager to do so; and I beg to thank you for permitting me to become one of your honorary members. — I remain, gentlemen, yours sincerely, H. H. Tasmania. (Applause.)

Visit to British Columbia.

Mr. Alex. Morton gave an interesting and instructive account of his recent visit to British Columbia to obtain salmon ova for the Tasmanian Fisheries Commissioners, and exhibited lantern views of scenes in Honolulu, Victoria City, Vancouver, and other parts of British Columbia. He advised travellers from Australia to England to go by way of Canada, because they would hear nothing the whole way but the English language. He mentioned that Honolulu was the only place in the world where the English sovereign was below par. There, there were no barmaids, the hotels closed at 11 p.m. on week days, and were closed all day on Sundays. Education was compulsory, and among the Hawaiians there was not a man, woman, or child (of age to leave school), who could not read and write. There were five daily newspapers in Honolulu. Passengers going to the United States had to answer 21 questions put to them on board ship before they landed. He read these, which were of a very inquisitive kind, and sometimes very amusing. One of them was "are you a polygamist?" and he heard this put to a lady, who had just stated in answer to another question that she was "single." Some of the ladies were very indignant at the questions. Victoria City, the capital of British Columbia, was the first city to adopt the electric tramcar.

Mr. J. W. Beattie (for the Bishop of Tasmania) exhibited two lantern pictures — Barn Bluff and The Cradle; and Barn Bluff from The Cradle.

A cordial vote of thanks was passed to the authors of papers.

FORTY-EIGHTH ANNUAL REPORT.

The annual meeting of the Royal Society of Tasmania was held at the society's rooms on Monday evening, April 21st, Mr. R. M. Johnston, F.S.S., vice-president, presiding.

Corresponding Members.

The following gentlemen, who during the meeting of the Australasian Association for the Advancement of Science, were presidents of the several sections, were elected corresponding members of the society: — Messrs. T. A. Coghlan, F.S.S., Government Statistician of New South Wales; Professor A. Pollock, B.Sc., Sydney University; W. R. Greig-Smith, M.Sc., Macleay—Bacteriologist, Linnæan Society, Sydney; Professor Mica-Smith, B. Sc., School of Mines, Ballarat; Mr. T. S. Hall, M.A., University, Melbourne; Sir Thos. Fitzgerald, K.C.M.G., and Mr. Percy Oakden, A.R.I.B.A., Melbourne; Dr. W. E. Roth, Chief Protector of the Queensland Aborigines; Professor W. B. Benham, D.Sc., M.A., Otago Institute, Dunedin; and Professor Arnold-Wall, M.A., Canterbury Institute, Christchurch, New Zealand; R. W. Chapman, M.A., B.C.E., University, Adelaide.

New Fellows.

Messrs. Chas. Hudson (General Manager of the Tasmanian Railways), T. D. McEwan Kay, B.A., and J. E. Philip were elected Fellows of the Society.

Annual Report.

The Secretary (Mr. Alex. Morton) read the following annual report.—

The Council of the Royal Society have pleasure in submitting the following report for the year 1901, and regret that, owing to the sessions of the Association for the advancement of Science and the International Medical Congress, it was not found possible to have the annual meeting of this society earlier in the year.

Meetings.—There have been eight meetings during the session, all of which were of interest, particularly those in which the timber industry and forestry of Tasmania were discussed. At the first meeting, presided over by His Excellency Sir John Dodds, Administrator, a paper was read on "Timber Conservation" by Mr. W. Heyn, a timber expert, then on a visit to Tasmania, which introduced the subject, and was followed by a number of papers dealing with the general and important subject of the preservation of our natural woods, and the cultivation of forests, as a national work, by Messrs. L. Rodway, A. Mault, and A. O. Greene. Papers on "Geology" and "Mineralogy" were contributed during the session by Messrs. R. M. Johnston, Petterd, Twelvetrees, and Professor Hogg. A paper by Mr. J. W. Beattie "On a Trip to the Barn Bluff," illustrated by numerous lantern slides, was also read.

Publications. — Botany of Tasmania.—Mr. Leonard Rodway, now recognised as the leading authority on Tasmanian botany, has prepared a work on this subject, which is being printed by the Government, who, on the representation of this Council, placed a sum on the estimate which was passed by Parliament for the cost of printing this important scientific production. The volume will be largely illustrated, and is expected to be ready during the present year. It will be of immense advantage to students, and a stimulus to the study of this fascinating subject by those who lay no claims to the possession of expert knowledge.

Early Records of Tasmania.—The late Mr. James Backhouse Walker, who at the time of his death was a member of this Council, had at different periods contributed some valuable papers on the early history of Tasmania. The Council made a suggestion to the Government that these papers should be collected and published in one volume, and a sum having been passed by Parliament for this purpose, the book is now in the press, and will be issued during the present session. The preface to what may be looked upon as the memorial volume of the late Mr. Walker, has been written by the Rev. George Clarke, Chancellor of the Tasmanian University.

Papers. — Nineteen papers have been read during the session.

Library.—The society has received the usual number of scientific exchanges.

Obituary.—The society has during the past year sustained a serious loss in the death of three of its members. The Hon. C. H. Grant, who died in September, was a member of the society for many years, and always took a deep interest in its welfare. Dr. R. S. Bright, who died in October, was a regular attendant at the meetings of the Council, and did all in his power to promote its welfare. The Hon. Sir James Agnew, the oldest member of the society, passed away in November, at a ripe old age. He was elected in 1841, and always took a generous share in the work of the society. As it is the intention of our new President, His Excellency Sir Arthur Havelock, G.C.S.I., to refer to the work of Sir James Agnew at the opening meeting on April 29, it is unnecessary to anticipate what will then be said.

Resignation. — The resignation of His Lordship Dr. Montgomery, late Bishop of Tasmania, was regretfully received by the Council in October last, the step being rendered necessary by his departure from Tasmania. Dr. Montgomery was always ready to help on the work of the society, and it was through his Lordship that the society obtained the portfolios of Tasmanian and Victorian scenery, painted during the years 1845-7-8, by Lieut. Simpkinson-de-Wesselow, R.N. The folio of water colours painted by the late Captain Owen Stanley, R.N., were also obtained through His Lordship's kind interest. A farewell address was presented on behalf of the Fellows at the meeting on November 5, and His Lor'ship was unanimously elected an honorary member of the society.

Changes in the Council.—The following gentlemen have been elected to fill the vacancies in the Council caused by deaths and resignation:—Hon. G. H. Butler, M.R.C.S.E., M.L.C., Professor Neil Smith, M.A., Messrs. L. Rodway and A. Mault.

Fellows.—Seven fellows have been elected during the year.

Finance.—The income has been—Subscriptions and donations, £229 0s 3d; expenditure, £158 3s 10d.

Adoption of the Report.

The Chairman, in moving the adoption of the annual report, referred to the serious loss of three of the members to the Council by death, and the resignation of his Lordship the Bishop of Tasmania, the Right Rev. Dr. Montgomery. The Chairman also referred to the work on botany being brought out by Mr. Rodway.

ADDITIONS TO THE LIBRARY.

The Secretary stated that the Library of the Society had been enriched by the addition of forty-five scientific works. This collection had been left to the Society by the late Mr. C. H. Grant and had been recently forwarded to the Royal Society by Mrs. Grant. The following is a list of the books presented:—

Entomology.—Illustrations of British Entomology; or, a Synopsis of Indigenous Insects: Containing their generic and specific distinctions; with an account of their metamorphoses; times of appearance, localities, food and economy, as far as practicable. By James Francis Stephens, F.L.S. Embellished with coloured figures of the rarer and more interesting species. Mandibulata, Vol. 1 to Vol. 8, with supplement. London 1828 to 1846. Do., do., Haustellata, Vol. 1 to Vol. 4. London 1828 to 1834. An Introduction to Entomology, or Elements of the Natural History of insects, by Wm. Kirby, M.A., F.R., and L.S., and W. Spence, F.L.S., with coloured plates. Four volumes, Vol. 1 to Vol. 4. London, 1828. The Zoologist Synonymic List of British Butterflies and Moths, by Henry Doubleday. London 1859. The British Coleoptera Delineated. Consisting of figures of all the genera of British Beetles, drawn in outline, by W. Spray, M.E.S. London 1840. An Introduction to the Modern Classification of Insects; founded on the natural habits and corresponding organisation of different families, by J. O. Westwood, F.L.S. Vols. 1 and 2. Plates. London 1839-40. The Butterflies of Great Britain, with their transformations, delineated and described, by J. O. Westwood, F.L.S., Coloured plates. London 1855. Essay on the Indigenous Fossorial Hymenoptera; comprising a description of all the British species of burrowing sand wasps contained in the Metropolitan collections; with their habits as far as they have been observed, by W. E. Shuckard, M.E.S. Plates. London 1837.

Conchology. — The Linnean System of Conchology, describing the orders, genera and species of Shells, arranged into divisions and families, by John Mawe. Plates. London 1823. A Conchological Manual, by G. B. Sowerby, junr. Illustrated by upwards of 660 figures. (Second Edition). London 1842. General Conchology; or a description of Shells, arranged according to the Linnean system, and illustrated with plates, drawn and coloured from nature, by W. Wood. London 1815.

Infusoria.—A History of Infusoria, including the Desmidiaceæ and Diatomaceæ, British and foreign, by Andrew Pritchard, M.R.I. Illustrated by 40 plates. London 1861. A Synopsis of the British Diatomaceæ; with remarks on their structure, functions and distribution; and instructions for collecting and preserving specimens, by Rev. Wm. Smith, F.L.S. Plates by Tuffen West. London 1853-56. Vols. 1 and 2.

Reptiles.—A History of British Reptiles, by Thos. Bell, F.R.S., etc. Plates. London 1839.

Echinodermata.—A History of British Starfishes, and other animals of the class Echinodermata, by E. Forbes, M.W.S. Plates. London 1841. Iacobi Theodori Klein Naturalis dispositio Echinodermatum accesserunt Lucubratiuncula de aculeis Echinorum Marinorum et Spicilegium de Belemnitis, edita et descriptionibus novisque inventis et synonymis auctorum. Aucta a Nathanaele Godofredo Leske. Lipsiæ, 1778. Plates.

Natural History Works.—The Natural History of Animals, by Thos. Rymer Jones, F.R.S. Plates. Vols. 1 and 2. London 1845. The Ocean World, by Louis Figuier. Plates. London 1868. The World Before the Deluge, by Louis Figuier. Plates. London 1867.

Sponges.—A History of British Sponges and Lithophytes, by Geo. Johnstone, M.D., Coloured Plates. Edinburgh 1842.

Geology.—Journal of Researches into the Geology and Natural History of the various countries visited by H.M.S. Beagle, 1832 to 1836, by Chas. Darwin, M.A., F.R.S. London 1840. Geological Observations of the Volcanic Islands visited during the voyage of H.M.S. Beagle, 1832 to 1836, by Chas. Darwin, F.R.S. The Structure and Distributions of Coral Reefs, being the first part of the Geology of the voyage of the Beagle during the years 1832 to 1836, by Chas. Darwin, F.R.S. London 1842. Corals and Coral Islands, by James D. Dana, LL.D. Plates. New York 1872.

Ichthyology.—Natural History of British Fishes, their structure, economic uses, and capture by net and rod. Cultivation of Fish Ponds. Fish Suitable for Acclimatisation. Artificial breeding of salmon, by Frank Buckland. Plates. London 1880.

General Zoology.—Introduction to Zoology, by R. Patterson. Belfast 1846. A Cyclopœdia of the Natural Sciences, by Wm. Baird, M.D., F.L.S. Plates. London 1858

Botany. — Exercises de Botanique à L'usage des commencans ouvrage elementaire, orne de 77 planches. Paris 1806. A Manual of Botanic Terms, by M. C. Cooke. Plates.

Vote of Thanks.

It was unanimously agreed that a special vote of thanks be accorded to Mrs. C. H. Grant, for the valuable donation of the above works to the society's library.

Re-Election of Vice-Presidents.

The Hon. N. J. Brown, Colonel W. V. Legge and Messrs. R. M. Johnston, and L. Rodway, the retiring vice-presidents, were re-elected.

Revision of Rules.

The following members of the Council were appointed a sub-committee:—Messrs. Thos. Stephens, Bernard Shaw, Russell Young, and A. G. Webster, to revise the rules.

The New President.

The Chairman said it would be very gratifying to know that His Excellency Sir Arthur Havelock, as president of the Royal Society, intended to take interest in the work of the society. The members would all remember the very keen interest their late respected president, Sir Robert Hamilton, when Governor of Tasmania, took in the work of the society. His Excellency had kindly consented to preside at the opening meeting of the 1902 session, on Tuesday, the 29th April, and to deliver the presidential address. He felt sure there would be a large gathering of members on that occasion.

Vote of Thanks to the Press.

On the motion of Mr. Russell Young, seconded by Mr. R. E. McNaghten, a hearty vote of thanks was accorded to the press, for the very able manner in which the proceedings of the society had been published.

The meeting then closed.

TASMANIAN MUSEUM AND ART GALLERY EXTENSION.

FOUNDATION-STONE CEREMONY.

The laying of the corner-stone of the extension of the Tasmanian Museum was performed by His Excellency the Administrator, Sir John Dodds, on March 20th, 1901.

Among those present with Sir John Dodds were Lady Dodds and Miss Gatehouse, and Mr. Warren Dodds, private secretary; the Premier (Hon. Neil E. Lewis), and Mrs. Lewis; the Bishop of Tasmania; the Mayoress of Hobart (Mrs. J. G. Davies); the Minister for Lands (Hon. E. Mulcahy); the Hon. Adye Douglas (President of the Legislative Council and Mrs. Douglas; the Chief Secretary (the Hon. G. T. Collins); Hon. Dr. Butler, M.L.C., and Mrs. Butler; Messrs. W. B. Propsting, John Hamilton, W. H. T. Brown, J. W. Evans, Davenport Hoggins, Ms.H.A.; the Town Clerk of Hobart (Mr. J. W. C. Hamilton) and Mrs. Hamilton; Mr. Justice and Mrs. McIntyre; Mrs. R. C. Patterson; the Chancellor of the University (Rev. Geo. Clarke); Mr. T. Stephens, and the Registrar (Colonel T. Stephens), and the Registrar (Colonel Cruickshank); Captain Munro, of H.M.S. Dart; the chairman (Rev. G. W. Sharp) and members of the Ministers' Association, several aldermen of the city, and several members of the Royal Society. There was a large concourse of the general public.

The corner-stone is of freestone, from Brighton, and is placed at the north-east corner facing Macquarie-street. The architect is Mr. J. Shields, Director of Public Works, the contractor being Mr. Cheverton, and the overseer of works, on behalf of the Government, Mr. J. Maddison. In the corner-stone cavity were placed copies of "The Mercury," the "Tasmanian News," and two Launceston papers; a list of the trustees of the Museum and the Council of the Royal Society, as well as some statistical documents and coins. The building is to be completed by November. Its upper room will be used as a new art gallery, and the remainder for the display of Tasmanian articles.

The silver trowel used was designed and manufactured by Mr. A. Butterfield, of Elizabeth-street, and inscribed—"Presented to His Excellency, the Administrator, Sir John Stokell Dodds, on the occasion of his laying the corner-stone of the new wing of the Tasmanian Museum and Art Gallery. Hobart, March 20, 1901." The inscription on the corner-stone is—"This stone was laid by His Excellency the Administrator, Sir John Dodds, C.M.G., on the 20th March, 1901."

His Excellency, in commencing the proceedings, said:—"Ladies and gentlemen, —Before proceeding to the very important duty of laying the corner-stone of the new wing of the Museum and Art Gallery, I propose to trace very shortly the formation and growth of the institution itself. It is the offspring of the society formed by Sir John Franklin in 1841, and which a few years later became the Royal Society of Tasmania. The meetings of the society in those days were held at old Government House, which stood near the site of the present Townhall. In the year 1846 the Council of the society, who had previously established the Botanical Gardens, decided to begin the collection of specimens of natural history for a museum. A room in the Legislative Council Chambers was obtained, and for some years that room constituted the Museum of Tasmania. In 1849 the Government, recognising the importance and value to the community of the growing institution, granted an annual sum towards its support, and the Royal Society then obtained more accommodation by removing to the building at the corner of Harrington and Macquarie streets, now occupied by the Athenæum Club. In course of time this building became overcrowded, and the Government, on being applied to, agreed to grant a site and to erect a suitable building for the preservation of the rapidly increasing collection of specimens, conditionally on the Royal Society contributing the sum of £1,500. Dr. Milligan, who was then Curator of the Museum, set to work to raise the money, and very soon he succeeded in collecting nearly £2,000 from the Fellows of the Society. This public-spirited action of the Fellows deserves the highest commendation. It was an unselfish and splendid effort on their part to provide a treasure house for the educational advantage of all who now or hereafter may desire to become acquainted with the scientific history of these southern lands. In 1862 the first portion of the new building, that which stands at the angle of Macquarie and Argyle streets, was completed. In 1883 it became necessary to appoint a new curator and secretary, and an excellent and very energetic officer was obtained in the person of Mr. Morton, then assistant curator of the Australian Museum at Sydney. To his exertions is due much of the success achieved by the Tasmanian institution. (Applause.) In 1885 another advance was made. Up to this date the Museum belonged to, and had been maintained principally by, the Royal Society, but it was felt that the time had arrived when it should become a national institution. Parliament passed an Act vesting the Museum in trustees for the public, and granted an annual endowment, and also a sum of £3,000 for an extension of the building. I had the privilege of bringing in that Act, and carrying it through the House of Assembly. The corner-stone of the extension was laid by Sir James Agnew in December, 1886, and the new building was opened for use by that good friend to Tasmania, Sir Robert Hamilton, in 1888. It gave greater and much-needed accommodation for the specimens belonging to the Museum, and also provided a room in which to begin the formation of a National Art Gallery. The first presentation of valuable pictures to this gallery was made by Miss Ada Wilson, and since then this lady and her sister, Miss Wilson, have presented other beautiful and costly works, which have been most highly appreciated. (Warm applause.) In passing, I may mention also that many other generous donors have presented pictures which delight all lovers of art who visit the gallery. And now I come to the present extension of the building, the corner-stone of which will be laid to-day. Its frontage will be on Macquarie-street, as you see, and it will provide a new Art Gallery of 100ft. long, and also another room of equal size, which is to be used for the exhibition of Tasmanian specimens only. At the back there will be another room of 60ft. long, which will became a bureau of information, and in which will be exhibited trophies of Tasmanian industries. When this extension is completed the Museum and Art Gallery will be a handsome addition to the public buildings of Hobart, and a monument to the perseverance of those who have so ungrudgingly laboured among us to promote scientific research and the study of nature. In this respect Tasmania justly can claim a proud place among the Australian States. Our Royal Society is the oldest Royal Society in these portions of the Empire. Her late Majesty, Queen Victoria, was its patron, and honoured it by the presentation of autographic copies of her own works. It has in no small degree contributed to the scientific knowledge of what has been called the "Land of the Dawning." On its roll of members there have been entered many famous names, Sir John Franklin, Sturt, Leichhardt, Sir Thomas Mitchell, Ross, Crozier, Gould, Sir Joseph Hooker, Strzelecki, and many others. Most of these have passed away, but there are left to us still others who are carrying on the work with untiring devotion. It is invidious to particularise, but I cannot forbear to mention Mr. R. M. Johnston and Mr. Thos. Stephens, as men whose work is conspicuous in quality and volume. And there is yet another whose association with the Royal Society is so complete, and whose services to it have been so great, that he stands out pre-eminently. I refer to Sir James Agnew. He has been a member of the society from the beginning in 1841, and during all the 60 years which have elapsed since he has taken the keenest active interest in its work, and often has given lavishly of his wealth to aid the society in promoting the intellectual culture of the community. (Applause.) We owe much to the Royal Society. It has obtained for us by the subscriptions and exertions of its members the Botanical Gardens, the Museum and the Art Gallery, and it has stimulated and encouraged a love of art, the pursuit of scientific knowledge, and a desire for a better understanding of the wondrous works of nature. I will now lay the corner-stone of the building, which, I think, is the first public one commenced in Tasmania since the accession of His Majesty, King Edward the VII." (Applause.)

The Chief Secretary (Hon. G. T. Collins) then handed His Excellency the silver trowel, with which he spread the mortar for the reception of the memorial stone. The stone was then lowered, and having given it the customary taps with the polished mallet, Sir John said:—"I have tested the laying of this stone with the level, and pronounce it to be well and truly laid. (Applause.) In the old country it is customary on occasions of this kind that a prayer should be offered in connection with the ceremony, though I am aware that it is a new feature in connection with such proceedings in Tasmania; but still, it is a good old custom, and a beautiful and simple prayer has been handed to me, with a request that I should read it, which I now do:—

"O God, who by Thy power hast laid the foundations of the earth, and caused Thy spirit to brood upon the face of the waters, regard with Thy favour the increase of this building, set apart for the furtherance of Thy glorious works. Guide, we beseech Thee, the students of truth, for whom we have prepared this house, that they may abundantly reveal the treasures of Thy creation, and help them so to labour that all things that Thou hast made may, with one voice, proclaim thy power and glory: enable us by their aid so to read what thou hast written in the books of nature, that we may adore Thy wisdom, and trace Thy gracious Providence in all the works of Thy hands. Grant this, we beseech Thee, O Heavenly Father, in the name of Jesus Christ, Thy Son, our Lord. Amen."

The Bishop of Tasmania then presented an address, beautifully illuminated, as follows:—"We the Council of the Royal Society of Tasmania, desire to take this opportunity to offer Your Excellency our warmest congratulations on the circumstance that you have attained for the second time, and have held for lengthened periods, the high position of Administrator of the Government. And we cordially recognise the fact that the various duties connected with this high office, when under your rule, have invariably been discharged with a courtesy, ability, and practical interest in both social and State affairs, which have not failed to secure the entire satisfaction of the community." The Bishop of Tasmania added:—"It is with regret, from one point of view, that I find myself the actual reader of this address. The honour of presenting it belongs, of unquestionable right, to our beloved senior vice-president, Sir James Agnew, a man full of days and honours, whose riches have for years been lavished upon public objects, and notably upon the Museum and the Art Gallery. (Applause.) No living man has done so much for us as Sir James. He is also one of the two survivors of the first members of the Royal Society when formed in April, 1841. The other is Sir Joseph Hooker. The society unanimously wishes that the most tenderly revered man in Tasmania were strong enough to witness this scene, which would give him such unfeigned pleasure. Nor is it right for the society to omit the mention on this occasion of the secretary of the Museum, to whom is due to a very great extent this new development. Ministers could not well have proposed the grant that Parliament has made, had they not been sure that the Museum held a high place in the estimation of the public as an institution which has attempted in every possible way to interest all classes here, and to sustain the reputation of Tasmania in scientific circles. This is due in a great measure to the work of Mr. Morton for 17 years. It only remains for me now, Your Excellency, to assure the public that the Royal Society feel confident that they, coupled with the unremitting exertions of Mr. Morton, will be able to make such arrangements for the forthcoming meeting of the Australasian Science Association in Hobart, in January next, that Hobart may more than support its reputation as a place where all great meetings of such a character are both pleasant and pre-eminently successful. Of course the work that falls upon the secretary, and upon the absurdly small staff at his disposal, is very heavy, and the society feels that the salary attached to the office of secretary at present is wholly inadequate for the work that has to be done. They would be glad if some means could be devised whereby a more adequate remuneration could be made, especially in face of the increased work that must follow upon so great a development of this building. (Applause.) We look forward with keen interest to the growth of science and the spread of art among our people in this new century, and pledge ourselves to do all in our power to enable Tasmania to take her full share in such progress. (Applause.)

Mr. R. M. Johnston, on behalf of the trustees of the Tasmanian Museum and Art Gallery, presented a handsomely-illuminated address, which said:—"We desire to give you our best thanks for the able manner in which you have conducted the auspicious ceremony we have just witnessed. It is a proof of the good work done by the Museum that its enlargement has become, for a second time, necessary; not only for the proper display of objects already in its possession, but for the exhibition of a great series of most valuable and interesting specimens indicative of the mineral wealth of Tasmania, which have been promised. It is almost needless to say that by increased facilities for display, the present scientific arrangements will be more effectually carried out, and will thus afford still better means than hitherto for educational study. We also desire to take this opportunity to offer Your Excellency our warmest congratulations on the circumstance that you have attained for the second time the high position of Administrator of the Government."

Mr. Alexander Morton presented an engrossed address of the members of the Microscopical Club of Launceston.

The Town Clerk (Mr. J. W. C. Hamilton) presented addresses on behalf of the Mayors and Corporations of Hobart and Launceston, the Town Board of Zeehan, Town Board of Devonport, and the Municipal Council of Brighton.

Mr. W. J. Watchorn, on behalf of the Marine Board of Hobart; Mr. Bernard Shaw, P.M., for the Civil Service; Mr. T. B. Blyth (Sergeant-at-Arms), for the Glamorgan Municipal Council; the District President (Bro. G. L. Swift), accompanied by the District Grand President Bro. G. E. Mills), for the Druids of Southern Tasmania; and Mr. G. S. Crouch, on behalf of the Y.M.C.A. and the Temperance Alliance, respectively, presented addresses, also Mr. Wilfrid Hudspeth, B.A., for the A.N.A.

The Bishop of Tasmania presented a handsomely illuminated address as follows:—"We, the Bishop, clergy, and laity of the Church of England in Tasmania, as represented by the Diocesan Council, desire with all respect to congratulate Your Excellency upon the position you have been called to occupy as the first Administrator of the State of Tasmania. You have represented the power and nobility of the great Queen, sir, in the last days of her glorious reign, and of King Edward also in the opening of an era which we hope and pray will be a fitting sequel to the Victorian age in a new century. This land once changed its name in the process of constitutional development, and in your term of office it has now transformed itself into a State, as part of what we fain would believe is destined to be the future Empire of the South Pacific. Whilst we rejoice in such expanding liberty, we note, at the same time, with deep satisfaction, an universal conviction that the truest freedom needs the most strenuous leadership. Just as we desire no timid Sovereign on the throne of England, so also we look forward with confidence to a long line of His Majesty's representatives among us to teach us that high authority implies deep responsibility, and results in courageous action. It is because we believe that, both in your office as Chief Justice and as the representative of His Majesty the King, you, sir, have taught us these principles, we respectfully and joyfully approach you to-day with our felicitations, praying that God may endow you with foresighted vision and just judgment, to preside over the destiny of our infant State, and we assure you of the continued and fervent loyalty of all the members of the English Church to the Throne of England, and to the Empire of that Greater Britain, the growth of which we follow with earnest attention, and of which we hope to be worthy members by the good hand of God upon us."

Revs. G. W. Sharp (president of the Council of Churches), and H. B. Barber (secretary) also presented an address.

His Excellency, in replying, said he recognised that they had paid a splendid tribute to His Majesty's representative, and that, combined with that spirit of loyalty, there was also a feeling of friendship towards himself. (Warm applause.) The support and encouragement that he had ever received from the people among whom he had spent his life, had been the means of producing all the efforts that they had been good enough to say had been worthy of their commendation. He would have but poorly filled his high office without such support and assistance. He regarded it as the highest honour of his life; it was a tribute so splendid that it was very rarely received even by the most distinguished. He again thanked them, and added that upon his return from the West Coast he would take the opportunity of replying individually to the addresses that had been so kindly presented to him. (Applause.)

The proceedings then terminated.

After the ceremony some two hundred visitors accepted Lady Dodds's invitation to afternoon tea in the Royal Society's and Tourist Rooms.

Mr. A. G. Webster, in proposing the health of Sir John Dodds, said he felt sure that the Museum would secure the support of the public and of Parliament.

Sir John, in reply, said he felt sure it would become an important factor in the life of the community, and of great educational value. He proposed the health of "The Premier and Parliament."

The Premier responded, and the Minister for Lands expressed the hope that the building would be completed to contract time.

ON SOME LAND AND AQUATIC SHELLS FROM MARIA ISLAND.

By W. F. Petterd.

I herewith submit a list of the species of land and fresh water testacea which were recently collected on Maria Island, East Coast. It includes several which have but a restricted distribution on the adjacent mainland, and the somewhat remarkable association of species is of more than passing interest, although the majority are such as are to be found widely dispersed. The appearance at this insular locality of the local Helix sinclairi is quite unexpected, and H. lottah and H. nelsonensis have strayed far away from their originally recorded habitats.

The almost microscopic H. halli is not usually an abundant species, but here it appears in considerable quantity, and is in fact the most common of the smaller forms. There are also several specimens of a new species with little affinity to any already known. Of the two species of aquatic shells, one is quite a new departure in the Ancylus, not only as regards our local molluscan fauna, but as well as relates to the genus generally.

Its unique characteristic is the widely-spreading margin of the aperture, a peculiarity not to be found in any of the numerous species of the genus. This remarkable departure from the normal condition, in a genus which affords but limited variation in general structural peculiarities, is difficult to adequately account for, but it would appear to afford a stronger attachment, and may thus resist disturbance in a swiftly flowing stream.

Description of New Species.

1. *Ancylus mariæ*, n. sp.

Shell small, thin horn-brown colour, broadly irregularly ovate, concentrically striate, with well marked lines of growth. Aperture extremely large, the margins broadly, prominently, and flatly expanded, thus forming an irregular base of attachment. Apex prominent, obtuse, oblique, and submarginal.

Long., 5; lat., $3\frac{1}{2}$; alt., $2\frac{1}{2}$ mill.

Habitat: Maria Island, East Coast, attached to submerged stones and aquatic plants in a small running stream.

This is a very peculiar form of a genus which has several representatives on the mainland. In its young state it has much the general appearance of A. tasmanicus, Tenison

Woods, but maturer examples have a constant and unique flat expansion of the aperture, which thus forms a firm base of attachment, and by this character it is separated from all known congeners.

So far as known, it is restricted to the insular locality mentioned. It is apparently abundant, and was the only species collected on the island.

2. *Helix discors*, n. sp.

Shell minute, openly umbilicated, depressed lenticular, of a pale brown colour, finely striated throughout with distant, prominent, oblique riblets, whorls 4, convex above, obtusely carinated at the periphery; aperture roundly lunate, margins approximating.

Diam., greatest, 2; height, $1\frac{1}{2}$ mill.

Habitat: Maria Island, under and attached to stones.

This new species is about the size of Helix hobarti, Cox., but differs much in both form and sculpture. Its decided lenticular build, and, for so small a shell, prominent riblets, quite separates it from the large number of minute species of the genus which have been described.

LIST OF SPECIES COLLECTED.

Aquatic Species.

1. Potamopyrgus simsoniana. Brazier variety.
2. Ancylus mariæ, n. sp.

Land Species.

1 Bulimus dufresnii. Leach. Abundant, but not large.
2. Bulimus gunnii. Pfr. Very plentiful in favourable localities.
3. Vitrina verreauxi. Pfr. Abundant.
4. Helix sinclairi. Pfr. Rare; of the usual type.
5. ,, ruga. Cox.
6. ,, legrandi. Cox.
7. ,, diemenensis. Cox.
8. ,, halli. Cox.
9. ,, nelsonensis. Cox.
10. ,, juliformis. Cox.
11. ,, hobarti. Cox.
12. ,, lottah. Mihi.
13. ,, discors, n. sp.

NOTE ON *HIPPOMEDON KERGUELENI*, MIERS, AN AMPHIPOD RECEIVED FROM CAPE ADARE, SOUTH VICTORIA LAND.

By Geo. M. Thomson, F.L.S., Corresponding Member of Royal Society of Tasmania.

In June of this year I received from Mr. A. Morton several specimens of an Amphipod crustacean secured by the "Southern Cross" expedition at Cape Adare, South Victoria Land They had been obtained by letting down a baited net through a hole in the ice, but there is no information as to the depth from which they were got.

The specimens, which are all females, belong to *Hippomedon kergueleni*, originally referred by Miers to *Lysianassa* (Ann. and Mag. Nat. Hist., vol. xvi., p. 74), and then to *Anonyx* (Trans. of Venus Exped., Zoology of Kerguelen Island, Crustacea, pp. 8 and 9, pl. xi., fig. 4), but more recently shown by Stebbing to belong to Boeck's genus *Hippomedon*. The Rev. T. R. R. Stebbing (Amphipoda of H.M.S. "Challenger," p. 623, pl. viii.) has drawn up a description of this species with that care and minuteness of detail which characterises his work. The specimens received by me differ only in trifling details from his description, but conform more closely to that given by Miers.

The genus is now credited with five northern and four southern species, but of these, two of Stebbing's Kerguelen Island species aad one Australian are founded on single specimens, and the former two may yet have to be merged into *H. kergueleni*.

TASMANIAN DIATOMACEÆ.

By F. E. Burbury.

The swiftly flowing South Esk River, confined to its narrow bed, in which numerous rock pools have been worn, the North Esk, a placid stream, subject to tidal influence for some miles; and the Tamar River, formed by the junction of these two, with a 40-miles course to the sea, and a gradually increasing salinity, offer a specially favourable habitat for various genera and species of the Diatomacæ, and it is interesting to note the distribution of the genera—in some cases indifferent to most severe changes in conditious, in others susceptible to the slightest influences. Thus Actinocyclus Barkleyi I have found at the First Basin, a mile above the bridge, in fresh water, in company with Synedra splendens and Nitzchia rigida and Nitzchia viridis. The Actinocyclus is brought down into the slightly brackish water of the Tamar basin, continues to thrive right down the Tamar, is found again at George Town, and probably on all coasts of Tasmania, as I have gatherings of it again from Hobart. Not so, however, the synedras and nitzchias. Nitzchia rigida at once gives place to varct. sigma and it. sigma amphioxys, the slight, and it must be very slight, amount of salt suffices to bar the one species and aid the other. The diatoms found in the purely fresh water of the South Esk are those of a cosmopolitan character, being probably all world-wide. In the North Esk, at that point where the tidal influence ceases, two interesting forms are met with—Eunotia transylvanica and a new Suirella of large size, only heretofore met with in the bed of the Yarra River. Coming down towards the wharves we find Hyalosira Whampoensis, syn. with Triceratium javanicum, an extremely interesting form. It is one of the three known species belonging to the genera, and which usually inhabit tropical seas. It is of interest to find it so far south. Some years ago this form was found, and sent home to Kitton by Mr. W. F. Petterd, and at this time was unknown except in Java. It has, however, been since found in a fossil state in Hungary. On the river flats by the Depôt grounds are found some fine specimens of the genera Suirella, viz., Suirella splendida, Suirella robusta and spiralis, with a newer species, rather rare, which also has been only heretofore located in the Yarra. Here also the genera Coxinodixus is represented by Eupodiscus commutatus. Some beautiful Camplydiscus—Camplydixus echeneis and daemelianus, and an occasional valve of Triceratium Robertsianum will reward

ERRATA.

Coxinodixus read Coscinodiscus.

Mastogloia read maxima.

Naricula read Navicula.

Plagiegramena read Plagiogramma.

Van Heuxtkia read Van heurckia.

Omit Xanthiopyxis umbonatus.

*The numbers in the following list refer to Van Heurck's Treatise on the Diatomaceæ, 1896 edition.

the collector. Lower down the Tamar, in the ti-tree swamp, a remarkable form is met with in Nitzchia clevei, a form which would seem to be almost unknown to the Old World. It can hardly be missed, its great length being in striking contrast to other species. Here also I have located Van Heuxtzia vulgare and a beautiful Stauroptera. At George Town and the Heads no less than 37 species are found, and these by necessary imperfect gatherings. The most striking frustules are those of Rhabdonema Adriaticum, which are very plentiful. Pleurosigmas decorum, formosum, latum, and strigalis, and a more or less rare and unknown variety are also found in company with Triceratium fimbriatum and a very large and very rare valve of Mastogloia species. Closely allied in their general forms are those gathered at Cornelian Bay, Hobart, the same Mastogloia being located, as also Eunotia transylvanica, the latter of which, however, I am unable to find in my George Town gatherings. I have also found some fourteen varieties at Prospect in an intermittent spring of hard water. These call for no special comment, except that, speaking broadly, they tend to ally themselves more to the marine forms than to those usually found in fresh water gatherings. Photo-micrographs of the more important and interesting forms have been taken. In conclusion, may I solicit the aid of members of the Society in this work. Green or yellow confervæ scraped from piles of wharves or floating buoys, or from stones, etc., at low tide contain many forms, and need only be sent on to me in a rough state.

Tasmanian Diatomaceæ.

Actinocyclus Barkleyi. 522. Grun. Inveresk, N. Esk, Hobart, Depot, Ti-tree.

Achnanthes salina. Kütz. N. Esk, Depot.

Achnanthes longipes. 279. Agvar. Hobart.

Achnanthes exilis. 282. Kütz. Prospect.

Achnanthes pusilla. Grun. George Town, Low Head. Rare.

Achnanthidium lanceolatum. 276. Bréb. Hobler's, N. Esk.

Amphora acutinscula. 134. Kütz. George Town. Uncommon.

Amphora marina. 129. Wm. S. Low Head. Uncommon.

Amphiphora lepidoptera. 263. Greg. Low Head. Rare.

Actinoptcychus splendens. Ralfs. N. Esk.

Auliscus sculptus. 482. Ralfs. Hobart.

Coxinodixus excentricus. 531. Ehr. Depot Grounds.

Coxinodiscus concinnus. Depot Grounds.

Camplylodiscus daemelians. Grun. Depot Grounds.

Camplylodiscus echeneis. 377. Ehr var. Depot Grounds.

Cerataulus sp. Hobart.

Cerataulus sp. George Town. Very rare.

Cymbella gasteroides. 146. Kütz. Hobart, N. Esk.

Cymbella cymbiformis. 147. Ehr var. Prospect.

Cymbella sp. Hobler's, N. Esk. Rare.

Cocconeis placentulata. Ehr. Hobart, Prospect.

Cocconeis scuttellum. 287. Ehr. Hobart, Low Head.

Cocconeis grevillei. Wm. S. George Town.

Cocconeis pseudomarginata. Greg. Low Head. Rare.

Cocconeis regalis. Wm. S. Low Head.

Cocconeis lineolata. Ehr. Prospect, Hobler's Bridge.

Cyclotella compta. 446. Kütz. Hobler's Bridge.

Cyclotella sp. N. Esk. Rare.

Cocconema cistula, var, minor. Hempr. Prospect.

Cocconema parva. Wm. S. Hobler's Bridge.

Eupodiscus commutatus. Grun. N. Esk. Depot.

Epithemia gibba. 296. Kütz. S. Esk. Depot Grounds.

Epithemia sorex, var. Turgida. 295. Kütz. Hobart.

Eunotia pectinalis and undulatus. 300. Raben. Hobart.

Eunotia transylvanica. Pant. Hobart. Very rare.

Encyonema gracile, var. minor. 151. Raben. N. Esk, George Town.

Encyonema turgidum. 150. Grun. Hobler's Bridge.

Gomphonema vibrio. 273. Ehr. Hobart, Prospect.

Gomphonema bacillum. Cleve. Prospect.

Grammatophora marina. Grun. George Town.

Grammatophora subtillissima. Bail. Low Head.

Hyalodiscus maximus. Eulst. Depot Grounds.

Hydrosira whamphoensis. Swartz. 453. Syn. Tricaratium Javanian. N. Esk, Ti-tree, Depot. Rare.

Melosira distans. Wm. S. Oatlands.

Melosira borrerii. Grer. Inveresk, Depot, Hobart. Low Head.

Mastogloia sp. Hobart.

Mastogloia grevilli. 155. Wm. S. Hobler's Bridge.

Mastogloia sp. Low Head. Very large; very rare.

Nitzchia sigma. 396. Wm. S. N. Esk.

Nitzchia sigma, var. amphioxys. Grun. S. Esk, Prospect, Ti-tree

Nitzchia rigida. 396. Grun. Cataract Gorge. Rare.

Nitzchia fasciculata. 397. Ehr. Prospect.

Nitzchia clevei. Brun. Ti-tree, N. Esk.

Nitzchia sigmatella. 397. George Town.

Naricula viridis. 165. Kütz. Cataract Gorge.

Naricula sp. Ti-tree, Tamar River.

Naricula liber. 222. Wm. S. Hobler's Bridge.

Naricula Smithii. 187. Breb. Tamar River, Low Head.

Naricula distans. 185. Wm. S. George Town. Rare.

Naricula splendida. Greg. George Town. Rare.

Naricula Braziliensis. Grun. Low Head. Very rare.

Podosira maxima. Kütz. N. Esk.

Pinnularia Brebissoni. Kütz. Prospect.

Pleurosigma strigosum. Depot Grounds.

Pleurosigma decorum. 254. Wm. S. George Town.

Pleurosigma var. George Town. Rare.

Pleurosigma formosum. 254. Wm. S. Low Head.

Pleurosigma latum. Grun. George Town.

Plagiogramena Gregoryanum. 337. Grev. George Town.

Rhabdonema adriaticum. 360. Kütz. Low Head.

Suirella minuta. 373. Breb. North Esk.

Suirella fastuosa. 372. Ehr. Hobart. Very rare.

Suirella splendida. 371. Kütz. Hobler's Bridge.

Suirella sp. (large, same as in Yarra), new. Rare.

Suirella robusta. 371. Ehr. N. Esk.

Synedra splendens. 309. Kütz. N. Esk, Ti-tree.

Synedra ulna. 310. Ehr. Depot Grounds.

Synedra longa. Wm. S. Prospect.

Synedra pulchella. Kütz. Hobler's Bridge.

Synedra Gallionii. Ehr. George Town.

Stephanopyxis sp. Cataract Gorge.

Stauroneis acuta. 160. Wm. S. Prospect.

Stauroneis phoenicenteron. Ehr. Prospect.

Stauroptera sp. Ti-tree, Tamar River.

Stauroptera aspera. Kütz. George Town.

Tabellaria ventricosa. 356. Kütz. Cataract Gorge.

Tryblionella maxima. 355. Grun. Hobler's Bridge.

Triceratium Robertsianum. Grev. Depot Grounds.

Triceratium fimbriatum. Wall. George Town. Rare.

Van Heuxtkia vulgare. 239. Prospect, Ti-tree.

Xanthiopyxis umbonatus. Wharf.

OBSERVATIONS REGARDING THE RECENT DISCOVERY BY G. THUREAU, F.G.S., OF A FOSSIL REPTILE IN THE MERSEY COAL MEASURES AT RAILTON.

By R. M. Johnston, F.S.S.

Mr. G. Thureau, formerly Government Geologist of Tasmania, has kindly submitted to me a carefully prepared cast of the remains of a fossil reptile discovered by him in the spoil-heap from a (then) new main shaft sunk by a Sydney company near Railton, in the Mersey Coal Measures, and, therefore, of Upper Permo-Carboniferous age. The original was placed by Mr. Thureau in the hands of the late Professor M'Coy for identification; but the regrettable death of the Professor soon after prevented this investigation, and Mr. Thureau is now anxious to make known his important discovery to the Members of this Society; because—as Mr. Thureau thoughtfully observes—the possession of this interesting fossil from our rocks—now in the Melbourne Museum—"rightly belongs to Tasmania."

The cast referred to—now submitted for the inspection of the Members of this Society—represents portion of the central and caudal vertebræ of the reptile, with the simple gently-curved ribs of the central part perfectly connected. The central or pre-sacral vertebra number 13 or 14, with a length of three inches, and greatest breadth one and a half inches; vertebra of the tail thicker, more pronounced, four to five in a length of nearly one inch.

The absence of the head, limbs, and caudal extremity, and the absence of definite knowledge regarding the articulation, form, &c., of the vertebræ, make it impossible to do more than assign its position to the great family of Labyrinthodonts, whose range in Europe is generally determined as from the Carboniferous to the Trias, and are especially abundant in the Permian. It is stated by

Nicholson and Lydekker that only one genus (*Rhinosaurus*) persisted to the Lower Jurassic.

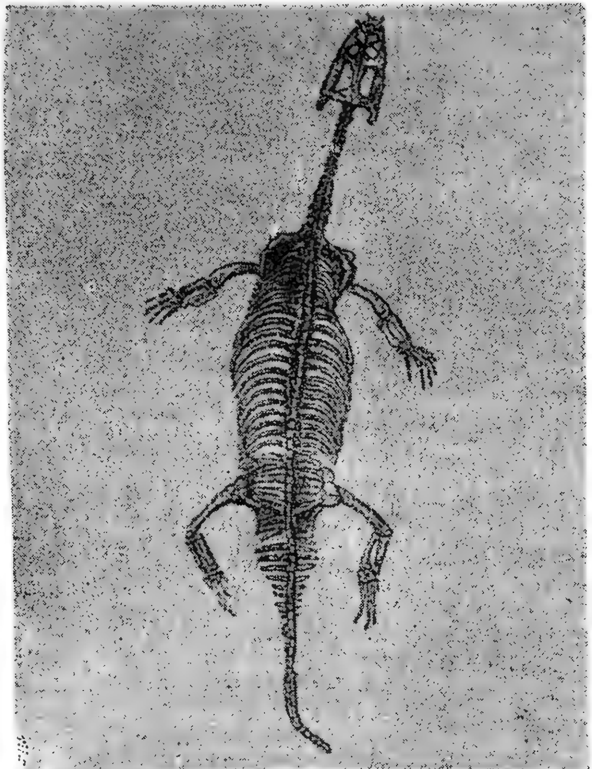
The Pterodactyls or winged reptiles, to which Mr. Thureau suggests a reference, had not the elongate central vertebræ of the form whose cast is now before you, and there is not the slightest evidence of the characteristic bones of the manus. Moreover, the Pterodactyls only make their first appearance in Europe in the rocks of Upper Jurassic age, whereas the fossil skeleton of the reptile now considered, if obtained, as stated, from the Mersey Coal Measures, undoubtedly belongs to Permo-Carboniferous age.

It is to be hoped that Mr. Thureau may be able to obtain the original for the Tasmanian Museum, to which, by right, it belongs, when the opinion of our best European or American specialists may be obtained as to its exact affinities among the reptilia. My own opinion, which I have great diffidence in expressing, is, that it probably comes within that group of the Labyrinthodontia, embraced within the Sub-order *Microsauria*. The Labyrinthodonts included in this Sub-order, resemble Lizards in outward appearance, and have the centra of the vertebræ more or less elongated, and long curved ribs.

One genus of this order, *Limnerpeton*, of the Permian of Bohemia, possesses characteristics of the vertebræ of the central and caudal parts, which come very close to our Tasmanian representation from the Permo-Carboniferous Coal Measure of Railton, Tasmania.

I am sure the Members of this Society will agree with me in thanking Mr. Thureau for his valuable cast of the reptile, and for his promise to endeavour to secure the original for the National Museum of the Country where the skeleton was found.

For the sake of reference, and as a compliment to Mr. Thureau, I propose in the meantime to refer always to this, the oldest known remains of a vertebrate in Tasmanian rocks, as "*Thureau's Microsaurian.*"



SKELETON OF *LARIOSAURUS BALSAMI* (Curioni)

Muschelkalk, Perledo, Lago di Como, Italy ($\frac{1}{8}$ nat. size; original in Munich Museum)

FURTHER NOTES ON THE "PERMO-CARBONIFEROUS FOSSIL CLIFFS" AT DARLINGTON, MARIA ISLAND.

By R. M. Johnston, F.S.S.

(Read 10th May, 1900.)

Maria Island, lying to the east of Spring Bay, must be regarded as the most southerly outline of the great granite axis forming the eastern fringe of Tasmania, traceable northwards through Schouten Island, Freycinet's Peninsula, Bicheno, Falmouth, St. Helens, Eddystone Point, to Gladstone. Crossing the narrow Banks' Strait it may be further traced through Clarke Island, Cape Barren Island, Long Island, Goose Island, Hummock Island, the Strzelecki Peaks, and Killicrankie Range of Flinders Island, and the elevated masses of granite forming the interesting cluster of islets known as the Kent's Group. From this point the granite axis is again traceable through the rocky shoals, reefs, and islets to the most southerly limit of the Australian mainland at the granite headlands of Wilson's Promontory.

Maria Island, like Bruni Island, is divided into two parts—North Maria and South Maria. The two divisions are connected, between Oyster Bay on the west and Reidle Bay on the east, by a narrow strip of sand two or three miles long, giving the island, as a whole, somewhat the appearance of an ancient hour-glass. The greatest length lies between Cape Boulanger on the extreme north, and Cape Peron on the extreme south, covering a distance of about 15 miles. The greatest breadth, about 10 miles, lies in a line between Long Point on the west, and Ragged Head on the east; that is within the larger division of the North Island. Maria Island, as a whole, covers an area of about 38 square miles, and, as its mass in the north rises rapidly, with fantastic outline, from the sea to a height of over 3000 feet, it presents a very imposing appearance as seen from the nearest part of the mainland, six or seven miles distant.

The general geological features of both North and South Divisions of the island are very similar, and closely agree with those of the Schouten Island and Freycinet's Peninsula, with which at one time, no doubt, they were connected.

Thus, in all, we find the easterly half entirely composed of grey and, sometimes red, granites, often coarsely porphyritic. The large tabular crystals of the various kinds of felspar are particulary conspicuous in places. Flanking the granites on their western side, in a more or less well-determined north and south trough or valley, occur metamorphic rocks of Archæan age, together with schists, slates, and close-grained limestone, probably of Lower Silurian age. In such situations stream-tin has been sparingly found, both on Maria Island and on the Schoutens. The great mass of the western half of both divisions is occupied mainly by the prevailing diabasic greenstones of the country, and form, as elsewhere throughout Tasmania, its loftiest and most characteristic physical features. The border of the greenstone ranges, in the southern and western portions of the northern division, is low-lying, composed of scrubby sand-dunes, enclosing marshy lagoons. Towards the north-east, at Darlington, occur fine sections of limestones, mudstones, and conglomerates of Permo-Carboniferous age.

Nowhere throughout Australia and Tasmania are there so complete a series or finer sections of the marine rocks of Permo-carboniferous age exposed than those occurring in the grand precipitous sea-cliffs near Darlington, at the north-western extremity of Maria Island. Darlington, the only settlement, wherein live a few families engaged in pastoral occupation, is most charmingly situated underneath the shadows of the two curious lofty peaks of Mount Maria, nearly 3000 feet high, whose well-known features, as seen from the seaward side, have suggested the fanciful idea of "Bishop and Clerk," a name by which they are now known. The northern outlook from the settlement is especially grand, as it embraces the distant outlines of the fantastic chain of serrated granite ranges of the Schouten Island and Freycinet's Peninsula. Away to the extreme north these crests melt away towards the cultivated settlements around Swansea and Great Swanport, at the head of Oyster Bay ; while to the left stands out the bold coast-line of the mainland, lying between Cape Bernier and Okehampton, near the entrance to Spring Bay.

Immediately to the north and east of Darlington, along the coast-line, occurs a low-lying spur of the diabasic greenstone, which suddenly terminates at the western shoulder of the great cliff-encircled half-moon bay lying directly under "The Bishop and Clerk."

From the point where the diabasic greenstone spur terminates, the coast-line north and east encircling the half-moon bay is walled in by perpendicular and partly overhanging cliffs, composed of stratified marine beds of the Permo-Carboniferous system. Looking downward from the crest of one of these perpendicular cliffs, in the direction of the "Bishop and Clerk," whose slopes and crest, composed of diabasic greenstone, rise abruptly from above the 400 feet perpendicular stratified fossil cliffs to a height of nearly 3000 feet, the half-moon bay and its environing fossil cliffs present a scene of exceeding grandeur. Along the base of the cliffs of stratified rocks there is a narrow marginal strip of low flat rocky ledges, upon which have accumulated, at certain points, vast quantities of fossiliferous blocks of limestone and mudstone, which, by the continuous undermining action of the great open sea-rollers, have been detached from time to time from the overhanging ledges on the face of the beetling cliffs.

The huge blocks which have fallen from these overhanging cliffs are strewn about or tumbled upon each other in the wildest confusion, while the fossils on the surface of the limestone masses, by the weathering action of sea and air, stand out in bold relief in greatest perfection.

The genus Pachydomus, with its large globose specific forms, is especially noticeable. Blocks, 40 and 50 tons in weight, seem at first sight to be made up of a compacted conglomerate of these large fossil bivalves ; but a closer inspection reveals the presence of numerous associates. Originally, in my larger work, on "The Geology of Tasmania," for the sake of convenience in description, I provisionally divided the various members of the Permo-Carboniferous rocks at this place into three great divisions or zones, part characterised by differences in the *prevailing forms* of fossil life, and partly by a considerable difference in the character and composition of the successive beds or groups of strata.

(1.) *Erratic Zone.*—The lowest beds visible above sea-level have been termed by me *The Erratic Zone.* Composed of more or less impure limestones, frequently studded with great erratic boulders of quartzites, slates, schists, and granites or conglomerates of these older rocks, cemented together by limestone. Some of these huge, angular, erratic granite blocks weigh over a ton.

There is abundant evidence now to show that these huge erratics must have been borne thither by meeting ice-sheets. Similar evidence of glacial action during the age in which these rocks were formed, occur in England; Talchir and Salt Range, India; Dwyka Conglomerates, South Africa: Bacchus Marsh Conglomerates, Victoria; New South Wales; and in many parts of Tasmania, in rocks of the same horizon. Fuller details of glacial evidence are given in my observations on "The Glacier Epoch of Australia," read before the Members of this Society, in the year 1893. (See Papers and Proceedings of Royal Society of Tasmania, June, 1893.)

(2.) *Pachydomus Zone.*—Immediately above the *Erratic Zone* occurs a series of alternating beds of calcareous shale and solid limestones, characterised conspicuously by the prevalence of the large globose bivalves of the genus *Pachydomus*. This series, or *Zone*, is about eighty feet in thickness, and was termed by me originally the *Pachydomus Zone.* It must not be inferred, however, that this genus is solely confined to this division, or that this genus alone is to be found within the limits of the zone so named. All that is intended here, by the classified name, is, that in this group of beds, the genus Pachydomus dominates supremely over all other forms of life, and a forty-feet bed is almost wholly composed of their fossils. The following is a fairly typical list of the Pachydomi of this zone, with their more common associates :—

Pachydomus globosus	J. de Sow.
„ de Konincki...........	R. M. Johnston.
„ Hobartensis...........	„
„ gigas.....................	M'Coy.
„ carinatus	Morris.
Eurydesma cordata	„
Notomya Gouldii	R. M. Johnston.
„ trigonalis	„
„ Beddomeii...................	„
Aviculopecten limæ formis	Morris.
„ Illawarensis	„
„ squamuliferus	„
„ Fittoni	„
Platyschisma ocula	J. de Sow.
Connularia Tasmanica	R. M. Johnston.
Stenopora Tasmaniensis	Lons.
„ informis	„
Favosites ovata	„
„ sp. indel. forming broad flat patches over a foot in superficial extent.	

(3.) *Fenestella Zone.*—Succeeding the *Pachydomus* beds there occurs a series of thin, friable, shaly, rusty mudstones, more or less decomposed towards the upper surface, and almost wholly composed of the crushed, laminated frond-like layers of the common species of *Fenestella*. These beds are now estimated to be about 124 feet in thickness, and are generally overlaid, as more recently observed by Mr. Montgomery, by a thin band or layer of volcanic ash or tuff, which he describes as being very hard, full of small glittering granules of glassy quartz, felspar crystals common, also fragments of various rocks. It decomposes into a yellowish-brown clayey stone, which still shows the glassy quartz granules very distinctly. As the whole of the beds of the cliff have a distinct uniform dip of about 1 in 15 in a direction south by east (S. 28° E.), this band, traceable at sea-level to the north, may be followed in the same position, continuously, to the higher surface north and west, where at a height of 185 feet, near the cliff top, and at the head of a deep gully or arm of the sea, it may be again observed in a more or less decomposed state. Mr. Montgomery draws particular attention to the position and peculiar character of this band, as he is of opinion it may serve as a valuable datum line by which to recognise the stratigraphical position of the beds further inland, where among a higher series they are to be found—as also along the higher members of the sea cliffs to the east occur the limestone bands, quarried for the Portland Cement Works of the Maria Island Company. The works lie inland, in a valley, towards the head of Bernacchi's Creek.

The common forms, *Fenestella internata*, Lons., *F. plebeia*, M'Coy, and *Protoretepora ampla*, Low, make up the greater part of the *Fenestella Zone*. Associated with them, however, may be found the following typical forms, viz :—

Spirifera Tasmaniensis	Morris
" Darwinii	"
" glaber	"
" duodecimcostata	M'Coy
Productus brachythærus	G. Low.
Strophalosia Clarkei....................	Eth.
" Jukesii	Eth. Jr.
Pleurotomaria Morrisi..................	M'Coy.

(4.) *Productus Zone.*—The series of beds overlying the Fenestella Zone are divided by Mr. Montgomery into two groups. The first group in succession termed by him *The Productus Zone* is about 30 feet thick, composed largely of beds of blue hydraulic limestone from 6 inches to 4 feet thick These are the beds chiefly worked at the quarries for the production of Portland cement. The blue limestone bands are separated from each other invariably by beds of calcareous shale and mudstone. The limestones are replete with the common forms of Spirifera, Strophalosia, Productus, Aviculopecten, Stenopera, Crinoids, and Fenestella. Pachydomus, common, but less frequent.

(5.) *Crinoid Zone*—The next and highest groups in position of the Darlington beds are estimated by Mr. Montgomery to be about 320 feet thick, and are termed by him the *Crinoid Zone.* This zone is composed of limestones, consisting chiefly of crinoid remains, occurring in beds from six inches to four feet thick, separated by thin shaly partings. Mr. Montgomery states that this limestone seems very pure, except that it frequently contains bands and masses of chalcedony *(Buhrstone)*, formed by the infiltration and segregation of silicious solutions. The beds of the larger quarry at the Portland cement works are stated to belong to the lower part of this series. The buhrstone referred to might yet prove to be of commercial value for milling purposes, as it is very abundant and easily quarried. It is greatly to be regretted that the manufacture of Portland cement at this place has failed of success, seeing, as Mr. Montgomery has reported, that good cement has already been manufactured there, and that there are good facilities of all sorts for making and shipping larger quantities of it.

To the geologist and palæontologist, the Darlington beds of Permo-Carboniferous age are of the greatest interest. The fossils of these rocks afford a splendid field for further palæontological investigations. Professor Boehm, of Freiburg University, Baden, whom I recently induced to visit this fine section at Darlington, declared to me that to him, as a professional palæontologist, it was the grandest sight that he had ever beheld. The main object that I had in view in recording these observations is that it may perhaps induce the younger members to systematically extend our knowledge of the Permo-Carboniferous age in Tasmania, and especially of these Darlington beds. I am indebted to Mr. Montgomery's paper for the large detailed table of strata appended, and for the sections which illustrate them. (Appendix B.)

For the series of splendid photographic slides of the Darlington fossil cliffs, prepared to illustrate this paper by Mr. Beattie, I am indebted to my friend, your Secretary, Mr. A. Morton, who obtained them when he last visited the island for this purpose, accompanied by Dr. Boehm. The enlarged figures of typical fossils of these rocks, to be shown on the screen, are taken from the plates which illustrate my large work, "Systematic Account of the Geology of Tasmania."

As the limestones quarried by the Maria Island Company for the manufacture of Portland cement are of much interest, from an economic point of view, I have appended (Appendix A) a valuable analytical report of the character of these limestones, submitted to Mr. Wallace, Secretary for Mines, by Mr. W. F. Ward, Government Analyst.

Appendix A.

Government Laboratories,
Hobart, 4th September, 1900.

Dear Sir,

The samples of cement received from you on the 14th ult., and stated to be from Maria Island, have been examined, with results following :—

	1	2	3
Silica, soluble	26·2	26·5	22·4
Silica, &c., insoluble	5·0	1·1	1·2
Oxide of iron	2·6	2·2	1·8
Alumina	3·8	3·4	4·0
Magnesia	1·1	1·2	0·8
Lime, &c., by difference	56·3	63·6	53·2
Carbonic acid and water	5·0	2·0	16·6
	100·0	100·0	100·0

No. 1, cement ; No. 2, blue lias clinker ; No. 3, crumbling cement brick, 10 years old. No appreciable amount of phosphoric acid was found in any sample ; a small quantity only of sulphate of lime is included in the lime.

To render the results more strictly comparable, they have been calculated, excluding the carbonic acid and water lost on ignition in each case, as follow :—

	1	2	3
Silica, soluble	27·58	27·04	26·86
Silica, &c., insoluble	5·26	1·12	1·44
Oxide of iron	2·74	2·24	2·16
Alumina	4·00	3·47	4·80
Magnesia	1·16	1·23	0·95
Lime, &c.	59·26	64·90	63·79
	100·00	100·00	100·00

Variations in compositions of cements from several different countries are added for comparison :—

	Per cent.
Silica	19·9 to 26·1
Alumina	5·2 „ 10·6
Oxide of iron	2·1 „ 5·0
Lime	59·1 „ 67·3
Magnesia	0·3 „ 3·5
Sulphuric acid	0·3 „ 4·2

It will be seen that in the Maria Island material the silica is rather above the maximum, and the alumina rather below the minimum given above. Alteration in these respects would probably mean improvement, but I am inclined to attribute the crumbling of sample No. 3 to mode of preparation of the cement, as there are some limestones which will yield cement or lime according to the

FALLEN BLOCKS OF FOSSILIFEROUS
At foot of Cliff, Fossil Cliff Bay, Darlington, Maria Island

temperature at which they are burned. A rotary kiln, very largely used in America, is a great improvement on the old forms of calciners.

Yours faithfully,

W. F. WARD, *Government Analyst.*

To the Secretary for Mines, Hobart.

Appendix B.

Detailed Description of the Darlington Beds, as described by A. Montgomery, M.A.

Zone	Thickness. Ft.	Thickness. In.	Description of Beds.	Total Thickness of Strata. Ft.	Total Thickness of Strata. In.
Crinoid Zone.	320	0	Limestones consisting chiefly of crinoid remains in beds from 6 inches to 4 feet thick, separated by thin shaly partings. This limestone seems very pure, except that it frequently contains bands and masses of chalcedony (*Buhrstone*) formed by the infiltration and segregation of siliceous solutions. The beds of the large quarry at B. on plan belong to the lower part of this series.	608	0
Productus Zone.	30	0	Beds of blue hydraulic limestone, 6 inches to 4 feet thick, worked in quarries at A. C. D. E. and F. on plan, separated by beds of calcareous shale and mudstone, amounting, probably, to nearly half the whole bulk of the beds. The limestones show fossils of *aviculopecten*, *spirifera*, *productus*, and *fenestella* in abundance; *pachydomus* common, but less frequent. Small stones not uncommon	288	0
	43	0	Shaly limestones, very rich in *Spirifera* and *productus*	258	0
	2	6	Dark shaly mudstone..........................	215	0
Fenestella Zone.	1	9	Volcanic ash or tuff, very hard, full of small glittering granules of glassy quartz, felspar crystals common, also fragments of various rocks: decomposes to a yellowish-brown clayey stone, which still shows the glassy quartz granules very distinctly..........	212	6
	124	0	Mudstones, with but little lime, very rich in species of *fenestella*, *stenopora*, &c...	210	9

DETAILED Description of the DARLINGTON BEDS—*continued.*

Zone	Thickness Ft.	Thickness In	Description of Beds.	Total Thickness of Strata Ft.	Total Thickness of Strata In.
Pachydomus Zone.	40	0	Thick limestone bed, almost entirely made up of shells of *pachydomus globosus*, but containing a great deal of sand and large stones	86	9
	6	0	Calcareous shale	46	9
	0	9	Solid hard limestone..........................	40	9
	2	0	Calcareous shale	40	0
	2	6	Limestone and shale with *spirifera* shells and a good deal of gravel................	38	0
	1	6	Solid hard limestone..........................	35	6
	5	0	Calcareous shale.....................	34	0
	1	6	Solid hard limestone..........................	29	0
	1	6	Calcareous shale...............................	27	6
	5	0	Limestone, almost entirely composed of shells of *pachydomus*.......................	26	0
	1	0	Calcareous shale	21	0
	2	0	Solid limestone................................	20	0
	1	6	Limestone full of boulders..................	18	0
	3	6	Calcareous shale	16	6
Erratic Zone.	4	0	Limestone with a great many stones in it..	13	0
	4	0	Conglomerate of boulders of metamorphic slate and sandstone and granite, cemented together by limestone	9	0
	5	0	Impure limestone, with boulders...........	5	0
			Sea Level	0	0

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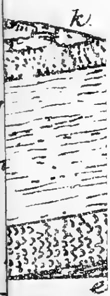

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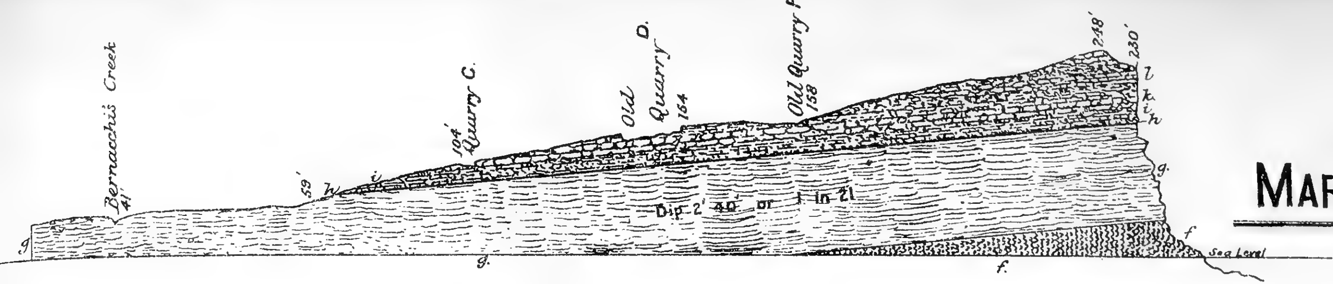
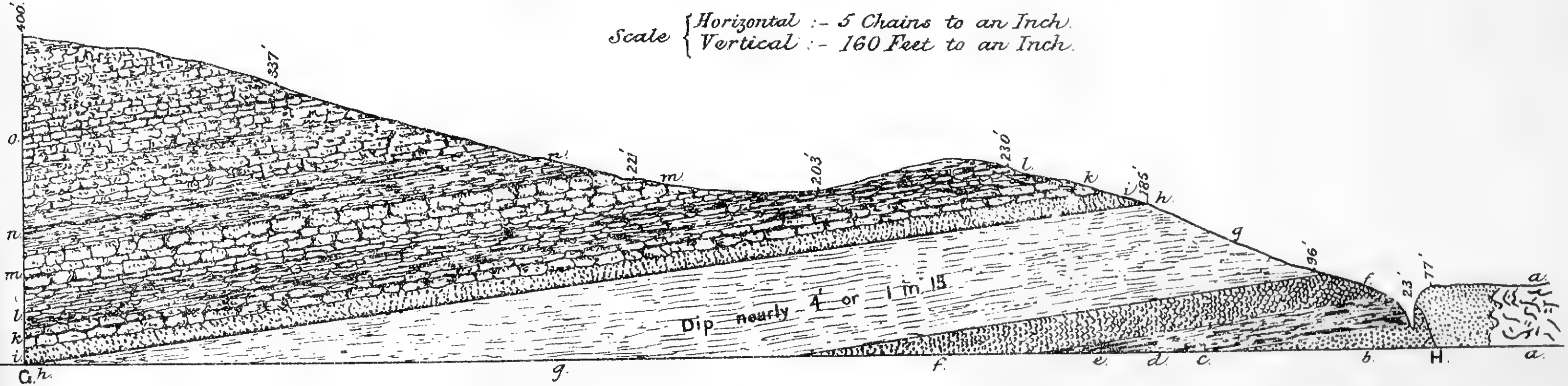
MARIA ISLAND.



SECTION THROUGH MIDDLE SPUR FROM CREEK TO COAST.

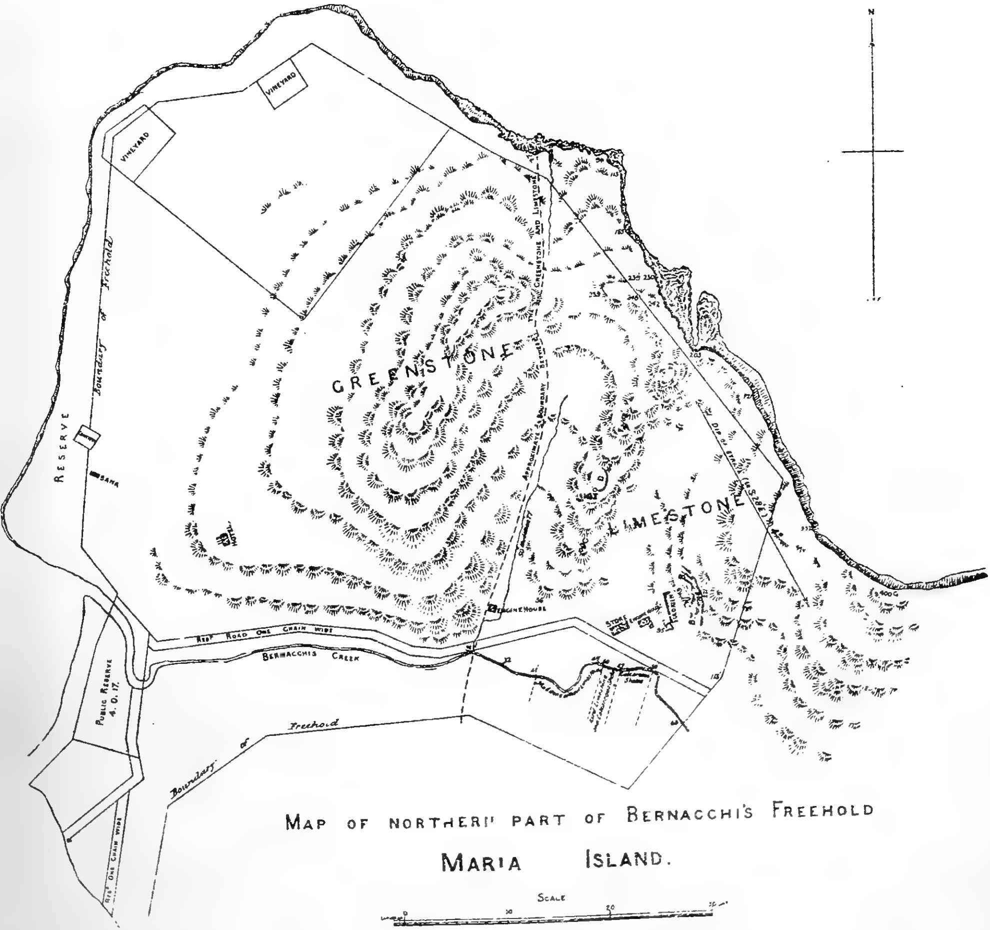
Scale { *Horizontal :- 5 Chains to an Inch.*
Vertical :- 160 Feet to an Inch.



SECTION ALONG COAST FROM G. TO H.

a. Greenstone. b. Limestone & conglomerate. c. Calcareous shale & thin beds of limestone. d. Bed of Pachydomus shells. e. Calcareous shales with thin beds of solid limestone. f. Thick bed of Pachydomus shells. g. thick bed of mudstones with very abundant remains of species of Fenestella &c. h. bed of volcanic ash. i. shaly limestone with numerous species of Spirifera, Productus &c. k. thin bedded hard limestones worked in quarries on Middle Spur. l. horizon of limestone beds worked for cement in quarry A. m. horizon of crystalline crinoidal limestones in bottom of quarry B. n. mixed beds of limestone and mudstone. o. beds of hard limestone seen in face of cliff at G.


Freehold



MAP OF NORTHERN PART OF BERNACCHI'S FREEHOLD

MARIA ISLAND.

PRESENT AND FUTURE PROSPECTS OF TIMBER IN TASMANIA.

Paper read by W. HEYN, Timber Department, Admiralty Harbour Works, Dover, at a Meeting of the Royal Society of Tasmania, 29th April, 1901.

AFTER introductory remarks, Mr. HEYN proceeded to say—

You will naturally ask me why I came out to Tasmania, a long distance of some 13,000 or 14,000 miles (a few hundred more or less not being of much matter) from England; what I came for, and the probable results of such a long journey. Had I come to see and admire the lovely scenery of your island, or to revel in the delightful air of one of the most perfect climates I have ever experienced, or other charms, I acknowledge that I would have been amply repaid for the protracted sea voyage and loss of time by what I have seen and enjoyed since my arrival in Hobart. But, as a business man, I must confess that none of these reasons actuated me in coming to Tasmania, for, to tell the truth, until I actually saw and experienced them, I never once imagined that such a beautiful island existed. The facts are these: In the English Channel, which, as you know, separates England from France, we have not along the whole stretch of coast, from the Isle of Wight to the mouth of the Thames, a single harbour of refuge, or marine station worthy of the name, or suitable for the large-sized ships, of which our naval and merchant services are now principally composed. You, who have one of the finest, if not the finest, natural harbours in the world, can scarcely understand what the want of a good, safe, and easily-entered harbour means in a channel ploughed by storms and heavy seas from the Atlantic on the one side, and from the North Sea on the other, and subject to be clouded over very frequently by those impenetrable fogs which are so common and dangerous along our English coasts. But, beside the question of having a place of refuge to which our ships can repair under severe stress of weather,—and, you must remember, that it is calculated that on an average nearly 2000 ships of one class or another pass Dover every day,—there is another reason equally strong, and, if possible, more important, as far as the interests of our great Empire are concerned, which rendered the construction of a great National harbour at Dover an absolute necessity, as well as a great national duty.

As you are aware, our coast at Dover is only about 21 miles distant from France; so close that one of our new torpedo-catchers could cross to Calais and return to Dover inside of an hour's time. You also know that the English Channel is the great highway through which all the European fleets, and a great number of other warships, are continually passing; consequently, Dover, with the requisite battleships and torpedo-boats, commands one entrance of the Channel, and can, in case of need, either attack a hostile fleet, prevent an invasion of our shores, or inflict punishment upon any neighbour who wishes to annoy us. When the Dover National Harbour is completed, it is computed that a large portion of our fleet and torpedoes can lie at anchor in safety there, ready to strike if any of these emergencies arise.

The necessity of the formation of a great national harbour in this part of the English Channel has for a great number of years engrossed the attention of the naval and military authorities of our country, and as long ago as 1844, a Royal Commission sat on the subject, and plans, for which the late Duke of Wellington was, I believe, in part responsible, were prepared and considered. These plans must have been tied up very tightly with red tape, for it took 52 years to open them, and it was not until the year 1896 that any tangible progress in the carrying out of this great national undertaking was made, and entrusted to Messrs. S. Pearson & Son to execute.

After all, perhaps, this delay was beneficial, for, when first proposed, it was intended only to spend two millions upon the work, whereas the present plans will require an expenditure of at least double that amount, with corresponding advantages in extent and execution.

I have prepared a sketch of the proposed works, which I will try to explain to you, so that you may have some idea of what has been accomplished during the last three years, and still remains to be done before one of the finest artificial harbours in the world will be finished, and which will still require about seven years for its accomplishment.

It is to find the timber requisite to enable us to carry out this gigantic work that I, representing the timber department, have been sent to Tasmania ; and you will be glad to hear that, so far, my mission has been most successful, and I feel certain that when the piles I have procured here reach England, they will prove admirably adapted for the work for which it is intended to utilize them. The splendid workmanship shown in the squaring of these logs will also prove that Tasmanian axemen are among the finest in the world. In connection with this I may mention that a considerable portion of this timber has been cut and prepared, and will be shipped from your township of Dover, to be taken to and used at Dover, in England—a curious coincidence.

This, I am happy to think, will add another record to the services which little Tasmania has been able to render to the mother country. She has already sent six contingents of her most stalwart and tallest sons to help to keep flying the flag so dear to us all, and now she is furnishing some of her finest and tallest trees as her contribution of the most necessary timber for the completion of a harbour in which Britain's fleet can keep watch and guard over those shores which must always be kept, and which we all intend to keep, inviolate from the tread of any invader.

To give you some idea of the magnitude of this work, only as far as the timber required in its construction is concerned, I give you the quantities which can be regarded as the minimum required before it is completed :—Hardwoods, principally greenheart and rock-elm, 25,000 cubic feet, and softwood, pitch-pine, red-wood, &c., 75,000 cubic feet for permanent work; and for merely temporary staging, 550,000 cubic feet blue-gum and other hardwood; and pitch pine, &c., for superstructure, 700,000 cubic feet; so that an undertaking which will consume some 27,000 to 30,000 loads, or 1,500,000 cubic feet, in its construction, is not a matter which any timber-producing country can regard with indifference.

You will naturally ask why we were obliged to come to Tasmania for these piles of 100 feet in length and 18 to 20 inches square? Could we not have got them in some other quarter less distant, and at a smaller cost? In reply to this, I can tell you that we could and did get very good timber of the same length and dimensions from Vancouver's Land, and have employed already a large quantity on the Dover works. We found, however, that this Oregon timber, which, I may mention, cost us considerably less in price than Tasmanian blue-gum, had certain disadvantages. In the first place, it has only 47 to 48 lbs. of specific gravity. This, in itself, is an objection for driving purposes. In a place like Dover, where we have to contend against strong tides and currents, it is nearly impossible to get a pile of Oregon 100 feet in length into position for driving it into the ground, through 47 feet of water at low tide, unless it is what we call "weighted" with old railway iron at the end, and which entails an expense in material and labour of nearly £10 per log. Then we have to reckon in these submarine structures with a very small, but most destructive, little insect called, in Latin, the "*Terridæ navalis*," or, in plain English, a species of seaworm. We found that in 21 months to two years' time this ravaging little animal completely honeycombed an 18-inch log of

Oregon, and rendered it unfit for further use as a pile. As all these piles are only employed as temporary staging to enable us to lay our 42-ton concrete blocks for permanent use, it stands to reason that, if after we have laid these blocks, we are able to use the piles a second time, they only cost us one-half; three times, one-third, and four times practically nothing. Now, we had received through one of your most enterprising timber firms, Messrs. Gray Bros., Adventure Bay, a small cargo of Tasmanian timber, in which we found blue-gum logs, which were, in our opinion, likely to supersede Oregon to our advantage. In the first place, the specific gravity of Tasmanian blue-gum being nearly 75 lbs. to the cubic foot, water being about 65 lbs., there was no necessity to weight the piles to get them into position, thus saving an expenditure of £10 per log, and in case of being carried away by accident they would sink where they were, and could be easily recovered, instead of floating about, a menace to the works or to ships and steamers. Experience showed us that the sea-worm did not find *eucalyptus* to its taste, and, consequently, virtually confined its ravages to the other timber of a softer and more succulent nature, of which it had no difficulty in procuring a sufficient supply for its wants in our harbour.

You have in your forests in Tasmania a tree which combines the *desiderata* we require for our piling purposes—length, dimensions, solidity, and high specific gravity, and less liability to attack by the *terrida*, in number sufficient for our wants for many years to come, and in situation near enough to the sea to allow of its being loaded on ships without too heavy a transport cost. This timber is known to botanists as the *Eucalyptus globulus*, and is commonly called Blue-gum, and for size, strength, and durability it would be difficnlt, in my opinion, to find any wood superior to it. The enormous size and height to which these giants of the bush grow, enable us to hew out of them piles of 100 feet in length and 20 inches squared parallel from top to bottom. To do this, however, we require a tree 15 ft. to 18 ft. in girth 5 feet from the ground, and about 150 feet to the first branch. We found trees of this length and dimensions in Norfolk Bay, and also at Port Esperance, where there are at present several hundred logs lying ready to be sent off in the ships now on their way to load them.

The following slides, so admirably prepared by Mr. Beattie, will give you a fair idea of our work in the bush :—

No. 2. Tree-felling.
„ 3. Squaring logs in bush.
„ 4. Squared log, with butt. (Axemen.)
„ 5. Bullocks bringing piles (driver and animals).
„ 6. Ditto at stage, ditto.
„ 7. Tramming piles to beach (behind horses).
„ 8. Ditto (before horses).
„ 9. Piles, Norfolk Bay, ready shipment.
„ 10. Ditto.
„ 11. Ditto.
„ 12. Dinner-time, bush.
„ 13. A bush road.
„ 14. A steam hauler (instead of bullocks).
„ 15. Hauling logs through bush.

You have also another species of *eucalyptus* growing in the same, or even larger, quantities, and of equal length and dimensions, I mean the Stringy-bark (*Eucalyptus obliqua*). When cut it is often difficult to distinguish it from blue-gum, except in the specific gravity, which is, I believe, generally about 5 lbs. less. When grown in the same soil where the best blue-gum is found, on the slopes of your gullies, with the roots imbedded among rocks and stones, there is little to chose between either, both being excellent. Personally, for this Admiralty work, I prefer the blue-gum, not alone for its greater specific gravity and consequent strength and durability, but also for a most important point, that is, its greater freedom from bad knots. I have found a much more considerable number of faulty and rotten knots in Stringy-bark than I have ever met with in Blue-gum. I can assure you that even one rotten knot in one of these piles is sometimes a most serious matter when it comes to driving them ten to twelve feet into the ground. I have even seen a log of Stringy-bark, 100 feet long and 18 inches square, break right across the centre, where one of these knots existed, merely from its own weight, which would be from nine to ten tons. In selecting, therefore, the Blue-gum here, I have studiously avoided all bad or suspicious knots, a defect which might, at a critical moment of its use, occasion serious damage to life and property. You will at once perceive how very careful we must be in the quality of the timber, and in the construction of the temporary staging, in which it is the prominent feature, when you hear that every part of this staging must be able to sustain a weight and resist a pressure of 450 tons throughout. Of course, I have had a long experience in Baltic and American timber, but, with the exception of rock-elm, which is a very treacherous wood, I have seldom seen knots so detrimental to the value of the log as in *eucalyptus*. I have often seen Danzig timber full of knots, but as long as it was not required for sawing purposes it could perfectly well be employed for beams, and, in fact, sometimes the knots were the strongest part; but in *eucalytus* my experience is that the tendency in the knots is to rot, and, if I may, I would suggest to your timber exporters to be very cautious in their selection in this respect. Of course, it is impossible, or nearly so, to get wood quite perfect, and Blue-gum, as well as Stringy-bark, has the defect of shakes and shrinkage; but both these may be very considerably modified by care and attention. At first I was rather frightened to drive piles which had great shakes at the ends, but I must say that, with one or two exceptions, they bore the ordeal very well. All those piles which I am now sending to Dover are ringed at both ends in the bush before being transported to the beach by tramway; and I find this a very good preventative. I think that, generally speaking, these shakes are more detrimental to the appearance of the timber than injurious to its real value But for timber which has to be sold in open market, of course it would be wrong to overlook the fact that these shakes might prove a serious obstacle to their sale. Ringing large logs, painting or tarring the ends, particularly of planks or boards, will, I feel certain, help to diminish this. As for "shrinkage," cutting at the proper time, or ring-barked three or six months before cutting, and then, particularly in the case of sleepers and boards, allowing them to season in the *open air*, but *under cover*, will, in a great measure, prevent this, and benefit the timber much. Your Stringy-bark of the best quality, when well cut and seasoned and polished, resembles a good deal our English oak, and might be used for many similar purposes at a remunerative price, for oak is getting very scarce in England, and fetches high rates now.

Respecting the value of Blue-gum and Stringy-bark for paving purposes, I can scarcely speak with any real authority, not having had any practical experience with these two woods employed in this way. I have seen, from personal experience, that the Australian Jarrah does very well, and stands a heavy traffic without shrinkage or apparent injury for a reasonably long period. The only sample of wood-paving I have seen in Hobart is not calculated to inspire much confidence or lead to larger export orders ; but, then, I do not consider that the wood has had anything like fair play. In the first place, it is not laid on a good concrete floor, one of the very first requisites for a wood pavement, either to serve for any time or to look well. Besides, I feel certain that the wood employed was not properly seasoned before laying, and, under these circumstances, it would be wrong to blame it, or to say that it was unfit for pavement. Why not give it a good trial?

If you will allow me to say it, I think, with careful scrutiny, you will be able to find a street in Hobart, for choice the one with the heaviest traffic, which could do with a new pavement. Why not take up a part or the whole of it and pave it with Blue-gum or Stringy-bark blocks, properly seasoned and prepared six months before, and then laid on solid concrete flooring? You will then have an opportunity of seeing and showing what the wood is worth in this capacity, and, considering that you have it close at hand, and that it is cheap, the cost would not be excessive ; or, even if it did cost more than your present pavement, it might be worth the difference in bringing in orders from other countries. Perhaps some wanderers to your shores, if the trial proved successful, which, I am inclined to think, if properly carried out, it would be, might be struck with its appearance; and in these days of unlimited Limited companies, which float far less legitimate projects, they might inaugurate a boom in your timber market which would be as welcome, as it is, to all appearance, badly wanted at the present time.

I cannot lay too great stress upon the absolute necessity of all the timber, particularly that intended for the European and English markets, being cut at the proper time when the sap is down, and seasoned for at least six months before exportation. The seasoning applies principally to boards, planks, sleepers, and small scantling generally. I can assure exporters, from a long personal experience, that there is not the slightest use in sending unseasoned scantlings of Tasmanian timber to England. It would arrive there warped, cracked, and disfigured, and would have no chance against the enormous quantity of really good wood with which it would have to compete. There are two methods by which seasoning may be accomplished, either naturally or artificially, but, I think every man practically acquainted with timber, will agree with me that the natural process is by far the more beneficial, not only as regards the appearance of the wood, but its strength, which has been proved to be greatly increased by proper seasoning, and lengthens its life nearly 100 per cent.

You will perceive that in the foregoing observations I have only spoken of Blue-gum and Stringy-bark. My reasons for so doing are—

1st. That I have had more experience with these two descriptions; and

2nd. Because I believe that they are likely to be the principal woods which, from the large supply you have of them, and their peculiar characteristics in length, dimensions, and durability, are the most likely to be able to compete against other timber in English or European markets. You have in your Huon Pine, Blackwood, Myrtle, and other woods (principally used for the manufacture of furniture), timber, which for beauty and solidity cannot easily be surpassed; but I do not think that they could hold their own in English markets against bird's-eye maple, black walnut, and many others which can be procured there much cheaper than they could possibly be delivered from Tasmania, leaving a fair profit to your exporters. A considerable quantity of Blackwood has, however, lately been sent to Woolwich, where it is being used in the construction of gun-carriages, and has, I believe, given satisfaction. Another thing of great importance, in a business point of view, is that these foreign woods can be delivered in nearly any quantity required, and that there always exist large stocks of them, seasoned and ready to be selected by intending purchasers. You, on the contrary, as far as I have seen or heard, have, comparatively, to Blue-gum and Stringy-bark, a very small quantity to dispose of; indeed, scarcely more than is necessary for your own and the neighbouriug States' consumption.

I shall not easily forget my impressions on entering your Bush for the first time. The whole scene struck me as so weird, so antediluvian, if I may so express myself, so very different from anything I had seen before; such a contrast to either our English woodlands or the continental forests. Those blanched giant trees, some of them 250 feet in height, spreading out their bare branches to the sky; the young undergrowth of gums in full foliage, and splendid ferns of every species and size, formed a picture which never can fade from my recollection. But, mingled with my feelings of instinctive admiration with which I regarded your splendid trees, a great emotion of regret, pity, and at last indignation overcame me when I saw the waste—wilful and ignorant destruction of some of the finest trees which ever existed in any country. When I thought and knew, that every one of those magnificent, but ruined, monarchs of the forest would have been worth, at least, some £50 in England, I felt really heartsick as I looked at such standing monuments of man's ignorance and folly in destroying, or allowing to be destroyed, such a valuable factor in the prosperity of your country and of its climate.

On investigation I found that bushfires, on the one hand, and wanton and useless ringbarking and burning on the other, were the principal causes of this deplorable destruction of such valuable property.

As for bushfires, I believe you have laws regulating the lighting of fires in the bush; but making laws is one thing, and seeing that they are enforced (a very necessary adjunct) is another. Are these laws enforced by proper and continual supervision? To speak from my own experience, I should say not. Everywhere I found abundant evidence of the recklessness with which fires were lighted, and the carelessness with which they were left burning afterwards, when a strong breeze might raise a conflagration in which lives and property would be imperilled. I believe in such cases Government has to compensate the sufferers. Would not prevention in this, as in so many other instances, be the better alternative, and money spent in supervision, save money spent in compensation, besides preserving valuable timber from destruction? This is, I think, a matter which should engage the serious attention of those in power, and any really practical move in this direction should have the approval of the inhabitants of this country. Personally, I feel convinced that eight out of ten bushfires are the result of culpable negligence or gross carelessness and ignorance in the use of fire for clearing purposes.

As for the terrible and disastrous waste caused by indiscriminate hacking, hewing, and even malicious vandalism, along with ringbarking, there ought to be some immediate and drastic measures taken to prevent this national loss to property. I may safely say that I have seen thousands of trees ringbarked and destroyed by ignorant men upon ground upon which nothing else could possibly grow, and who had thus destroyed the only valuable asset upon their land. Had these men been properly instructed in the first elements of forestry, they could not possibly have failed to see the folly of spending their labour, time, and money in annihilating the only good thing their soil could produce; or had there been anyone to call their attention to the suicidal irrationality of such a procedure, the waste and destruction might have been stopped in time, and the owners would have seen that it was their interest to preserve rather than to destroy.

It appears to me, therefore, that ignorance is really more to blame for the waste and destruction of your timber than carelessness or recklessness. A man who really understands a business from which he hopes to gain a living or profit, is not, generally, reckless or careless. He knows what he is about; the value of the products with which he has to work; the best and most economical way of getting the utmost out of them, trusting to technical and practical knowledge to help him through, and not to haphazard and indiscriminate methods which can never end in any good result. Now, I believe that it is the first duty of a really enlightened Government to give their citizens an opportunity of gaining this knowledge, which does not come intuitively, but has to be *taught* and *learned*, on reasonable terms; and this can only be done by the organisation of good, well-appointed, Technical Schools. You have done, and are doing, a great deal in this respect for the Mining industry, the other great factor in Tasmanian prosperity. Why not do something for the other branch—forestry and agriculture? After all, the value of the mines is a problematic one. You are perfectly right in doing your utmost to promote their proper exploitation, but why neglect the sister industry, where you have the positive evidence of existing value and worth? The proper management of the one is as much a science as it is of the other.

Now, as far as timber is concerned, it seems to me that when a country possesses such treasures of vegetable wealth as Tasmania, no effort should be spared to make the most of such a source of national wealth and prosperity, by establishing a School or Schools of Forestry and Agriculture, where those who have the sense to appreciate the value of the great gift with which nature has endowed this land can either learn themselves, or have their children taught, the proper way to set to work to derive the greatest advantage from it. You would not expect a man to be able to make a pair of shoes or a piece of machinery without some practical previous knowledge of bootmaking or engineering; so how can you be surprised if a man who knows absolutely nothing of the laws of forestry and agriculture, by his ignorance wastes and destroys the products of the land entrusted to him, impoverishing the country, and doing no good to himself or anybody connected with him? And it is not alone the conservation and intelligent use of the timber which *already* exists here which concerns you, but also the propagation of other kinds of wood, which now and in future, as the country develops, you will require in quantities sufficient to repay any reasonable expenditure in its acquirement. I see that your timber merchants are importing cargoes of Norwegian deals and boards, at a cost, I should say, of nearly £20,000 per annum. Why not take prompt measures to grow similar timber here, and keep this annual payment to foreigners in your own country? Larch, fir, and pine all grow splendidly here. As a proof of this assertion, pines and ash planted as far back as 1821, 1840, and 1860, gave splendid results, attaining 12 feet in girth and 70 to 80 feet in length. I have seen here very fine average oaks, beech, ash, chestnut, and firs, and have not the slightest doubt that, if properly chosen and planted, they would thrive well. The cultivation of these trees might be encouraged by the Government leasing suitable tracts of waste lands at a very low or peppercorn rent, on condition that they should be used solely for this purpose. You have plenty of ground in the Peninsula, Huon district, and inland regions on which to make plantations, which in ten or twelve years' time will already begin to show useful results. But all this must be done in a methodical and scientific manner, otherwise badly-directed energy will end in failure and disappointment.

From what I can learn and see, a School of Forestry, Agriculture, and State Nursery would not be a very expensive undertaking, even in the beginning, and ought, under proper management, to become soon, at the very least, a self-supporting institution, while rendering invaluable services to the country.

I have been informed, on very good authority, that a suitable plot of ground can be acquired in the neighbourhood of Hobart, about 100 acres in extent, on a lease of 21 years, at an annual rental of £25, with the right of purchase at the termination of the lease at £12 per acre, and with the necessary supply of water practically guaranteed. This seems a promising starting-point for the project which, I believe, would prove so advantageous to Tasmania if properly carried out. This establishment should, in my opinion, provide for three sections at the outset; others can follow as the undertaking succeeds.

1st. *Forest Section.*—This would include importation of desirable seeds from different parts of the world, as well as collection of native seeds. Growth and distribution of nursery stock, particularly of trees likely to benefit materially and physically Tasmania, such as firs of all description, and walnut, to replace your blackwood, and bird's-eye maple your Huon pine; beech, birch, &c. Practical teaching, with ocular demonstration, of the art of forestry to those desiring it.

2nd. *Orchard Section.*—Treating of typical fruit-trees, to which the many heterogeneous growths could be compared and named. The various principles of planting, pruning, thinning, manuring, treatment of pests, best mixtures to enhance quantity and quality of crops, to be taught in a practical manner.

3rd. *Cereal and Grass Section.*—Dealing with the proper production of cereals; experiments in fertilisation and pest eradication; analysis of soils and of manures, and practical instruction in ploughing, sowing, planting, management, &c.

I have been told that the initial cost of such an establishment, including the building of a small house, clearing of several acres, and salary of a permanent resident gardener, besides cost of imported seeds, would be about £500, and that an annual subsidy of about £250 would suffice to keep it going. I am not in a position to verify the exactness of this statement; indeed, I fear the initial expense should be much higher if the establishment is to be of real service; still, if the necessity of such an institution was in principle acknowledged, these details could be settled afterwards. I believe, if properly organised and practically worked, such a school would soon become self-supporting, as so many similar ones on the Continent are at the present day. For one instance, take the Forestry and Agricultural School established for many years at Gembloux, in Belgium. Boys, when they have reached 13 or 14 years of age, after having gone through the usual schooling term at their respective schools, are allowed to enter this institution after passing an examination, which any properly educated lad with ordinary intelligence can easily do. He is boarded, taught practically and scientifically everything necessary to make him, in two or three years, during which he has to pass periodical examinations, proficient in forestry and agriculture, at an expense to his parents or friends of about £30 to £40 per annum. There are scholarships attached, which, in many cases, cover this outlay. Any lad who leaves the school with a certificate of proficiency is sure to meet at once with an engagement from large land and forest owners, who are only too glad to avail themselves of the services of persons thoroughly and practically brought up. There are numbers of them employed also at very remunerative salaries in foreign countries, such as Russia, Siam, Burmah, Turkey, &c. Your youth would, however, soon find an opportunity, either under Government, or for their own or family's account, to turn their practical training to good advantage at home. In these schools, also, there are, during certain months of the year, classes for adults, which farmers and foresters can profitably attend, at a very small expense. The school fees, charges for analysis of manures and soils, valuation of properties, laying-out of grounds, gardens, products of nursery, cattle, &c., render such schools soon self-supporting, and as the manual labour in the estabishment is practically done by the pupils, and nearly all the necessaries for living are produced there, the annual expenditure should not be very great.

I cannot help thinking, from what I have seen here, that this instruction is very much required, and I believe that your best agricultural men would agree with my views. I have visited many of your orchards and fruit farms, and it seems to me that, in a great many cases, a good deal more of technical knowledge was required—in choosing the trees, planting and pruning them, as well as packing the fruit for export—if your great fruit industry, of such enormous value to Tasmania, is to succeed as it ought. Of course, I will be met with the objection that the Government resources might not be adequate to establish and keep up such a school. I do not see why all the expenses of such an establishment, in my opinion so necessary for advancing the pecuniary and commercial interests of those engaged in timber and agricultural pursuits, should fall entirely upon the Government. The personal initiative and support of the large number of persons interested ought to be forthcoming if such a scheme is considered advisable and necessary, and after formulating the lines on which it was to be run and the amount which the promoters considered likely to be forthcoming, the Government could be approached for the grant of an annual subsidy until the institution became self-supporting, as I feel sure, if properly managed, in a few years, it would. To raise these funds by an infinitesimal tax on exported fruit and timber, or an annual subscription by all those interested, should not be a matter of great difficulty if taken in hand by competent persons, consisting of timber and export merchants, members of your agricultural societies, fruitgrowers, shipping companies, and prominent public men.

Another point which I should like to impress upon Government is the fact that in numerous parts of Tasmania young trees are coming up from seedlings, which, in 15 to 30 or 40 years, will be valuable timber, and that these locations should be jealously reserved, and all "rights" inimical to State interests there eliminated.

I have thus given you a few of my impressions, and made some suggestions which I believe would materially benefit the forestry and agricultural interests of Tasmania. It rests with you to decide whether they are worthy your attention. You may be quite certain that systematic forest and agricultural management not only benefits those directly interested, but also the whole industry of the State.

I would impress upon you, however, that, if you decide on doing something, lose no time in doing it at once. You have already lost enormous quantities of valuable timber through its destruction by ignorance, waste, vandalism, and preventable fires. If you allow this to continue unchecked for a few years more, it must result in the exhaustion of your timber, and disaster to thousands of people depending on this branch of industry; but if a bold comprehensive scheme to conserve what you have, and to plant for the future, and for the practical and scientific development of agriculture in all its branches be adopted and carried out, not only will you reap an abundant reward in the present, but coming generations will profit by and bless you for the efforts you have made to promote and protect one of the most important industries in this Island.

In conclusion, if, either here or on my return to England, my services can be of any use, they are, as far as my official duties will permit, entirely at your disposal, either for reference, information, or advice.

I can assure you that I will always not alone think it a pleasure, but consider it a duty, to do my utmost to advance the interests of Tasmania, to which I am so much attached, and where I have met with so much kindness.

SUPPLEMENTARY NOTES ON SOME ANTARCTIC ROCKS AND MINERALS.

By W. A. Macleod and O. E. White.

In the proceedings of the Royal Society of New South Wales, Vol. XXIX., page 461, *et seq.*, appears a paper, read in 1895, on Antarctic Rocks collected by Mr. C. E. Borchgrevink.

The authors are Professor David, Messrs. W. F. Smeeth, and J. A. Schofield. A brief summary of this valuable paper will be interesting, more especially as since then there has been donated to the Tasmanian Museum a small collection of Antarctic rocks and minerals.

The paper mentioned is sub-divided into two parts :—

I. Introductory notes about Antarctica—

(*a*) A general introduction.

(*b*) A summary of the history of Antarctic Exploration.

(*c*) A summary of Antarctic Geology.

Under this last head the authors show that *Eruptive Rocks* (Plutonic and volcanic, granite pegmatite, granulites, syenite, diorite, diabase, pumice, andesites, augite-labradorite rocks, basalts, basic scoriæ, Palagonite tuffs), *Sedimentary Rocks* (Tertiary limestones, and rocks of, perhaps, Triassic and Palæozoic age, sandstones, shales, quartzites, arkose), and *Metamorphic Rocks* (Gneisses, mica schists, argillaceous schists) are well represented. Then follows a list of the then known volcanoes, and their heights and other interesting Geological data.

II. Petrology of the rocks collected by Mr. C. E. Borchgrevink :—

(*a*) Specimens from Cape Adare—

Garnetiferous-Granulitic-Aplite.
Trachytes.
Glassy Augite Andesite.
Vesicular Andesite Glass.

Basaltic Andesite.
Olivine Dolerite.
Olivine Basalts.
Limburgites.
Basic Tuff.
Mica Schist (Biotite).

(b) Specimens from Possession Island—
Amygdaloidal Trachyte.
Augite Andesite.
Basalts.

The specimens presented to the Tasmanian Museum have been placed at the author's disposal, through the kindness of Mr. A. Morton, and comprise the following—

Minerals—
Quartz, containing Siderite.
Ferruginous Quartz Specimen.
Massive Olivine.

Rocks—
Basalt (Olivine).
Basalt (Olivine).
Basalt (Hornblende).
Scoriaceous Basalt.
Sandstone.
Mica Schist.
Decomposed Basalt (?) Ferruginous.

Taking these in the order above given, the first specimen is that of a milk-white variety of quartz, attached on one side to mica-schist, and fringed on the other edge (water-worn) with crystalline carbonate of iron. Another more massive specimen is a ferruginous or "rusty" quartz. Unfortunately, these specimens are barely large enough to permit of assay specimens being taken; still, the appearance of quartz would warrant prospecting for gold, if climatic conditions were favourable.

The remaining mineral specimen consists of a granular and fragile massive mineral, pale green in colour, and resembling bottle glass. The hardness, colour, and chemical tests (yielding $Si\ O_2$, $Mg\ O$, and a little $Fe\ O$) clearly point to the mineral being "olivine." This is a particularly fine specimen, and the mineral probably occurs in connection with the basalts to be mentioned.

Amongst the Rock specimens *Basalts* are well represented, and vary in texture from fine-grained, dense, dark-coloured rocks to scoriaceous, lighter-coloured varieties.

The first and smallest specimen is that of a dense black *Basalt*, showing here and there a few black augites and very small grains of olivine. Under the microscope the augite (of which an excellent cross-section is present in one slide) appears almost colourless. Prismatic and a weaker pinacoidal cleavage are shown: prismatic angle about 87°. The augites are quite free from corrosion, and enclose a few magnetite grains. The olivine grains show traces of crystalline outline, and are altered round the margins and along cleavage cracks into ferruginous matter. Magnetite is present in large and small grains, sometimes showing crystalline form. The base consists chiefly of lath-shaped felspars, which show what appear like fluxion phenomena round the porphyritic constituents. The felspars, which are of a basic variety, are closely packed together, and in the interstices come fine grains of magnetite and a little glass. Fig. I. is a diagrammatic drawing showing a cross-section of an augite prism, and the base.

The rock termed Hornblende Basalt is one possessing a peculiar whitish-grey coat of weathering products, but, on fracture, shows a very fine dense rock, with here and there a few porphyritic crystals. Mr. Twelvetrees suggests that, on account of these porphyritic hornblendes, the rock is an andesite. In the New South Wales collection some doubtful andesites are mentioned. An analysis of this specimen gives 45 per cent. of $Si\ O_2$, placing this rock amongst the Basalts.

Under a high power the base of this rock is seen to consist of long lath-shaped felspars, grains of magnetite, and everywhere are scattered small needle-shaped crystals, which do not extinguish straight, and probably are felspathic microliths. These are set in a glass of a light brown tint. Fig. IV. shows the arrangement of felspars, microliths, and glass.

In the scoriaceous Basaltic Rock, augites and olivines are clearly visible to the naked eye. The augites are similar to those above mentioned, but the olivines are

FIG. 1.

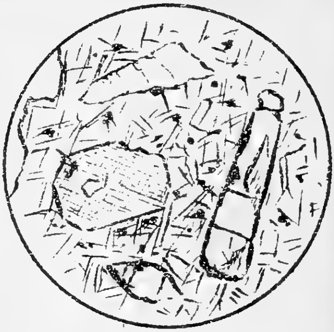


FIG. 2.

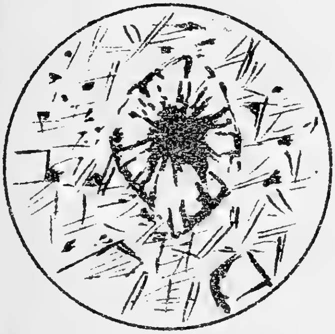


FIG. 3.

FIG. 4.

W. A. M.

much better developed than usual, and exhibit good crystalline outlines, high refraction, straight extinction, and an irregular cleavage transverse to their length, and somewhat similar to that exhibited by the Fayalites in the Sandy Bay Basalt. Fig. II. diagrammatically represents a section of this rock. The olivines are only slightly decomposed. Magnetite sometimes forms peculiar skeletons (perhaps decomposition products of the olivine), one of which is represented in Fig. III. The section of this rock is too thick to admit of an accurate determination of glass in the base.

Of the Sedimentary Rocks we have a single representative, in the form of a sandstone, fine-grained, and composed of angular fragments of felspars.

Amongst the altered rocks there is one specimen of a grey schistose rock which, under the microscope, in transmitted light, shows a confused mass of transparent flakes (perhaps sericite), with here and there large spots, probably occupying the place of former crystals. Analysis shows this rock to consist chiefly of $Si\,O_2$, $Fe_2\,O_3$ (or $Fe\,O$), and $Al_2\,O_3$, with traces of $Ca\,O$, and a high ignition loss of 5·45 per cent. This would point to a rock from which $K_2\,O$, $Na_2\,O$, $Mg\,O$, and $Ca\,O$ had been leached out, and secondary hydrous compounds formed. This analysis agrees with those given by Rosenbusch (Elemente der Gesteinlehre, p. 497), and points to a rock of continental origin, and along with the Biotite Mica Schist of Professor David's collection, gives strong circumstantial evidence as to the existence, *at some time*, of an Antarctic Continent.

The remaining specimen is of a brown-red colour, and slightly scoriaceous, and, most probably, is a decomposition product of some scoriaceous basalt.

The authors, in conclusion, wish to thank Mr. Morton for the kind loan of the above specimens; and also Mr. W. H. Twelvetrees, for some kindly hints.

A FURTHER NOTE ON OBSIDIAN BUTTONS.

By T. Stephens, Esq., M.A., F.G.S.

The occurrence in Tasmania of these singular spheroids of jet black obsidian, popularly known as "buttons," was brought under the notice of the Royal Society in 1897, by Messrs. Twelvetrees and Petterd,* who gave a very full description of the specimens which had come under their observation, and discussed the various theories which have been put forward to account for their origin and distribution. In the same year I contributed a few supplementary remarks on the subject † with special reference to the earliest records of the discovery of these "buttons" in Australia and Tasmania. In 1898, during a journey from Texas, U.S.A., to San Francisco, I had noted the presence of obsidian in lava-flows of Northern Mexico, and had seen some extensive tracts of comparatively recent volcanic rock in Southern California, which suggested the possibility of our obtaining from that source further evidence respecting these singular volcanic products. Shortly after my return to Tasmania, I sent copies of the abovementioned papers to Dr. Joseph LeConte, the well known Professor of Geology in the University of California, in the hope that his intimate knowledge of the geological conditions of the United States might enable him to throw fresh light on this very obscure subject.

The occurrence of obsidian in the peculiar form under consideration does not appear to have been noted in California, but Professor LeConte kindly replied to my

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* On the occurrence of obsidian "buttons" in Tasmania, by W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S. Proc. Royal Society of Tasmania, 1897, p. 39.

† Remarks on obsidian "buttons," by T. Stephens, M.A., F.G.S. Pro. Roy. Soc. of Tasmania, 1897, p. 54.

inquiries, saying that he had consulted Dr. A. C. Lawson, Associate Professor of Geology and Mineralogy, and that their joint suggestion was, that the button-shaped forms described and figured in the paper of Messrs. Twelvetrees and Petterd might possibly be due to the formation of spherulites in a lava with obscure flow-structure, this structure being brought out by weathering; but this suggestion appeared to have been offered with some hesitation in the absence of any opportunity of examination of specimens. The next thing to be done was to attempt to supply specimens for personal examination, and an application to the Trustees of the Tasmanian Museum resulted in my being enabled to forward to San Francisco three obsidian buttons from a collection made many years ago near Glenelg, in Victoria, and presented to the Museum.

By the last mail from America I received a second letter from Professor LeConte, in which he says that, after careful examination of the specimens, he gives up the theory of their possible concretionary origin. His letter continues as follows:—

"I cannot think they have any relation to volcanic bombs: their meteoric origin seems to me out of the question. Professor Lawson throws out the following suggestion:—'May they not be the result of the bursting of bubbles on the surface of some liquid stiffly-viscous lava, ready to solidify? The bursting of such a bubble would probably leave a mound-like centre surrounded by an elevated ring-like margin, sharply elevated at first, but quickly becoming more rounded by gravity and by cohesive shrinkage, before setting completely. Thus might arise the appearance of the flat side. Subsequently the little ring and mound separate from the lava-mass by conchoidal fracture, forming the hemispherical side. The fracture is supposed to be determined by inequality of surface tension produced by the bursting of the bubble.'

"You see it is a mere suggestion, but I can think of nothing better to offer. As to their mode of occurrence, it is easy to see that their *form* would favour wide distribution by mechanical means, and their *singularity*, by human agency.

"Many thanks for these valuable additions to our Museum."

The suggestion thus offered by Professor LeConte claims attention as being the nearest approach to a satisfactory solution of a difficult problem that has yet been put forward. It is necessarily conjectural, for the exact conditions attending the bursting of bubbles of interstitial steam or gas near the surface of a rapidly cooling glassy volcanic magma have never been witnessed by any human eye. The ellipsoidal shape, which is not uncommon in Australian specimens of the buttons, is inconsistent with the theory of a long rotatory flight through the air, for any such volcanic ejectamenta must have cooled too quickly to allow of any change of form on reaching the ground. A similar elongation of originally spheroidal cavities in vesicular basaltic lavas is a familiar instance in this connection.

The general probabilities seem to be in favour of the origin of the obsidian in or near the country in which the "buttons" are found, even if volcanic rocks of the necessary acidic type are not now in evidence: that they have been largely distributed by human agency cannot be doubted. Their reported occurrence in drift gravels in certain localities is still a mystery for the elucidation of which no satisfactory explanation has yet been offered.

THE GLACIAL BEDS OF LITTLE PEPPERMINT BAY, TASMANIA.

A Paper read before the Royal Society of Tasmania by Professor E. G. Hogg, M.A.

Little Peppermint Bay is a small arm of the sea on the western side of D'Entrecasteaux Channel, about 27 miles south of Hobart. The nearest point at which the Channel steamers call is Woodbridge, or Peppermint Bay, about half a mile south of the beds described in this paper.

The prevailing beds in the locality belong to the Permo-Carboniferous series, and have, over a large area, a fairly uniform dip to the S.E., at about an angle of 30°. They are intruded into by two distinct types of igneous rocks, viz., the Oyster Cove porphyries and the diabase greenstone, and, near the contacts, are disturbed to a considerable extent.

The glacial beds are exposed on the beach at the western part of Little Peppermint Bay, along the new and old roads from Woodbridge to Kingston, where they cross the Little Peppermint Bay Creek, and may be traced along the course of the creek for over half a mile. The greatest height at which they are found above the sea-level is about 200 feet. This occurs at the most westerly point at which they can be traced. The rock in the neighbourhood at this spot is the felspar porphyry, but no contact could here be found to determine the relations of the glacial and the igneous rocks.

The glacial beds are composed of an extremely tenacious fine-grained matrix, in which are embedded boulders, generally of small size, for the most part rounded, and frequently striated. Photographs of some of the striated stones are appended to this paper. No boulders to which the term massive could be applied were found; in fact, no boulder was seen which was more than one foot in its longest dimension. The colour of the rock varied in places, but, except on the sea-beach, the prevailing tint was grey, with patches of purple-coloured clay in places. The clay, except for its greater tenacity, has many points in common with the glacial beds of Coimaidai, near Bacchus Marsh.

Among the included boulders are black, grey, and white quartzite, chert, coarse-grained granite, sandstone, slate (unfossiliferous), white and rose quartz, mica-schist, micaceous sandstone, quartz-porphyry, quartz-felspar-porphyry, and quartz-felspar-hornblende-porphyry. A large number of microscope slides were prepared from the igneous rocks for the purpose of comparison with the Port Cygnet and Oyster Cove igneous rocks—a very necessary point to determine if, as it would appear, certain of the Port Cygnet rocks are contemporaneous with the marine beds of Port Cygnet. However, a comparison of the slides of rocks taken from the glacial beds, and of over 100 slides taken from the Port Cygnet and Oyster Cove igneous rocks, appears to lead to the conclusion that the igneous rocks found as boulders in the glacial beds do not belong to the Port Cygnet and Oyster Cove series, and that we must look elsewhere for the origin of these rocks. From the granite specimens no conclusion can be drawn. It is worth mentioning that, so far as the author is aware, the nearest granite *in situ* is at the Hippolyte Rocks, south of Maria Island, on the east coast of Tasmania.

Among the included blocks was a piece of hard, dark-blue limestone, containing a fossil, which Mr. R. M. Johnston, F.L.S., has kindly identified for me as a form of Tellinomaya, probably of Upper Silurian age. The fossil is not in a state to admit of specific determination.

Where exposed on the beach in Little Peppermint Bay the glacial beds are pierced by three well-marked parallel dykes and an irregular dyke, all bearing S. 30° E. The dyke material is much weathered, but on the whole it appears probable that the dyke belongs to the Oyster Cove porphyry series.

The occurrence of glacial beds at the horizon of the Permo-Carboniferous series exposed at Little Peppermint Bay is of the greatest interest. The glacial conglomerates exposed at the north end of Maria Island lie nearly, if not quite, at the base of the Permo-Carboniferous series. The Little Peppermint Bay beds lie almost certainly on a much higher horizon. Further examination may tend to show that in S.E. Tasmania the glacial beds are related to each other in a manner somewhat similar to that of the glacial beds at Lockinvar and Branxton, New South Wales, as described by Professor David, F.R.S. (Proc. Roy. Soc. N.S. Wales, 1899, p. 154).

ON A METEORITE FROM THE CASTRAY RIVER.

By W. F. Petterd.

There is invariably considerable interest attached to the discovery and identification of meteoric substances. I therefore assume that a few remarks respecting the recent acquisition of a small but veritable meteroic stone, fully authenticated as having been unearthed in this State, may be of interest. The specimen in question makes the second* which has been discovered in this Island, and brings the total number recorded up to date as having been obtained in Australasia, to about 33 examples†. These vary in weight from 3 to 4 tons to that now described, which is the smallest hitherto obtained. It is beyond reasonable doubt that many have been, and are, overlooked, as to the average observer they are remarkably unattractive, and it is usually only when they fall into the hands of the mineralogist that their true nature is revealed. Specimens of over 250 independent occurrences in various parts of the world are preserved, often with detailed records (*vide* Dana's System of Mineralogy, 1898).

As is well-known to those interested, it has been found convenient to class these objects into three divisions, although they pass more or less gradually into each other, viz. :—

1. *Siderites*, or meteoric iron proper (consisting chiefly of nickeliferous iron, and enclosing schreibersite, troilite, graphite, &c.)
2. *Siderolites* (consisting chiefly of nickeliferous iron and silicates, both in large proportion.)

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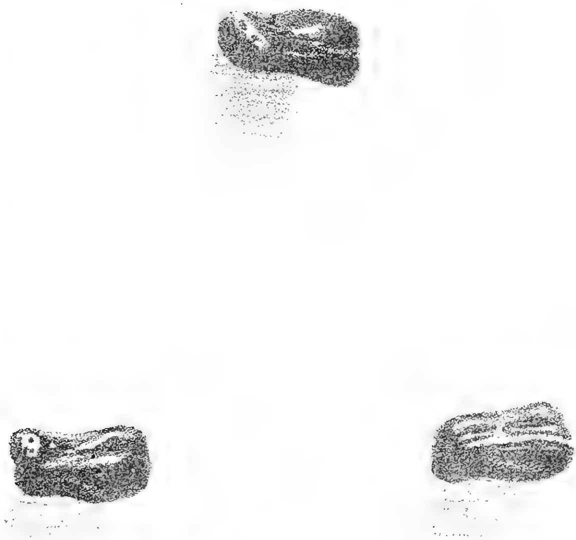
* The minerals of Tasmania, 1896, p. 53.

† Records of Australian Museum, 1897-8-9.



THE CASTRAY METEORITE.

3. *Aërolites*, or meteoric stones, (consisting generally of one or more silicates, interspersed with isolated particles of nickeliferous iron, troilite, &c.).*

It is estimated that about one-third of the known elements have been detected in the various forms of meteoric substances, many in their free state, but by far the greater number as homogeneous mineral species in the condition of alloys, oxides, sulphides, silicates, phosphides, and hydrocarbons.† Of the somewhat large number of compounds which have been recognised and described, about 12 species are unrepresented among the terrestrial minerals.

Of the meteorites recorded from Australia, 22 are classed as belonging to the first, or siderite section, seven to that termed siderolites, and one doubtfully belonging to the aërolites.

That already recorded from this State, as well as the one now described, belong to the siderite or nickeliferous-iron section.

A noted peculiarity of the metallic ingredients in thin section is the development of the "Widmanstatten" markings on a polished surface being exposed to the action of acids or bromine, owing to the inequality of action on the various alloys of nickel and iron.

Details of Specimen.

Castray Meteorite—

Type: Siderite.

Weight: 51 grs.

Size: Length, 18 millimetres; greatest breadth, 10 millimetres.

Locality: Castray River, North-West Tasmania.

The specimen is dark, almost black, with the characteristic smooth, almost graphitic, surface glimmer common to this class of meteoric substances. In shape

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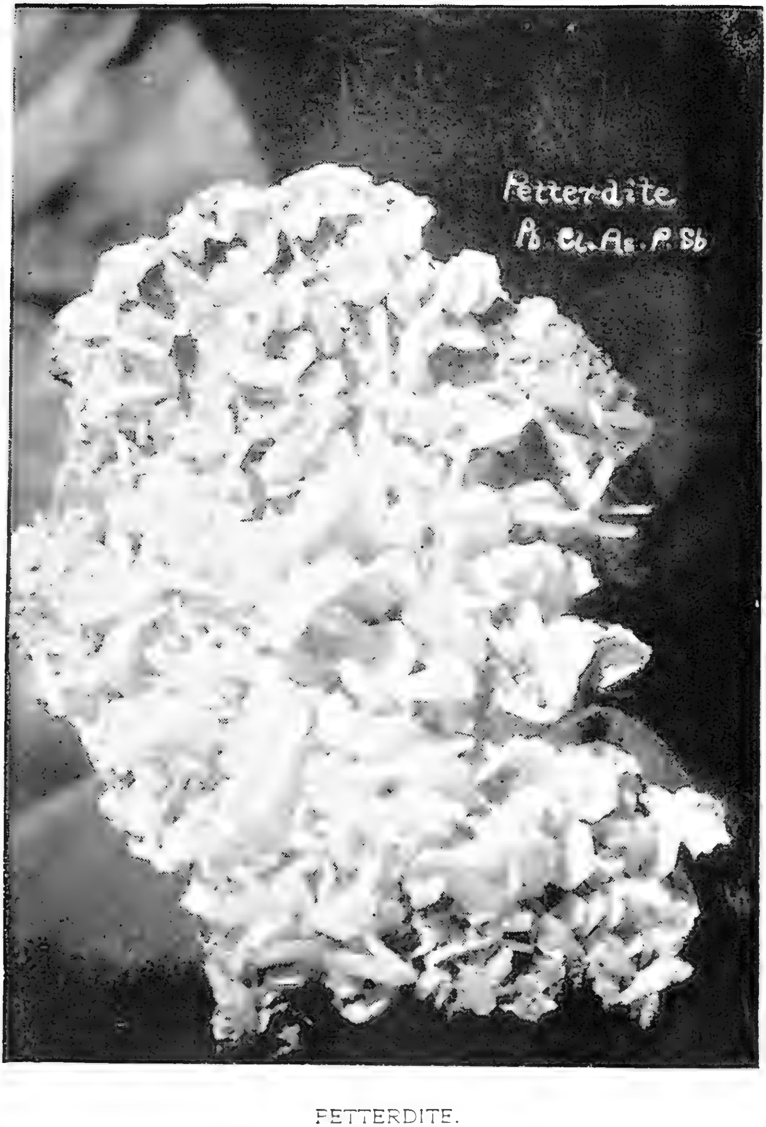
* Introduction to the Study of Meteorites. (British Museum, 1896.)

† The discovery of undoubted diamonds in the numerous masses of meteoric iron found in the Canyon Diable, America, was announced in the American Journal of Science, July, 1891.

it is elongably quadrate, tapering, and abruptly angulated at one end; it is longitudinally furrowed, and has several irregular pittings or diminutive "thumb-marks" on the respective surfaces. It is strongly magnetic. It was originally obtained, with two others of like size and character, by a miner, in 1899, when ground-sluicing the auriferous drift on the banks of the Castray River, and afterwards, direct from the discoverer, came into the possession of Mr. T. Birkett, a well-known mine manager, by whom it was presented to the mineral collection of the writer.

I have to thank Mr. W. H. Twelvetrees, Government Geologist, for illustrating this interesting object.



PETTERDITE.

DESCRIPTION AND ANALYSIS OF A NEW SPECIES OF MINERAL, PETTERDITE, A NEW OXYCHLORIDE OF LEAD.

By W. H. Twelvetrees.

This apparently absolutely new chemical combination occurs in attached crystal groups in a quartz gangue containing disseminated pyrites, in the form of somewhat thin hexagonal plates, which are usually minute in size (about 5 millemetres in diameter), but occasionally reach 9 mm. dia., and, still more rarely, a larger size.

Macles are not rare, irregularly attached and implanted on each other, and on the matrix.

Fracture :—Rather irregular, brittle and dull.

Colour :—White, passing to pale grey on the surface.

Streak :—White.

Lustre :—Dull, inclined to rough, waxy, opaque, shining on the edges of the crystals.

Hardness :—1·5 to 2.

Gravity :—7·16, determined by Mr. W. F. Ward, Government Analyst.

Before blowpipe :— On coal OF. forms white to yellow mass. RF. a bead of metallic lead is easily produced without fluxes.

Heated in forceps, strongly decrepitates.

Flame :—With OCu distinctly azure blue. In powder with $H_2\ SO_4$ dull greenish blue.

In cold HNO_3 dissolves quietly and very slowly; in hot acid dissolves slowly, giving with $AqNO_3$ a thick, curdy precipitate.

The powder heated before blowpipe gives slight odour of As_2O_5.

Analysis, kindly made by Mr. O. E. White, of Hobart :—

PbO	=	74·04
As_2O_5	=	2·60
P_2O_7	=	2·10
Sb_2O_5	=	·50
Cl	=	20·

Locality.—In the superficial workings of the Britannia Mine, Zeehan.

It is evidently rare, and, so far as known, confined to the locality mentioned. One remarkably fine specimen contains about 200 perfectly formed implanted crystals. The accompanying illustration fairly represents this specimen. It is an attractive mineral when in large groups, as shown, and is easily distinguishable from the more abundant sulphate and carbonate of lead. It is occasionally associated with fine groups of campylite.

THE MICROSCOPIC STRUCTURE OF SOME TASMANIAN ROCKS.

By W. F. PETTERD.

I PURPOSE to describe in this paper some aberrant members of the basalt family, which, although not common in this Island, are occasionally met with, and which are not only difficult of interpretation to the ordinary observer, but are sometimes a puzzle to the field geologist.

As is so well understood, the normal basalts are basic lavas (silica = 45 to 55%) of high specific gravity and dark colour, and are essentially composed of plagioclastic (labradorite), felspar, augite, magnetite, and often olivine. They cover considerable areas in the northern part of the Island, and isolated patches occur in the eastern and southern portions.

As far as is known, the Tertiary basalts as occurring here do not differ in their normal characteristics from the familiar types, with the exception of the fayalite basalt of One-Tree Point, and the melilite basalt of the Shannon Tier.

The varieties now enumerated and described are the abnormal accompaniments of the usual types which occur in but limited quantity, or are formed under peculiar local conditions.

No. 1.—Tachylyte, Bothwell.

(Sp. Gr.: Spherulitic, equal to 2·72; non-spherulitic, equal to 2·77.)

This is the glassy form of basalt, originating from the rapid cooling of the magma by contact with a cooler substance. It is commonly in thin selvage layers, but sometimes is met with, as at the locality quoted, in comparatively large lumps. It varies in colour from rich dark brown to intensely black, and when freshly broken has a shining vitreous lustre. It is sub-conchoidal in fracture, and, though hard, it is brittle. On weathering it often generates a thin film on the exposed surface of a beautiful pale to dark ultramarine blue, which renders it an object of curiosity and interest. External nodular spheruloids are occasionally prominent on the surface, which show a pronounced radiating structure. It may vary to a structure known as variolite, and in a single example which has come under my notice the tachylyte has, apparently, become interwoven into this spherulitic substance.

It also occurs at Fern Hill, near Deddington, and, in a lesser quantity, at Burnie.

Microscopical Characters.

This is a basalt glass, yellowish brown and structureless, containing large opaque spheroidal segregations inert on polarised light, and only capable of being examined towards their edges, which, being thinner, transmit a little light. In this part their colour is dark brown, becoming slightly purple at the periphery, which is roughly crenulated. Over their thinnest areas they may be seen under a $\frac{1}{8}$ objective to be crowded with globulites and thin rods, the latter essentially trains of globulites forming longulites, and arranged mostly radially towards the circumference. Their arrangement side by side resembles that of hairs on the coat of a furry animal. This structure ceases on approaching the crenulate border. The smaller dark brown crenuli, or segregations, in the rock are too dense to transmit light. Many of them are surrounded by an absorption area, in which the glass is bleached to a pale yellow, and incipient areas of this description are scattered everywhere, giving the field a somewhat mottled appearance. These spheroids appear to be independent of the cracks in the glass, and which pass through them undeflected, which suggests that these segregations were the latest phase in the consolidation of the rock. The glass of which the rock consists is covered with a network of fractures, and trains of globulites have occasionally collected along the cracks, which are also frequently the depositories of minute granules of magnetite. With a high power, globulites may be discerned in abundance everywhere in the glass.

No. 2.—Limburgite.

(From Burnie-Waratah Railway. Sp. gr., equal to 2·8.)

This is a dense, hard, and extremely tough rock, so much so that it became notorious during the construction of the railway connecting Burnie and Waratah, where it occurs as a narrow band at the 7-mile. It is dark, almost black, in colour, and very fine-grained in texture.

Microscopical Characters.

This is a felspar-free basalt, with augite and olivine, equal to limburgite (Rosenbusch) and magma-basalt (Boricky), and has many of the features shown by slices of Bohemian magma-basalts, and described by Boricky in his work on the basalt rocks of Bohemia (1). Such rocks occupy a position between the basic and ultra-basic rocks, and Rosenbusch has given the name of limburgite to those with abundant olivine, with the intention of detaching them from basalts, and of emphasising their position as extreme members of the nepheline and melilite effusive series. Limburgite has been recorded from Cape Verde, Kilimanjaro, and Madagascar, besides the European occurrences. Judd and Cole (2) describe it from Lamlash (Holy Isle), Arran (2).

The constituents of the Burnie rock are olivine, augite, and magnetite, in a brown glass devitrified by the development of globulites and crystallitic rods.

Augite is in colourless crystals, porphyritically dispersed, and, as numerous small laths and prisms, vertical sections give an extinction angle up to 36°-40°.

Olivine is abundant and fresh, giving numerous characteristic hexagonal sections in the zone (010), (001). Its crystals are often corroded and scattered, and cracks introduce inclusions of the base.

Magnetite is present in fair quantity in well-formed crystals and minute grains.

The base is a brown glass with globulites, belonites, and microlitic laths of augite. Some of the rods may, perhaps, be incipient felspars. The globulites cluster more densely round the borders and in the neighbourhood of the larger crystals, forming semi-opaque aggregations. Amygdaloidal cavities are discernible, some beautifully fringed with zeolites, some with an isotropic periphery and a faintly-polarising crystallitic centre.

*No. 3.—Basaltvitrophyre** (*Glassy Basalt*).

(From Sheffield.)

This is, microscopically, one of the most attractive rocks occurring in this State. It is usually intensely black, although rarely of a dark grey-brown colour, with a shining vitreous lustre, having commonly numerous veins and patches of milk-white to glassy zeolitic magma, which, in

(1) Petrographische Studien an den Basaltgesteinen Böhmens, 1874, pp. 53–60.

(2) On the Basalt Glass of the Western Isles of Scotland, Q.J., Geo. Soc., 1883, p. 459.

* As Pitchstone, "The Geology and Palaeontology of Queensland and New Guinea," Jack and Etheridge, 1892.

Minerals of Tasmania, 1896, page 68.

the cavities, crystallises into definite forms, and then shows clusters of chabazite, phillipsite, with beautiful patches of mesolite interspersed. It is extremely brittle, and thus easily reduced to fragments.

Microscopical Characters.

This is the glassy form of basalt, a true vitreous basic lava, with pheno-crysts of olivine sparsely scattered in a structureless glass of a pale yellow tint, occasionally deepening into gamboge. Apparently, it occurs massive, and does not form a mere tachylytic selvage. It, consequently, falls into Rosenbusch's division of basaltvitrophyres. It is a volcanic product, which is typically represented by the Kilanea lavas in the Sandwich Islands, and its structure is strikingly repeated in slides of modern lava from Hawaii. The olivine crystals are nearly as fresh-looking, and have the same inroads of the corrosive magma.

Like the same form in the Sandwich Islands, the glass is wonderfully clear, a marked contrast to the opaque nature of so many European tachylytes. It carries small colourless or yellowish globulites, some with opaque margins, but the bulk of the iron, instead of separating out into magnetite, would seem to have been used up by the olivine. There are no complete displays of perlitic structure, but it is incipient, and some of the porphyritic crystals are surrounded by a perlitic ring associated with globulites. The strain phenomena are instructive. Several olivines have tufted fissures proceeding from their borders into the surrounding glass, arranged like cilia, evidently the result of the strain of crystallisation, upon the glass. These fissures sometimes connect two fissures, and spring, too, from larger cracks, which traverse the glass in various directions. The same crystals under partly-crossed nicols show a reaction rim, which in plain light is seen to be a granulated border. Wherever the smaller fissures are numerous, they are associated with granulation, yellow translucent globulites. The crystals of olivine often enclose the glassy base in ovoid and circular forms, some of which are prolongations of the base, being connected with the outside magma by a narrow neck. I could not detect more than a crystal or two of augite and triclinic felspar. In the darker portions of the glass zeolitic cavities occur with spherulites round their margins. Elsewhere a spherulite exists with an approach to an axiolitic nature, being elliptical in form, with an elongated medium axis.

No. 4.—Hydrated Olivine Basalt.

(From Native Point, Perth.)

A rock of abnormal physical character, inasmuch as it is invariably heavy from the absorbed moisture, and soft to a degree. It is pale brown in colour, showing a variety of tints between almost yellow to a fairly-dark shade. On exposure to atmospheric action, it commonly fractures in all directions, and finally breaks up into fragments. It closely resembles the tuffaceous substance known as palagonite. It was obtained in sinking-holes in the locality mentioned.

Microscopical Characters.

This structure is that of a normal basalt. The porphyritic mineral is olivine, and augite in the form of grains and minute prisms is embedded in a plexus of narrow lath-shaped felspars. There is a glassy base, and large patches of zeolitic substance (chabazite ?) and vesicles crowded with minute spherulites. Magnetite is present in small quantity. The twinned felspars give extinction angles up to 27°, and are probably labradorite.

The most important mineral is the olivine, which exhibits interesting alteration features. The crystals have the irregular forms which intra-telluric minerals receive from the attacks of the magma at the crisis of eruption, and are invariably margined with a deep orange or brownish-red border, consisting of fine fibres perpendicular to the contour. The interior is of a citron-yellow colour, and both the interior and the border have assumed a pleochroic nature. The former is serpentinous (sometimes chloritic), and the latter, in all probability, is a hydrated ferric oxide. No fresh olivine remains in the rock. The change sometimes proceeds until the precipitate of ferric oxide colours the whole crystal, and occasionally we see it result in laminæ with the cleavage lines, pleochroisms, and red and green interference colours of biotite. This mineral is very similar to the hydrated silicate of iron, lime, magnesia, and soda called "iddingsite," but its general features indicate that it is a pseudomorph after olivine. For a discussion of this kind of replacement, see H. H. Arnold-Bemrose on the Microscopical Structure of Carboniferous Dolerites and Tuffs. Q.J., Geol. Soc., 1894, p. 617.

OUTLINES OF THE GEOLOGY OF TASMANIA.

By W. H. Twelvetrees, F.G.S., *Government Geologist.*

Tasmania, a small geological outlier of Eastern Australia, offers a highly interesting field to the geological student. It must, however, be conceded that its physical history in pre-Cambrian and early Palæozoic times can only be dimly guessed at. In later Palæozoic times, the conditions appear to have been insular; in the Mesozoic, there was evidently a connection with the great Gondwana continent, which sank beneath the Indian Ocean prior to the Tertiary period. The greater part of the island has since remained above sea-level.

The inaccessible nature of the highlands has greatly retarded geological research; still, in spite of the physical difficulties, the progress made in this direction has been considerable. In 1841-5, Count Strzelecki published some geological notes on the Island. From 1851 to 1855, Dr. J. Milligan, then Secretary of the Royal Society of Tasmania, reported on a large portion of the East and South Coasts. In 1855, Mr. A. R. C. Selwyn reported on coal seams. In 1861-7, Mr. Chas. Gould, Government Geologist, prepared numerous important reports and maps. Mr. S. H. Wintle contributed various geological notes, 1865-1882; Rev. J. C. Tenison-Woods has written several papers on Tertiary geology and palæontology; Mr. C. P. Sprent, Deputy Surveyor-General, from 1876 to 1887, wrote on the Western geology of the Island; Mr. Thos. Stephens, M.A., from 1863 to the present date, has constantly contributed to our knowledge of the geology of the State; in 1888, Mr. R. M. Johnston's monumental work, "The Geology of Tasmania," appeared under Government auspices, and for many years this author has enriched our geological literature. The late Professor G. H. F. Ulrich, in 1874-6, reported upon Mounts Bischoff and Ramsay. Our Government Geologists, Messrs. G. Thureau, Alex. Montgomery, M.A., and Mr. Jas. Harcourt Smith, B.A., have, in no mean degree, extended our knowledge of the general geology of the Island. Mr. W. F. Petterd has contributed his "Catalogue of Minerals of Tasmania," and several papers on the eruptive rocks. Other workers, Professors David, Tate, Krause, Hogg, Feistmantel, Mr. R. Etheridge, Jun., Mr. J. Dennant, have added the results of their researches, while the names of authors of papers read before the Royal Society of Tasmania (Messrs. W. F. Ward, Alex. Morton, Danvers Power, T. B. Moore, Graham Officer, &c.) suffice to show that this Society has had an honourable share in the construction of the literature of the subject.

Mr. R. M. Johnston, the *doyen* of Tasmanian geologists, has worked out thoroughly the stratigraphy of the Tertiary, Mesozoic, and Upper Palæozoic systems, and successive Government Geologists have contributed to our knowledge of detached areas in different parts of the Island; but the lower Palæozoics still require much study before they can be properly defined. In this sketch, the main developments of each system, as far as at present known, will be briefly referred to.

Pre-Cambrian.

The massive quartzites at Port Davey are usually referred to this age, but their stratigraphical relations need working out. The mica-schists and gneiss-like rocks at the Dove River, and the hornblende zircon-gneiss of the Upper Forth, are also possible members. In the North-West, the hornblende and talc schists, with associated dolomitic limestone in the Rocky River district, enclosing deposits of pyrrhotite and copper pyrites, need investigation. These rocks are well seen at the Rocky River Mine, and at the Rio Tinto, further north, on the same strike. The hornblende schist runs through to the junction of the Nine-mile Creek with the Whyte River.

Cambrian.

The only strata which can be definitely referred to the Cambrian system are the friable yellow sandstones at Caroline Creek, between Railton and Latrobe. These have a strike (E. 60° S.) different from the prevailing direction of the Silurian strata of the Island, and contain *Dikelocephalus tasmanicus* (*R. Eth., Jun.*), *Conocephalites stephensi* (*R. Eth., Jun.*), *Asaphus sp.*, *Scolithus tasmanicus* (*R. M. Johnston*), *Leptaena.* These are the most ancient fossils yet found in our rocks. The elucidation of the relations of these strata with the adjacent schists and limestones is much needed.

Silurian.

The divisions of this system are still largely tentative. The following scheme, in which the eruptive rocks of the period are included, must be taken as provisional:—

Upper and Middle Silurian.

5. Quartz porphyries and felsites at Mounts Darwin, Jukes, Owen, Tyndal, Read, Red Hills, Black, Murchison, Farrell;
4. Gabbros, peridotites, pyroxenites, and serpentine at Dundas, Trial Harbour; Heazlewood, Forth, Anderson's Creek;
3. Brachiopod sandstone, at Middlesex, Heazlewood, Queen River; slates, sandstones, and limestones, with melaphyre lava, at Zeehan;
2. Schists, conglomerates, and limestones, at Mount Lyell; greywacké series at Dundas; slates and argillaceous schists, at Mounts Read and Black.

Lower Silurian.

1. Limestone, at Gordon River, Railton, Chudleigh, &c.; slates and sandstones, at Beaconsfield, Lefroy, Mangana, Mathinna, Scamander, &c.

The Silurian system is strongly developed in Tasmania, especially in the N.E., N.W., and W. Owing to paucity of fossils, its subdivisions are unreliable, except in a few instances, and its boundary-lines with the Cambrian rocks are still obscure. The lower division is represented on the West Coast by the Gordon River series, and on the East by the slates, in which our gold reefs occur at Lefroy, Beaconsfield, Mathinna, &c. The limestones along the Gordon River are fossiliferous, containing *Favosites, Orthoceratites, Raphistoma, Orthis, Rhynchonella, Euomphalus, Murchisonia*, &c. They reappear to the N.E. of Mount Farrell in the bed of the Mackintosh, a short distance above its junction with the Sophia River. The limestones of Chudleigh, Mole Creek, and Ilfracombe are placed provisionally in the lower division. They are non-fossiliferous, and the only way of fixing their age is to connect them stratigraphically with the Caroline Creek Cambrian beds. The slates and schists between the Heazlewood and Corinna belong to an undetermined horizon in the system, and some of them may be pre-Silurian. The slate and schist reefs which run out to sea on the N.W. Coast can only vaguely be referred to as Silurian; at Rocky Cape, they are probably lower in the geological record.

The auriferous slate series, with sandstones and conglomerates, appear at Beaconsfield, Lefroy, Waterhouse, Gladstone, Mount Victoria, Mathinna, Scamander, Fingal, &c. Fossils are extremely rare. They comprise doubtful fucoid casts, worm tracks, and, in one instance, a graptolite is recorded from the Lisle slates. The specimen was found by the late Mr. G. Thureau, and subsequently lost; but, from inquiries, it seems nearly certain that it was a Diplograptus. Unfortunately, the range of this genus is too great for use in determining the horizon of the beds. The metamorphic sandstones of the St. Helens and Scamander districts are referred doubtfully to the same horizon as the slates.

It is difficult to locate the so-called schists (slates and argillites) of Mounts Read and Black. These are charged with complex gold and silver-bearing sulphidic ores of zinc, lead, and copper. They may be low down in the system; or, on the other hand, they may be contemporaneous with the Lyell schists. The latter also cannot be placed definitely, but, from fossil brachiopods found at Gormanston, it seems possible that they belong to the Queen River series, greatly metamorphosed. The King and Queen River slates and sandstones, charged with fenestellidæ and encrinites, and casts of brachiopods (spirifera and orthis), belong to the Middle Silurian or the lower part of the Upper Silurian. Silurian sandstones at the Heazlewood, towering above the road at the 14-mile, and on the old Godkin Amalgamated, are referred by R. Etheridge, Jun., to the lower part of the Upper Silurian. They have yielded the following fossils:—*Hausmannia meridiana*, *Cromus murchisoni*, *Cornulites tasmanicus*, *Rhynchonella capax*, *Tentaculites sp. ind.* (*Favosites grandipora* in limestone). At Zeehan, the sandstones, slates, and limestones, which are traversed by argentiferous galena lodes, appear to occupy the same geological horizon, and carry the following fossils:—*Hausmannia meridiana* (in the Despatch limestone), *Asaphus sp. ind.* (in the Despatch limestone), *Illænus johnstoni sp. nov.* (in the Despatch limestone), *Cromus murchisoni* (in slate), *Rhynchonella cuneata* (in slate), *Rhynchonella borealis* (in slate), *Strophodonta sp. nov.*, *Leptodomus* (?) *nuciformis sp. nov.* (in the Despatch limestone), *Lophospira* (in quartzite), *Murchisonia* (in quartzite), *Eunema montgomerii* (in the Despatch limestone), *Tentaculites sp. nov.* (in slate), *Raphistoma* (?) *sp. nov.* (in white sandstone).

The general trend of the Zeehan beds is west of N. and east of S., and their dip is to the N.E. at angles of from 60° to 70°. It may be mentioned that a high angle of dip characterises the Silurian strata throughout the Island. Interbedded with the sedimentary beds at Zeehan are sheets of Silurian basalt (melaphyre), known locally as "white rock." This is often tuffaceous and vesicular. In the Oonah and Montana mines, it may be seen in the form of contemporaneous sheets.

Of about the same age are slates, sandstones, and limestones in the Bell Mount district, between the Forth and Wilmot rivers. The sandstones there and at Mount Claude contain abundant casts of fucoid stems; fenestella, trilobites, and rhynchonella also occur at Bell Mount and the Five-mile Rise. Clay slates, with calymene, orthis, cardiola, in the Eldon Valley, are referred to the Upper Silurian.

Associated with the rocks of the system in the N. and W. is an extensive development of serpentine, the altered form of gabbro and its appendages, peridotite and pyroxenite. Dykes of it cross the Silurian strata on the road between Waratah and the Whyte River, and the rock underlies metamorphosed sandstones at the Heazlewood. A great variety of gabbros and pyroxenites may be seen along this road. Nickel Hill, at the Sixteen-mile, is a mass of serpentine rock, containing nickel ores, and Bald Hill, immediately to the west, is likewise serpentine as far as the Nineteen-mile, where it impinges against Silurian slates. A pyroxenite dyke in Silurian strata carries the silver-lead lode at the Magnet Mine. Gabbro, pyroxenite and serpentine occur in the Dundas district, and reappear west of the Comstock, and again at Trial Harbour. In the Valley of the Forth, and at Anderson's Creek, west of Beaconsfield, further areas of serpentine are exposed, and at the latter place the rock is often asbestiform, and is mined for asbestos. It is difficult to assign a precise age to our gabbros and serpentine. They have been thought to be pre-Silurian; but the Heazlewood intrusions suggest the close of the Silurian as a possible date.

Very important rocks are the quartz-porphyries, or felsites, which form the backbone of the West Coast Range. These are the geographical axes of Mounts Darwin, Jukes, Huxley, Tyndal, and continue northwards through Mount Murchison, and on the east side of Mount Farrell. They are the home of copper ores, and enclose characteristic deposits of hematite and magnetite. Chloritic copper-bearing schists, some of them probably schistose porphyries, flank them, and are enclosed in them. On the whole, the quartz-porphyry is massive, but it occurs also laminated. It was probably intrusive, but this can only be decided after further investigation. Its tendency to assume laminated forms indicates that it was involved in the foliation of the Silurian rocks. Its connection with our granites has not been worked out. It is placed with some hesitation at the close of the Silurian.

A belt of felsite, a little to the west of this zone, can be traced through Mounts Read and Black, across the Pieman River, at the railway crossing. The green augite-syenitic rock at Lynchford has probably some connection with the felsites.

Devonian.

3. Dial Range and West Coast upper conglomerates.
2. Soft slates at Fingal.
1. Granite in North, East, and West Tasmania.

Our granites are considered to be of Lower Devonian age, *i.e.*, soon after the close of the Silurian. No granite intrusion into Permo-Carboniferous strata has been observed, while it is frequently intrusive into the Lower Silurian slates, and has been established as intrusive into Upper Silurian at Middlesex. Evidence has been forthcoming recently, at the Heazlewood and at Mount Agnew, showing that the consolidation of the granite was subsequent to that of the gabbroid rocks. There is an exposure of granite, generally tin-bearing, running down the eastern side of the island from Mount Cameron and Mount Stronach to the Blue Tier and Ben Lomond, St. Marys. Seymour, Bicheno, Freycinet's Peninsula, Maria Island, as far south as the Hippolyte rocks. It occurs again in the Middlesex Field, at Granite Tor, Mount Farrell, Hampshire Hills, Mount Housetop, Magnet and Meredith Ranges, Mount Heemskirk, Mount Darwin, and evidently underlies the whole of the West Coast. The quartz-porphyry dykes at Mount Bischoff, the tourmaline lodes at Mount Black, Renison Bell, and elsewhere in North Dundas, the stannite lode and spherulitic quartz reef at Zeehan denote the granitic reservoir below a large portion of the mineral fields on the West Coast. The normal granite is a dark mica one, mostly spotted with large porphyritic crystals of orthoclase felspar. In its tin-bearing varieties the magnesian mica disappears, and gives place to muscovite and lithia micas.

The Fingal slates, of a soft sandy nature, have been doubtfully retained in the Devonian, on the strength of a fossil resembling *Anodonta jukesii*; but it is uncertain whether they can be stratigraphically separated from the Silurian slates at Fingal.

The horizontal beds of conglomerate, which lie as heavy caps on the Dial Range and most of the Western Mountains, have been assigned to this system. These massive conglomerates crown Mount Farrell, Murchison, Lyell, Owen, Jukes, Roland, Claude, &c.

Permo-Carboniferous.

These rocks consist of sandstones, mudstones, grits, conglomerates, and limestones, with shales and thin coal seams. The most productive coal measures in Tasmania do not belong to this system, but are Upper Mesozoic, probably Jurassic. The Permo-Carboniferous strata have been thoroughly examined by Mr. R. M. Johnston, and his classification is adopted:—

Upper—

7. Elæolite syenites, phonolites and trachytes, at Port Cygnet.
6. Southport, sandstones and shales.
5. Mount Cygnet and Adventure Bay, sandstones and shales.
4. Upper marine mudstones overlying Mersey coal; Porter Hill shales and sandstones, Sandy Bay.
3. Lower coal measures, Mersey Basin.
2. Tasmanite shales.

Lower—

1. Lower marine mudstones, limestones, conglomerates, and grits, throughout S.E., N.E., and Midlands.

Conglomerates, grits, and micaceous sandstones and slaty flagstones, in thick beds, form the base of the system. These conglomerates, at One Tree Point, North Bruni, at Darlington, the northern point of Maria Island, below the limestone beds, contain large blocks of granite, porphyry, &c. The angular blocks on Maria Island are over a ton in weight, and on Bruni, too, they are very large. The Lower Marine series of limestones and mudstones comprises, in Southern Tasmania:—

3. Fenestella mudstones, at Porter Hill, The Grange, Cascades, &c.
2. Spirifera and strophalosia mudstones, Huon Road, &c.
1. Limestones, on Maria Island, at Bridgewater; also at Fingal, Middle Arm, &c., in the North. They contain *favosites, spirifera, productus, conularia, pachydomus, notomya, aviculopecten,* &c.

These marine beds occur all along the Derwent, from Bruni Island to New Norfolk. At Porter Hill, south of the Alexandra Battery, on the Brown's River Road, sections are exposed of the lower marine series, with its common fossils, passing upwards into shales and sandstones of the upper division of the system, with *Gangamopteris* and *Cythere tasmanica* (Johnston).

Fossiliferous limestones and mudstones occur at Variety Bay. At Eaglehawk Neck, the sea beach exposes grits and conglomerates with rectangular joints filled with oxide of iron, forming a natural "tesselated pavement" greatly admired by visitors. The jointing is probably due to the vicinity of a concealed body of intrusive diabase. At the Middle Arm of the Tamar, near Beaconsfield, the fossiliferous limestones repose on Silurian rocks. Dally's old quarry abounds with *Eurydesma cordata.* Fossiliferous mudstones, with *spirifera, productus, terebratula, pachydomus, eurydesma,* occur on the Meander, near Cheshunt. At Mount Cygnet, the succession is—3, fenestella zone; 2, spirifera zone; 1, shaly mudstones. The spirifera sandstones occur all round Lovett and Lymington.

On the West Coast, the lowest conglomerates of the system are composed of pebbles of schist and quartzite, and rest on ancient schists in the Barn Bluff district.

The upper division of the system comprises sandstones and shales, which contain the coal of the period, and includes marine mudstones, overlying the coal in the Mersey district. In the Mersey Basin, notably, near the Great Bend of the river, near Latrobe, beds of variously-coloured clays enclose thin layers of bituminous shale, called Tasmanite, from the abundance of fossil spore cases of the lycopod *Tasmanites punctatus* (Newton), which contains over 25% of resinous matter. The exact relation of these shales to the other beds in the Mersey Basin is not settled.

The beds of the Mersey coal measures are grits, variegated sandstones, marls, and the coal plant remains are the forms characteristic of the Permo-Carboniferous, viz.:—*Glossopteris, Gangamopteris spatulata, G. obliqua, Noeggerathiopsis media.* Mr. Johnston has also recognised a *schizoneura* (rare). The coal of these measures is superior in quality to the coal in the Jurassic measures, but the seams are not of such importance. They are overlaid by marine marls and limestones, sandstones, and conglomerates, with *Fenestella plebeia, Spirifera tasmaniensis, Terebratula sacculus, Pleurotomaria morrisiana, Pachydomus, Aviculopecten, Cardiomorpha, Pterina,* &c. These are called the Upper Marine Beds in Tasmania.

The upper zones of sandstones and shales at Porter's Hill, in the South, correspond with the Upper Marine beds of the Mersey. Two hundred feet of the former are exposed along the Derwent, containing *Cythere tasmanicus* (Johnston), *Gangamopteris, Spirifera tasmaniensis, S. darwinii, S. duodecimcostata, Terebratula sacculus, Avicula, Arca, Aviculopecten, Eurydesma sacculus, Edmondia, Inoceramus, Pachydomus pusillus, Pleurotomaria morrisiana, Conularia, Theca*, &c.

On the north bank of the Henty River, on the West Coast, between the Henty and Badger, the lower coal measures are hard dark grey shales, which contain *Gangamopteris spatulata* (McCoy), *G. obliqua* (McCoy), *Noeggerathiopsis media* (Ettingsh.). Above these are mudstones and impure limestones, with *Fenestella plebeia, F. internata, Protoretepora ampla, Stenopora tasmaniensis.*

In the North-East part of the Island, foraminiferal limestone of this system has been found by Mr. Thos. Stephens. At Harefield, in the Fingal Basin, a diamond-drill bore has revealed the existence of 97 feet of conglomerates, sandstone, and shales, resting on Silurian slates, at a depth of 674 feet in the bore-hole. These underlie the Upper Marine beds. Very little coal was found, but the shales contained imprints doubtfully referred to *Schizoneura* and *Gangamopteris.* The Upper Marine beds overlying these were 313 feet thick, and consisted of fossiliferous blue shale, limestones, mudstones, &c.

At Mount Cygnet, the lower coal measures rest on the fenestella beds, and are overlaid by 200 feet of grey sandstone. The coal shales contain impressions of *Vertebraria australis* and *Gangamopteris spatulata.*

At Adventure Bay, on Bruni Island, lower coal measure shales and seams lie conformably on the lower marine mudstones, conglomerates, and sandstones. They contain dwarfed forms of *Gangamopteris spatulata, G. obliqua, Glossopteris browniana, var. præcursor* (Brongt.).

At Southport, brown sandstone is overlaid by carbonaceous shales, with imprints of *Vertebraria australis.* The Adventure Bay and Southport series form the uppermost beds of the system.

The elæolitic and trachytic rocks, which are developed at Port Cygnet and Oyster Cove, are referred provisionally to the close of this period. Some of them appear to be fluidal, and interbedded with the Permo-Carboniferous mudstones and sandstones, but further examination is requisite. The majority are intrusive rocks, forming parts of a mass of elæolite-and alkali-syenite, with associated dykes of phonolitic, tinguaitic, and trachytic porphyries. The accessory minerals of the nepheline rocks, nosean, ægirine, sodalite, melanite, &c., are present here in all the wonderful variety characteristic of that group. Mounts Livingstone and

Mary, on either side of Lovett, and the beach south of the Regatta Ground, show these rocks in great variety. A good deal of free gold has been shed into the alluvial flat at Lymington. The source of the metal is believed to be the line of contact between the porphyries and the Permo-Carboniferous sediments. This belt of rock passes S. to the other side of the Huon River, and N. across to Oyster Cove.

Mesozoic.

The series of freshwater beds which succeed to the Upper Palæozoic belongs to the Mesozoic division, but cannot, as yet, be subdivided with certainty. The nearest approach to a subdivision would be as follows; but the reference to European equivalents is quite provisional:—

Cretaceous (?)—

4. Diabase (dolerite) in intrusive masses, laccolites, sills, and dykes.

Jura—

3. Upper coal measure sandstones.

Trias—

2. Sandstones and shales, with coal seams, at Ida Bay, containing *Pecopteris lunensis* (R. M. Johnston).
1. Variegated sandstones, with *Vertebraria australis* (McCoy), and remains of heterocercal fishes and amphibians.

1. The sandstones at the Government House Quarry, in the Domain, at Knocklofty, at Ross, &c., belong to the Lower Mesozoic. Mr. R. M. Johnston considers the Lower Sandy Bay mudstones, exposed three miles from Hobart, on the Brown's River Road, to be the base of the system. They contain obscure plant impressions. The variegated sandstones of Lower Sandy Bay are supposed to overlie them conformably. In the Domain, the sandstone has yielded bones of amphibians (*Labyrinthodonts* ?). From the Cascades to Knocklofty, there are about 1000 feet of these sandstones, from which the heterocercal fish, *Acrolepis hamiltoni* (Johnston and Morton), has been recorded. Messrs. Johnston and Morton give the section in ascending order, as follows:—

	Feet.
1. Yellow fissile sandstone … … … … … … …	20
2. Flaggy sandstone, with fish remains … …	5
3. Mottled shales, with plants … … … … … …	60
4. Thick sandstone beds, quarried for building … … … … … … … … … … … … … …	715
	800

The sandstone near Tinderbox Bay is on the same horizon as the Knocklofty beds, and contains remains of a fish described by Messrs. Johnston and Morton, under the name of *Acrolepis tasmanicus.* This sandstone overlies conformably the uppermost beds of the Permo-Carboniferous mudstones.

This series of sandstones and shales contains the plant remains called *Vertebraria australis* (McCoy). Recently, Vertebraria has been regarded as the rhizome of glossopteris. In Tasmania, it is confined to the Lower Mesozoic, and the passage beds at Southport, which are just the strata in which glossopteris has not been found.

3. The sandstones which enclose the Mesozoic coal seams are readily recognised by their soft, felspathic nature; they are generally greenish-grey to yellowish brown, sometimes white. They are widely spread throughout East and South-East Tasmania, and occur also in the South. The maximum development observed is about 1000 feet. They are largely interrupted by intrusions of diabase, which breaks through, and, to all appearances, locally overspreads, them. Whether this overspreading is real, or only apparent, is still a matter of dispute. They flank the Central, Western, and Eastern Tiers, and fringe isolated mountain caps of diabase at Mount Nicholas, Mount Victoria, Mount Saddleback, Ben Nevis, Mount Elephant, Mount Dundas, Cradle Mountain, Ben Lomond, Tower Hill, &c.

From Fingal and Mount Nicholas they extend on the outskirts of the diabase ranges southwards to Seymour, Douglas, and Denison rivers, Llandaff, Spring Bay, and thence all over South-East and a good deal of South Tasmania, besides encircling the whole of the elevated central part of the Island with a narrow girdle. In the South-East they are cut up very much by intrusive diabase. In this brief description detailed mention of localities is impossible. Well-known occurrences are those on Ben Lomond, Schouten Island, Triabunna, Okehampton, New Town, Sandfly Rivulet, Tasman Peninsula, Upper Derwent, Campania, York Plains, Norwich, &c. The fossil flora from these beds must be regarded as characteristic for the Upper Mesozoic. The plants have been scheduled by Mr. R. M. Johnston, as follow:—

Filices—

Alethopteris Australis	(Morris)
" serratifolia	(R. M. Johnston)
Cardiopteris Tasmanica	"
Cyclopteris? Australis (possibly a Salisburia)	"
Danaea Morrisiana	"

Gleichenia dubia	(M'Coy)
Glossopteris moribunda	(R. M. Johnston)
Macrotaeniopteris Wianamattae......	(Feiston)
Neuropteris antipoda	(R. M. Johnston)
„ Tasmaniensis	„
Odontopteris crispata	„
Pecopteris Buftoni........................	„
„ caudata	„
„ odontopteroides	(Morris)
Rhacophyllum coriaceum	(R. M. Johnston)
Sagenopteris Tasmanica	(Feiston)
Sphenopteris Morrisiana	(M'Coy)
Sagenopteris salisburioides	—
Sphenopteris alata........................	(Brongt)
„ elongata	(Carruthers)
„ Tasmanica	(R. M. Johnston)
Strzeleckia gangamopteroides.........	„
„ tenuifolia	„
Taeniopteris morrisiana	„
„ tasmanica	„
Thinnfeldia buftoni	„
„ feistmantelii	„
„ obtusifolia	„
„ media	(T. Woods)
„ polymorpha	(R. M. Johnston)
„ superba	„
„ trilobita	„
Trichomanides ettingshauseni	„
„ spinifolium	(T. Woods)
Equisetaceae.	
Annularia australis	(Morris)
Cycadaceae.	
Podozamites distans?	(Presé)
Pterophyllum dubium..................	(R. M. Johnston)
„ risdonensis	„
„ strahani	„
Sphenozamites feistmantelii............	„
Ptilophyllum oligoneurum	(T. Woods)
Coniferae.	
Baiera tenuifolia..........................	(R. M. Johnston)
Ginkgophyllum australis...............	„
Salisburia hobartensis	„
Zeugophyllites (poa-cordaites) elongatus	„

The sandstones are extensively broken by intrusions of diabase, or dolerite, which cut up the coal measure areas into different basins. Dykes of diabase traverse the beds. This rock, called dolerite in England and diabase on the Continent, is a holocrystalline mixture of augite, labradorite, felspar, and titaniferous iron ore, or magnetite. Its effusive equivalent is basalt; gabbro forms its plutonic roots. It appears to have been a subterranean intrusion of molten material, which never succeeded in reaching the surface, or if it did, its superficial, subaërial portion has been removed by denudation. The masses now visible, as at Mount Wellington, and crowning the Tiers, may be looked upon as huge laccolites and sills. Up to the present, no evidences of lava flow have been found in the structure of this rock. It is devoid of ore-deposits.

Tertiary.

A great stratigraphic break exists between the Mesozoic and the succeeding strata. The Tertiary system cannot be subdivided as in Europe. Mr. R. M. Johnston has proposed the two divisions, palæogene and neogene, which are here adopted. According to this arrangement, the Tertiaries will be subdivided, as follows:—

Neogene (= approximately to pliocene)—

4. Glacier moraines of the Western highlands.
   River terraces and estuarine deposits.

Paleogene (= Eocene to miocene)—

3. Basalt lavas.
2. Fluviatile and lacustrine clays and sands, tin-ore drifts and leads.
1. Fossiliferous marine beds at Table Cape (= Eocene).

1. The researches of J. Dennant and the late Professor Ralph Tate have shown the marine fossiliferous beds at Table Cape to be of Eocene age. These strata are covered with the basalt, which, in the Island, appears to separate the lower from the upper Tertiaries.

2. The extensive lacustrine deposits within the watershed of the Tamar and its tributaries were described long ago by Mr. Johnston, under the apt title of sediments of the Launceston Tertiary basin. They cover an area of 600 square miles, and embrace the pre-basaltic or palæogene clays and sands, which are spread all over that part of the Island, as well as the post-basaltic, or neogene, valley terraces. The thickness of these beds is from 900 to 1000 feet.

At Launceston, the ferruginous sands and clays of the Windmill Hill are palæogene. They contain fossil impressions of the plant genera, *Betula*, *Fagus*, *Quercus*, *Cinnamomum*, *Banksia*. At Dilston, Windermere, and Muddy Creek similar beds occur. At Carr Villa, the boring-core showed an impression of *Betula* at a depth of 500 feet. A bore at Belmont went down in the palæogene sandstones and shales to 894 feet, without reaching bottom. This is equivalent to about 200 feet below sea-level. At Beaconsfield, palæogene clays rest in a gutter of palæozoic rocks, 270 feet below sea-level, and their lowest layer is rich in fossil fruits (*Spondylostrobus*, *Platycoila*, *Cordia*, &c.), and a leaf of *Cinnamomum* has been recorded. Fossil conifers are also found in this bottom clay. In the N.E., the high plateau of sand and gravel, containing alluvial tin-ore, near Derby and Branxholm, which is capped with basalt, marks the ancient course of the Ringarooma River before it was choked with lava, and diverted to its present channel. At Burnie, in a white pipeclay below the basalt, imprints of leaves of European types have been found. At Waratah, leaf-imprints have been obtained from a greyish Tertiary sandstone, beneath 45 feet of basalt, at a height of 2000 feet above sea-level. These leaves have been determined by Mr. R. M. Johnston, as follows:—*Eucalyptus kayseri* n.s., *Laurus sprentii* n.s., *Quercus bischoffensis* n.s., *Ulmus tasmanicus*, *Cycadites microphylla* n.s. Leaf-beds of similar age, and containing impressions of *Cinnamomum*, also occur in the cliff at Strahan. Tertiary leaf-beds also exist in the tin-drift in Thureau's deep lead at St. Helens. The basin of the Derwent exhibits a series of Tertiary sands and clays, the latter of which, at Cornelian Bay, Sandy Bay, One Tree Point, Glenora, &c., contain the usual impressions of *Quercus*, *Fagus*, *Salix*, *Cinnamomum*, &c. The so-called travertin, at Geilston, contains *Cypris alburyana* (Johnston), conifer stumps, and leaf impressions of *Quercus*, *Fagus*, *Salix*, *Cinnamomum*. At the head of Oyster Bay, near Swansea, there are Tertiary, probably palæogene, clays, which contain a good deal of clay ironstone. Beds and seams of lignite occur at Dilston, Evandale Junction, Kelly Basin, and other places in Tertiary areas. At Kelly Basin, such beds contain fossil resin, and at Evandale Junction the beds also enclose resin globules.

3. At the close of the Palæogene, a great outpouring of basaltic lava took place, and this rock is very general throughout the Island, though rarer on the West Coast. Three types of basalt have been met with up to the present:—1, olivine basalt; 2, nepheline bearing olivine basalt; 3, melilite basalt, associated with nephelinite. The first type is the common variety of the Island. It has overspread the Campbell Town and Conara plains, and widely conceals sediments in the Launceston Tertiary basin. Its mineral constituents are uniformly felspar + augite + olivine. Its texture is doleritic on the coast N. of Lefroy, at Mount Horror, at Paddy's Peak, Hampshire. Fine

columnar structure may be seen in the quarry near the breakwater at Burnie. Dykes of this basalt traverse the granite at Lottah, and at the summit of the Blue Tier. At One Tree Point, Sandy Bay, a basalt is exposed which contains the red-iron olivine fayalite, visible under a hand-lens, as dark red spots (described by O. E. White and W. A. Macleod). Basalt-glass, or tachylyte, occurs in the basalt in several parts of the Island, *e.g.*, Waratah, Richmond, Bothwell, &c. No craters are known.

The second variety of basalt is that forming the remarkable bluffs at Circular Head and Table Cape. The late Professor Ulrich at one time determined it to be nepheline-bearing, but afterwards withdrew the reference to nepheline, believing the mineral in question to be apatite. Apatite is abundant in the rock, but recently microscopical examination has shown nepheline to be present also. The structure is doleritic; the mineral constituents are plagioclase + augite + olivine + nepheline.

The third type is melilite basalt, with typical nephelinite, or nephelinite-dolerite, at the Shannon Tier, near Bothwell. The geological horizon has not yet been determined, but the age is believed to be Tertiary.

4. *Neogene.*—The post-basaltic valley terraces can only be separated from the earlier Tertiaries by position and lithological characters. Some of the gravel drifts of the Derwent, of the Longford plain, and in the neighbourhood of Launceston, belong to this division. The lignite beds of the Henty River contain leaves of *Fagus jonesii* (Johnston) and *Acacia meiringii* (Johnston), both closely resembling existing species.

The close of the Tertiary, or the beginning of the Quarternary, witnessed a glacier epoch in the western part of the Island. The highlands round Barn Bluff, Mounts Tyndal, Sedgwick, Jukes, Darwin, &c., and the western edge of the great central plateau, abound with tarns, ice-scratched stones, and moraines. Signs of ice-action have been traced to sea-level on the West Coast, but the most abundant evidence is to be found above the 2000-feet level. No proof of glacier conditions in this period in the Eastern part of the Island has been adduced yet.

Tin-ore and gold-ore are the most important of the mineral resources of the Tertiary system. These occur in the alluvial gravels and leads of the period. The sands in the Savage River, and other tributaries of the Pieman, have been worked for osmiridium, and, at Mount Stronach, for monazite. The zircon sand, near Table Cape, was also exploited a few years ago. Tertiary clays are used largely for brick-making and pottery; the gravels for road-making. Though there has been great volcanic activity, there are no signs of Tertiary lode-deposits.

Quarternary.

Recent—

3. River alluvium and sand dunes.
2. Raised beaches and helicidæ sandstone.

Pleistocene—

1. River drifts.

The later terrace drifts in the valleys of existing rivers are referred to the Pleistocene. Sand dunes, consolidated to shelly sandstones, occur on Cape Barren, Badger, Kangaroo, and other islands in Bass' Straits, containing shells of helix, succinea, &c. These sandstones sometimes overlie a raised beach. The raised beaches on the North Coast indicate elevation within the recent period.

The foregoing sketch does not pretend to do more than merely outline the general geology of the Island. Much information has been drawn from the labours of Mr. R. M. Johnston, here acknowledged, but many important matters still require attention. Among these are—(1) age of the schists of Mounts Lyell and Read; (2) age of the hornblende schists of the Rocky River; (3) age of the quartz-porphyry, or felsite, of Mounts Jukes and Darwin, and its relation to the granite; (4) age and nature of the Barn Bluff schists; (5) age of the gneiss and schists of the Upper Forth; (6) connection (if any) of the Lynchford augite-syenite-porphyry with the felsites on Mount Jukes and Mount Read; (7) geological occurrence of the Mesozoic diabase; (8) origin of the obsidian "buttons"; (9) connection of the nepheline basaltoid rocks at Circular Head and Table Cape with the prevailing normal basalts; (10) age of the elæolite syenites and phonolitic rocks at Port Cygnet and their boundaries; (11) origin of the lake basins in glacier areas and on the Tiers; (12) the nepheline and melilite rocks at Shannon Tier; (13) the occurrence of garnetiferous chlorite schist in granite at St. Helens, and numerous other questions fraught with interest to the geologist.

These remarks may be closed by mention of the names of resident geologists, to whom inquirers may address themselves for information:—In the South: Mr. R. M. Johnston, stratigraphy and palæontology; Mr. Thos. Stephens, M.A., Hobart, stratigraphy; Mr. O. E. White, Hobart, eruptive rocks. In the North: Mr. W. F. Petterd, Launceston, mineralogy and petrology of the Island; Mr. Geo. A. Waller, Assistant Government Geologist, Launceston, geology and ore deposits. In the West: Mr. F. J. Ernst, Zeehan, eruptive rocks and ore deposits; Mr. T. B. Moore, Strahan, glacial geology. In the East: Mr. Henry Grant, St. Helens, granites and tin-ore deposits.

Suites of Tasmanian rocks, fossils, ores, and minerals may be seen at the Tasmanian Museum, Hobart (Mr. Alex. Morton, F.L.S., Curator); the Victoria Museum, Launceston (Mr. H. H. Scott, Curator); the Zeehan School of Mines (Mr. Reid, Director); the Government Geologist's Office, Launceston. A complete collection of Tasmanian minerals is owned by Mr. W. F. Petterd, Launceston.

THE MINERALS OF TASMANIA.

By W. F. Petterd, C.M Z.S.

To the geologist, the fascinating science of mineralogy must always be of the utmost importance, as it defines with remarkable exactitude the chemical constituents and combinations of rock masses, and, thus interpreting their optical and physical characters assumed, it plays an important part part in the elucidation of the mysteries of the earth's crust. Moreover, in addition, the minerals of a country are invariably intimately associated with its industrial progress, in addition to being an important factor in its igneous and metamorphic geology. In this dual aspect this State affords a most prolific field, perhaps unequalled in the Commonwealth, for serious consideration.

In this short article, I propose to review the subject of the mineralogy of this Island in an extremely concise manner, the object being, chiefly, to afford the members of the Australasian Association for the Advancement of Science a cursory glimpse into Nature's hidden objects of wealth, beauty, and scientific interest. It will be readily understood that the restricted space at the disposal of the writer effectually prevents full justice being done to an absorbing subject, which is of almost universal interest, viewed from the one or the other aspect. The economic result of practical mining operations, as carried on in this State, has been of a most satisfactory character, and has, without doubt, added greatly to the national wealth; but, for detailed information under this head, reference must be made to the voluminous statistical information, and the general progress, and other reports, issued by the Mines Department of the local Government. Suffice it to say, under this head, that metallic ores and metals to the gross value of about fifteen million pounds sterling have been won during the past decade.

This short article has been prepared for the collector of minerals as such, thus leaving the geological aspect of the subject to other hands, and the economic side of the question to its special State Department. It will be found that this Island is one of the most favoured hunting-grounds for the mineral collector; its diversified topographical character, with numerous mountains and valleys, affords special facilities for the prospector and miner, while its geology offers the wide range of the crystalline quartzite and schists of the Archæan and Silurian epochs to the Tertiary and Recent formations. In addition, the Island presents an almost boundless variety of igneous rocks, ranging from the older and almost indecipherable felsites to the effusive melilite and normal basalt, with their varieties.

A prominent feature on the North-West and North-East and granite bosses, enclosing pegmatite dykes and elvan courses, which afford the minerals peculiar to these acidic rocks. The serpentine intrusions of the North and North-West add diversity to the region available to the mineralogist, while the apparently intrusive Mesozoic dolerite, which claims so large an extent of the Island, is not an altogether barren field for the ardent mineral collector. On almost every side something great or small will be found worthy of attention, and, should the excursion be extended to the northern portion of the State, the most advanced enthusiast may rest assured that ample scope will be found for hammer and bag, with every reasonable certainty of his being able to add to the cabinet specimens both rare in nature and fine in quality.

Concise Retrospect of the More Important and Interesting Minerals Known to Occur.

Among the native elements may be mentioned the beautifully-crystallised alluvial masses of gold which have been and still are occasionally obtained in the district immediately west of the mining township of Waratah. Native bismuth occurs, disseminated through a hornblende matrix, at Mount Ramsay, and, in association with fluor, wolframite, and chalcopyrite, at Mount Black, and a mass, weighing 55 lbs., was obtained near Weldborough in alluvial tin-drift. Native copper is found, as foil of extreme tenuity, in the cleavages of the killas, or slate, adjacent to the celebrated Mount Bischoff Mine, and is abundant in the form of arborescent masses about Mount Lyell; in fact, at one locality it has been worked as an ore of the metal. Native silver occurs at several of the Zeehan and Heazlewood mines, and some remarkably beautiful examples have occasionally come to light. Sulphur has been obtained in some quantity in the Mount Bischoff workings, and a limited dusting of this element has been observed on some of the galenite won at the Montana Mine, Zeehan. Diamonds have been shown as from the Mount Donaldson district, Pieman River; but the reported find needs confirmation. Osmiridium occurs in association with gold at the Savage River and other localities north of the Pieman, and, in small particles, near the Blue Tier, Beaconsfield. This alloy has been extensively sought for recently for the iridium contents, but with only scant success as regards quantity. Native iron is known from two recorded meteorites; the first obtained at the Blue Tier, and the second, a small but veritable specimen, from the Castray River. (Proc. Royal Soc., Tas., 1901.) Tellurides are not actually known to occur, but the refining of bismuth from the Shepherd and Murphy Mine, Bell Mount, reveals the fact that tellurium occurred as a contamination. It is, therefore, reasonable to anticipate the discovery of telluride of this metal. In the sulphides the majority of those usually encountered in metalliferous localities are abundant, with several of exceptional occurrence, such as dufrenosite, huascolite, stromeyerite, zinkenite, and jamiesonite. Stannite is mined as an ore at the Oonah Mine, Zeehan, where it is occasionally found intermixed with bismuthenite, a most unusual association. Fahlerz, or tetrahedrite, is remarkably abundant, often highly argentiferous, such as that mined at the Curtin and Davis Mine, near Ringville, where it frequently assays several hundreds of ounces of silver to the ton; while specimens have been obtained at the Hercules Mine assaying as high as 3000 ounces. At the Heazlewood, a richly-nickeliferous variety of pentlandite occurs, which has been named heazlewoodite. Bornite of most beautiful colouration is commonly found in the Mount Lyell district, and stibnite only occurs in the auriferous reefs of the Lefroy district. Tennantite is said to occur at the Mount Lyell Mine, associated with cupriferous pyrite and chalcopyrite. On the North-East Dundas field, compound sulphides of unrecognised species are occasionally met with. They are homogeneous interchanges of the elements S, As, Bi, Cu, Fe, and Pb, with more or less Ag and Au. A remarkably fine example was obtained at the No. 1 Curtin and Davis Mine, in the form of an interwoven group of large prismatic crystals, longitudinally striate. This, on analysis, proved to be a sulphide of bismuth and antimony, with small proportions of iron and copper. To this I propose to apply the specific name of histrixite (porcupine ore). The metallic minerals of this portion of the State are well worthy of study. At Mounts Reid and Murchison are enormous deposits of the mixed sulphides of Fe, P, Zn, and Cu—all more or less auriferous (sometimes to a high degree) and argentiferous. They are, apparently, the result of metasomatic replacement. The arsenides and sulph-arsenides are but sparsely represented in variety, but are occasionally abundant individually. Arsenopyrite is very characteristic of the mineral field in the vicinity of the Scamander River, and leucopyrite occurs in the Colebrook Mine, in company with axinite and pyrrhotite, and also contaminates the ores of the North-East Dundas district. At Barn Bluff, zones of the older schists occur, impregnated with pyrrhotite and cupriferous pyrite. A noticeable feature in this last-mentioned district is that, on the exposure of the freshly-taken-out mineralised rock, it is quickly coated with an efflorescence of white and yellow iron sulphates. At the McKimmie Mine, near the junction of the serpentine and Silurian slates, some quantity of massive pure niccolite was obtained and exported, but it is not now accessible. The compounds of Cl, Br, and I are but sparsely represented; the superficial portions of some of the silver-lead lodes occasionally contain appreciable quantities of cerargyrite, embolite, and, still more rarely, iodyrite. A very impure Halite, occurs at the Salt Pans, east of Oatlands, and atacamite has been observed in comparatively small spangles on the outcrop of the Comet Mine. The most noticeable discovery in this group is a species recently described under the name of petterdite, and collected in the silicious outcrop of the Britannia Mine, near Zeehan. It is a chloride of lead, containing As_2O_5, and P_2O_7, with a smaller quantity of Sb_2O_5. It occurs in implante groups of quasi-hexagonal plates of somewhat large size and attractive appearance.

Of the fluorine compounds, fluorite is abundant at the Mount Bischoff Mine, where, also, prosopite—a hydrous fluorite of aluminium and calcium—also occurs as a secondary product. At the Republic Tin Mine, Ben Lomond, as well as at the Mount Black Mine, fluorite is obtained from white to a dark purple colour, sometimes in well-cut but small cubes. Its variety, chlorophane, occurs at Bischoff and Hampshire in amorphous and crystalline bunches.

In the assemblage containing the oxides of the gold, iron, and tin groups, the number is naturally somewhat extensive, and, individually, often exists in considerable quantity, such as asbolite (occasionally cobaltiferous); hematite—that at the Blythe River being of remarkable purity, and practically inexhaustible abundance—limonite, pyrolusite, &c. Among the more noticeable are the fine crystal developments of cuprite in the vicinity of Mount Lyell. Its lovely variety, chalcotrichite, occurs in small capillary tufts of an intense crimson colour at the Colebrook Mine, near Ringville. The sapphire occasionally abounds in tin-drift in the North-East mining districts, and is sometimes of the beautiful royal blue so eagerly sought after by gem-hunters. The pleonaste, or black spinel, on the same tin-fields, is one of the many common minerals known to the miner as "Black Jack." On the Zeehan and Dundas field very fine specimens of stilphnosiderite and massicot have been met with. Cassisterite occurs in fine, well-developed, intensely black crystals—often macled—at the Lottah Mine at Blue Tier, Bell Mount, and Storey's Creek, in the Ben Lomond district. At Constables' Creek, on the North-East Coast, bunches of well-formed mahogany-coloured crystal groups have been met with, and at Mount Bischoff the impregnations of this mineral in the local topaz-porphyry are of special interest.

At the Rex Hill Mine, the tin-ore is impregnated throughout a granite rock, in which the large orthoclase crystals are pseudomorphed to cassiterite, this being the first recorded instance of such a replacement in this State, or, perhaps, outside the classical locality in Cornwall, England. Alluvial tin is found in great profusion of colouration; it varies from glassy (almost colourless), to amber, brown, and ruby, hence the local appellations of resin tin, ruby tin, and so on.

Among the oxides of the elements of the arsenic and sulphur groups, nothing worthy of special mention has been exhumed, with the exception of wolframite, bismite, and cervantite.

Chief among the elements of the carbon-silicon group is the oxide of the latter quartz. It appears here in hosts of varieties, even for so variable a mineral. Among the more common forms are rock crystal, chalcedony, cornelian, cacholong, and infusorial earth. The milk-opal, with an occasional splash of the fire and colour of the precious variety, is abundant, impregnating and seaming the Permo-Carboniferous sandstone at Bothwell, and wood opal (silica after organic matter) has been obtained in very beautiful and perfect examples, so much so that much of the material is worthy the attention of the lapidary. In the bi-silicates, which comprise the rock forming iron-magnesium minerals, are pyroxene and hornblende, with their array of conflicting variations, both as regards diversity of colour and growth. In the Heazlewood district, the rhombic form, bronzite, and its variety bastite, are obtained in characteristic development, and the monoclinic diallage, often altered to schiller-spar, occurs at the same locality. Well-formed crystals of augite of fair size may be collected in quantity near the Railway Bridge which spans the Hellyer River. At the Colebrook Mine, uralite reaches a remarkable state of development. The average specimens of hornblende, tremolite, and actinolite are found, while beryl of comparatively enormous size, but dull colouration, occurs in a pegmatite dyke about 500 yards north of the Republic Mine, Ben Lomond. It is associated with extremely fine and perfect crystals of an almost white orthoclase, the individuals of which sometimes reach several inches in length, and are occasionally twinned.

Among the unisilicates, axinite is to the front as a prominent species. It is almost solely confined to the igneous formation known as the Colebrook Mine. It is in large violet-coloured plates, freely interspersed in association with calcite, pyrrhotite, datolite, arsenical and iron pyrites. Garnet of several sub-species is occasionally met with, and a new manganese variety, which has been named Johnstontite, has been discovered in the peculiar rocks at Port Cygnet. At Hampshire Hills there is an extensive development of well-crystallised idocrase, which, practically, illustrates a contact phenomenon. The white silvery lithia variety of muscovite, which is termed zinnwaldite, is plentiful in the tin-districts on the North-East Coast. Of the whole group of felspars, as occurring in this State, orthoclase has its highest crystallographic development. In the trachytes and phonolites of Port Cygnet wonderfully-fine crystals are easily broken free of the rock, and these often show both Baveno and Carlsbad twinning; its variety, sanidine, also occurs at the same locality in almost colourless glassy crystals. A massive white scapolite has been unearthed at Beaconsfield. Saussurite is abundant in the altered gabbros of the Heazlewood district. In the alluvial tin-drifts of the North-East and at Shekelton, near Table Cape, the zircon occurs in extreme profusion. Many from the former locality are really nice gem-stones when properly cut, and are reported to be among the most lustrous in the world. In the rock-forming section of the group we can claim hauynite, nephelite, and melilite, all old-world forms only recently identified as occurring here, the last giving its prefix to a basaltic rock at Shannon Tier.

Here we must note those remarkable pellets of mystery, the only known form of acidic volcanic glass which has, so far been discovered in the Island, and which are usually termed obsidian buttons, but more recently obsidianites and australites. Whence came they, and why have they been so long neglected by our local geologists and physicists?

Although obscure in appearance and diminutive in size, they are difficult of interpretation, and offer a field of investigation worthy of any student of natural phenomena. That they are extra-terrestrial is almost beyond doubt; in any case, it is obviously apparent that they can have no connection with the known Tertiary volcanic rocks as occurring here, for these are all of basic composition. The writer is strongly of the opinion that but one shower of these objects occurred, in post-Pliocene times, which impinged upon the earth in a north-western track, crudely extending from this Island to Victoria, from thence to the northern part of West Australia, and thence to the western islands of the Malay Archipelago. It has been noticed that examples collected from many points along the track indicated have the same general characteristics as regards form, colouration, size, and composition. Moreover, they almost invariably present the same amount of surface abrasion. Recent writers have shown that there are reasonable grounds for the supposition that they are of meteoric origin, but there still exists a remarkable diversion of opinion as to their source.

In the sub-silicates we possess a few species which will repay attention, not the least interesting being the water-clear topaz, which occurs so abundantly about Mount Cameron, at Bell Mount, and at Killikrankie Bay, Flinders Island. These make veritable gem-stones of high lustre and limpid beauty, and are often used as such. Sometimes they are of unusually large size and good crystallographic development. The variety pycnite occurs at Bischoff, in patches of radiating disks. The ordinary black schorl, or, more scientifically, tourmaline, is very abundant in large masses and radiating bunches wherever the stanniferous granite prevails. A hair-brown variety has been collected near the northern flank of Mount Heemskirk, and its near ally, zeuxite, which assumes an aciculated habit, is plentiful at Mount Bischoff, its only locality in this Island. Our local petrologists know how microscopically abundant and disseminated sphene has proved to be. At the Lucy River, a tributary of the Pieman, our only known sillimanite schist occurs. In the zeolites, we have a goodly array of species, in conformity with the variety and profusion of their parents, the effusive and other igneous rocks. Analcite is often met with in the hauyne-phonolite of the Port Cygnet series. The prevailing dolerite affords scolecite, which affects a radiating structure. In the nephelinite of the Shannon Tier the white natrolite is extremely plentiful, freely bespattering the rock with bunches, and coating the vughs. At Bell Mount, remarkably-fine double-terminated crystals of gmelinite have been obtained. The ordinary forms, such as chabazite, phacolite, and phillipsite, are to be found in more or less quantity, and in all states of preservation, where the Tertiary effusive rocks prevail. In the basaltvitrophyre, which is, apparently, common about Sheffield, numerous beautiful zeolites abound, including radiating masses of stilbite several inches in length. The margarophyllite section embraces a large number of those indefinite so-called mineral species which, as a rule, do not afford the mineralogist any serious interest. It includes the normal chlorite, and a variety poor in iron, which is termed leuchtenbergite, which has been identified in the variolite rock at the Magnet Mine, beyond Waratah. In every way, typical gilbertite is abundant at the Anchor Tin Mine. Sericite occurs as sericite-schist, and talc of a beautiful pale-green colouration and glimmering lustre has been discovered on the north flank of the Meredith Range. A thin seam of green pyrophyllite, highly auriferous, occurs at the Mount Lyell Mine, as a thin flucan between the ore-body and the adjacent country-rock. Serpentine in considerable variability is prominent at the Forth, near Beaconsfield, at the Heazlewood, on the Huskisson River, and at Dundas, that from the last-mentioned locality often showing splashes and blebs of kammererite. At the Heazlewood this substance appears to merge into the ultra-basic and gabbroid rocks of the locality. In the class of anhydrous phosphates, apatite is only known in very limited quantity at the Hampshire Hills; the same may be said of mimetite and plumbogummite. Pyromorphite, in compact entanglements of the hexagonal prisms of a peculiar dark-green colour, has been found plentiful at one of the Zeehan silver-lead mines, and carminite has recently been identified from the Magnet Mine. At the Britannia Mine, Zeehan, a small quantity of campylite, showing the characteristic barrel-shaped crystals, is known to occur. Quite recently diligent search has been made for the phosphate of the cerium metals, monazite, on account of the thorium contents, which element, in the form of nitrate, is used in the manufacture of the incandescent gas mantles. It has been found to occur in the form of heavy alluvial sand, practically, wherever the granite is met with. In this form it has been obtained at the Stanley River, a tributary of the Pieman, at Mount Stronach, at the Pioneer Mine, at the South Esk Tin Mine, and at Derby; but, so far, not in sufficient quantity to render it of economic value. Of the hydrous phosphates, wavellite is, perhaps, the most abundant and mineralogically interesting. It is found in aggregates of mining, radiating disks of silvery white, implanted on the cleavages of the Silurian slate at Back Creek. It is often accompanied by varisite, and a little of the former has been noticed at Mount Ramsay. Clustering radiating acicular bunches of pale blue symplesite occur on ferro-manganese gossan in the upper levels of the Magnet Mine, and evansite has been obtained at Zeehan under similar circumstances. At the Comet, Dundas, and other silver-lead mines, masses of bindheimite have been mined, but good examples are not now, by any means, easily obtainable. Of the tungstates, &c., a few species are known to occur occasionally, such as scheelite (Mount Ramsay), wolframite, and a small quantity of vanadinite.

The sulphates and chromates of the metals are always of interest, and welcome additions to the cabinet of the collector, as they are often beautifully crystallised and attractively coloured. The Comet Mine has become somewhat celebrated as the producer of, perhaps, the finest groups of anglesite that have been found in the Commonwealth, and the carbonates of lead (cerussite) from the same mine have an almost equal reputation. But the mineral which has rendered this State famous among collectors in all parts of the world is the inimitable crocoisite, especially that obtained some few years back at the Adelaide Mine, Dundas. Its intensely-bright hyacinth-red colour, prismatic habit, and adamantine lustre render it one of the most attractive objects in the mineral world, and it has, consequently, been most eagerly sought after by all who admire Nature's handiwork. Few collectors of any note are now without specimens of this beautiful substance, but still the demand appears to continue; from far and wide, applications are continually being made for the mineral as occurring in the Dundas Mine. It has also been obtained at a few other localities, notably, in the Heazlewood district and at the Magnet Mine.

On the East Coast, the extremely-rare phospho-chromate of lead and copper, vauquelinite, has been obtained. It assumes a curious siskin-green colour, and is almost invariably amorphous, without any indication of crystallisation. It has been thought to be practically confined to the silver-lead region of Siberia, and, therefore, its detection in this State is of more than passing interest.

The hydrous section is represented by alunogen, epsomite, melanterite, and a few others of like nature, including a peculiar group of iron-chrome sulphates from the Blue Tier, near Beaconsfield. In the carbonates we have fine crystallised cerussite from the Mount Reid and Comet mines, and equally attractive delicate-pink rhodochrosite from the Hercules Mine. On all our silver-lead fields siderite is a common lode gangue, and, as such, it not unrarely shows finely-developed crystals, and the same applies to the dolomite of the Magnet Mine. In the hydrous class of carbonates is the local dundasite, and the bright apple-green zaratite—the latter confined to the serpentine region at the Heazlewood. It is, undoubtedly, the finest occurrence known of this comparatively rare substance. In habit it assumes a varnish-like coating on pentlandite and chromite. The carbonates of copper malachite and azurite both occur, but not nearly so highly developed as at many localities on the Mainland.

Among the hydro-carbons there are a few worthy of more than pasing interest, among which may be mentioned the tasmanite of the Mersey, the pelionite, or cannel coal, of Mount Pelion, and the asphaltum found on the eastern Bass Straits islands; but, unfortunately, not in quantity to render it of commercial importance. With the Tertiary lignite at Macquarie Harbour, masses of copalite, or a species allied thereto, are often met with. It burns with a bright, smoky flame, and gives off an aromatic odour.

In conclusion, it may be well to remark that the total number of distinct species known to mineralogical science may be estimated at between two and three thousand, and of this number a few years' investigation has resulted in the discovery and recording of not less than 300 in Tasmania; so it may be conceded that within the restricted confines of this Island we have an unusually prolific harvest of these compounds and native elements. In all reasonable probability, this is a larger number than has been recorded for any equal area on the surface of the globe, an area, moreover, which is, apparently, far from exhausted. It may be of interest to state that about forty species occurring here have not, so far as known, been discovered on the mainland of Australia, while at least five are not known elsewhere. Several of the more prominent for beauty and scientific interest, such as crocoisite, vauquelinite, zaratite, datolite, and axinite, were, until recent years, supposed to be confined to classic localities, but in our little Island are comparatively abundant and attainable.

THE MAGNETIC SURVEY OF TASMANIA.

By Professor E. G. Hogg, M.A.

[*Read before the Royal Society of Tasmania, 13 August, 1900.*]

Section I. The History of Magnetic Observation in Tasmania.
Section II. Magnetic work in Victoria and New Zealand.
Section III. The work of the proposed Survey.

I. *The History of Magnetic Observation in Tasmania.*

The earliest record of a magnetic determination in Tasmania I owe to the kindness of Mr. T. Stephens, M.A., one of the Vice-Presidents of this Society. From his communication to me it appears that when Sir John Franklin founded the village of Lachlan in 1839 the magnetic declination at Lachlan was 10° 10′ E.

In the first volume of the *Tasmanian Journal* is a copy of the communication addressed by Sir James Ross on the 7th April, 1841, to the British Admiralty, in which he sets forth, among other matters, his discovery of the position of the southern magnetic pole. In latitude 76° 14′ S. and longitude 164° E. he found the magnetic dip to be 88·40°, and the declination 109·24° E.; from which he deduces that he was then only 160 miles from the magnetic pole. The impetus given to magnetic research by his discovery was, probably, the determining cause which led to the subsequent selection of Hobart as the spot on which were afterwards carried out the first systematic magnetic records ever made in Australasia.

From its southerly latitude, its situation relative to the great land-mass of Australia, and its position almost in antipodes to Great Britain, Tasmania is eminently fitted as a station for magnetic observations, and, recognising this, the Royal Society of London, in the early forties, fitted out a complete survey party, with the latest form of instruments, to investigate, under the superintendence of Lieut. Kay, R.N., the magnetic elements of Tasmania, and to determine the rate of variation of these elements. The instruments were set up in the Domain, not far from Government House, and observations were taken covering the period from 1842 to 1850. The results obtained in Hobart were subjected to the closest examination by Sir Edward Sabine, and from them, taken in conjunction with observations made at a later date in other colonial observatories, some important generalisations were obtained by Sabine with regard to the magnetic problem in the southern hemisphere.

It is a matter of regret that neither in the library of this Society, nor in the public and parliamentary libraries of Hobart, is to be found the official publication of either the magnetic observations made by Lieut. Kay and his colleagues in Hobart, or of Sabine's report thereon. In this context it may not be out of place to state that in the Hobart Observatory is a large accumulation—perhaps 60 or 70 volumes—of the actual records of observation made by the members of the Royal Society's expedition. The scientific enthusiasm of the Government Astronomer, Mr. Kingsmill, has rescued them from the decay into which they were likely to speedily depart if left in the condition in which he found them when he took possession of the observatory; and, though they now rest in the decent obscurity of a shelf in the observatory cellar, this scarcely seems to be a suitable place of interment, and I trust that this Society, as the leading scientific body in Tasmania, may see its way to secure these records, which are, so to speak, scientific heirlooms of the greatest interest.

I will now lay before the Society a brief *résumé* of the results obtained by Lieut. Kay and his party during their prolonged stay in Hobart. In 1843 the mean declination of Hobart was 9° 53′ 19″ E., and between this date and 1848 it increased to 10° 0′ 37″, giving a total increase of 7′ 18″, or an annual increase of about 1′ 27″. During the period covered by Lieut. Kay's observations the dip fell from 70° 42′ 18″ in 1842, to 70° 32′ in 1845: it then began to increase, and in 1848 it had attained the value of 70° 35′ 42″. The happy accident that, during Lieut. Kay's stay in Hobart, the dip passed through a minimum value, is a matter for much congratulation. It is also of great interest to find that, during the period under consideration, the mean value of the horizontal intensity also passed through a minimum value. This minimum value was reached, not in 1845, when the dip was at a minimum, but three years later—in 1848. An admirable account of the instruments used by Lieut. Kay in his magnetic work in

Hobart is given by him in Vol. I. (1842) of the *Tasmanian Journal.*

A long gap is now met with in the magnetic history of Tasmania. No absolute determination of the magnetic elements was again made until the visit of Dr. Neumayer to Hobart, in 1863. This observer determined the mean declination of Hobart in 1863 as $10^\circ\ 25'\ 9''$ E. If the mean rate of increase inferred by Lieut. Kay from his observations had held true over the period between 1843 and 1863 the declination should have been $10^\circ\ 22'\ 53''$. The difference between the observed and computed values of the declination for 1863 may (in part) be accounted for by the fact that the stations selected by Lieut. Kay and Dr. Neumayer were not identical, though both were situate in the Domain. I shall, later on, have occasion to refer to the part played in magnetic work in Tasmania by the volcanic rock—known as Tasmanian greenstone—which occurs so widely in the S.E. of the Colony, and, in particular, outcrops so much in the Domain. Accepting Dr. Neumayer's result as correct, the increase of declination of Hobart between 1843 and 1863 amounts to $31'\ 50''$, giving a mean annual increase of $1'\ 36''$, as against $1'\ 27''$ computed from Lieut. Kay's observations. The declination in 1881, when the next determination was made, should have been $10^\circ\ 53' 48''$; assuming the previous rate of increase to have been maintained, but the observations made by His Excellency Sir J. H. Lefroy at the station employed by Kay discovered the declination to be only $8^\circ\ 49'\ 2''$ E., a quantity somewhat more than 2° in defect of the computed value. Although the instrument employed by Sir J. Lefroy—a prismatic compass—is not the most delicate instrument for determining the magnetic declination, the difference between the observed and computed values of the declination in 1881 cannot be put down entirely to errors of observation. The explanation is not far to seek: between the dates mentioned the declination must have attained a maximum, and was, in 1881, proceeding to a minimum. In the neighbouring Colony of Victoria we know that in the 15 years preceding 1881 the declination decreased at the rate of about $2'$ per annum, and from what we know of the secular variations elsewhere, it is permissible to assume that a state of affairs obtained in Tasmania similar to that in Victoria. If the same weight be attached to Sir J. Lefroy's determination as to that of Dr. Neumayer, we should have that, during the period under discussion, the annual average rate of change of declination was no less than 5′—assuming that the maximum declination was neached in 1863—the most suitable hypothesis for reducing the change of declination to a minimum. Seeing that the annual rate of change in Victoria between 1866 and 1881 only amounted to 2′, it is difficult to accept for Tasmania an annual average rate of change so large as 5′. The explanation may lie in the rough method of determination employed by Sir J. Lefroy; at all events, it is a matter of some importance that this difficulty should be cleared up.

If any magnetic measurements were made by the American expedition to Hobart to observe the transit of Venus in 1874, I have been unable to find them. The same remark applies to the observations made by the Austrian scientific expedition which visited Hobart between two and three years ago. As, however, the observations of the lastmentioned party were made at the Observatory, where the highly magnetic greenstone outcrops, their results are quite valueless for the purposes of comparison with those of Kay and Neumayer.

The results of the observations taken by Lieutenant Colbeck and Mr. Bernacchi of the Southern Cross, during the recent stay of that vessel in Hobart, have not yet reached me.

This brief summary of the history of magnetic research in Tasmania shows that during the visit of the Royal Society of London's expedition both the dip and the horizontal intensity passed through minimum values, and leads us to infer that after Dr. Neumayer's visit the declination passed through a maximum value, but when this occurred we do not know, and what is the present annual rate of change of the declination we do not know.

II.—*Magnetic work in Victoria and New Zealand.*

Absolute magnetic measurements were first begun in Victoria, in 1858, by Dr. Neumayer. Between that date and February, 1863, he carried out, without interruption, hourly readings of the magnetic elements, these differential observations being kept under control by frequent determinations of the absolute values of the magnetic elements, eight such absolute determinations being made, on the average, each year. During the same period Dr. Neumayer made a complete magnetic survey of Victoria, the magnetic elements being measured at no less than 235 stations. After the departure of Dr. Neumayer from Australia, absolute measurements of the elements were made from time to time by Mr. Ellery, F.R.S., then Government Astronomer, with Neumayer's instruments, until 1865. In the following year a new set of instruments was provided for the magnetic observatory, and since that time the absolute values of the magnetic elements have been determined about ten times each year. This work is now being carried on by Mr. Baracchi, F.R.A.S., Government Astronomer, to whom I am indebted for this brief sketch of the history of magnetic observations in Victoria.

Some few years ago the question of the magnetic survey of New Zealand was brought before the Government of that country, who decided to devote the sum of £500 a year to the purpose. The work was entrusted to Mr. Coleridge Farr, B.Sc., and a complete set of instruments was borrowed for him from the Kew Magnetic Observatory. At the meeting of the Australian Science Association held at Melbourne last January, a report was made to the Association by Mr. Farr, on the subject of the survey, from which it appears that up to that date he had succeeded in making absolute determinations of the magnetic elements at 69 stations.

III.—*The work of the proposed Survey.*

The investigation of magnetic phenomena may be carried on in two ways—either in the magnetic observatory, or by survey work in the field. The date seems far distant when Tasmania will possess a magnetic observatory, though, perhaps, when the value of Tasmania as a meteorological station is more fully appreciated, it may be possible to secure a magnetic observatory, to be worked in conjunction with a properly equipped meteorological observatory. The magnetic survey of a country stands on a somewhat different footing: though its work is of the highest scientific value, it is not without its utilitarian aspect, as it may contribute information of great importance to the sciences of navigation and surveying.

I will now proceed to lay before this Society a brief account of the work proposed to be done by Professor M'Aulay and myself in connection with the magnetic survey of Tasmania, which it is our intention to begin during the coming summer.

The instruments to be employed are the bifilar magnetometer and declinometer of the latest Kew pattern; they have been lent to us by the University of Sydney, through the kind offices of Professor Pollock of that University.

Having regard to the short time—8 or 10 weeks—during which the instruments will be at our disposal, we consider that the most valuable results will be obtained by limiting our observations, for this summer at least, to about 10 well-selected stations. By this means we hope to be able to get a fairly complete grip of the general magnetic distribution in Tasmania, and expect that the information disclosed by this summer's work will be of the greatest value when we come to select stations of observation at any future time. The stations we propose to select are :—Hobart, Port Esperance, Port Davey, Strahan, Mt. Lyell, Wynyard, Longford, Scottsdale, St. Helens, Spring Bay. If time permit, Oatlands will also be made a station of observation. It will be seen that the places selected are fairly spaced through the Island of Tasmania; if the magnetic elements are determined at these points, it will be easy to compute them approximately for any other station.

Our selection of the stations enumerated has been largely guided by geological considerations, owing to the prevalence in Tasmania of magnetic rocks. At a meeting of this Society held as far back as the 2nd April, 1845, attention was drawn by Mr. R. C. Gunn to the magnetic properties of the greenstone taken from the summit of Brady's Look-Out, and most surveyors of experience in Tasmania can testify to abnormal deviations of their compasses arising from masses of greenstone and basalt close at hand. An interesting illustration of this is to be found in the University grounds, where the declination varies from 7° E. to 11° E., according to the spot at which the instruments are set up. It may be added, that highly magnetic greenstone occurs on the summit of Mount Wellington. Our sites of observation have obviously been chosen so as to avoid, as far as possible, proximity to volcanic masses known or suspected to be magnetic.

At each of the selected stations we propose to determine, in absolute measure, the declination, dip, and horizontal magnetic intensity. These quantities being known for ten places, well distributed over the Island, we shall be in a position to construct a rough magnetic map of the country, on which the iso-magnetic lines will be shown. This map, as a first approximation, will not allow for the abnormal magnetic phenomena introduced by the greenstone and basalt: the determination of the local abnormalities so introduced must be left to some future time. The variation of the magnetic elements is of not less scientific interest than the determination of the absolute values of the elements themselves, at any given date. To ascertain the variation, it will be necessary to redetermine, after an interval of a few years, the magnetic elements at the stations previously employed; and to properly effect this, it is necessary that the sites of observation should be suitably marked, so that future observers may have no difficulty in picking them up. The erection of permanent marks, such as are employed in all important geodetic operations, appears, to Professor M'Aulay and myself, to be so important that we have laid before the present Government of the Colony an application for a grant of £150, to defray the cost of their erection and other incidental expenses incurred in the survey. In the event of this grant of the public moneys being made, we propose that the work of the survey should be carried out in co-operation with the Surveyor-General's Department. We are assured of the cordial assistance of the Surveyor-General in all matters connected with the survey.

At the selected stations of observation we propose to mark out the true geographical meridian, and, when the stations are suitable, to determine the bearings relative to the site of observation, of any prominent landmarks in view. The information so acquired may be of value in supplementing that already acquired for the purpose of constructing the map of Tasmania. A full description of the exact locality of each site of observation will be lodged with the Surveyor-General, together with a detailed account of the method employed to lay out the meridian.

It is scarcely necessary for me to detain the members of this Society by pointing out the importance, to all concerned with navigation, of an accurate knowledge of the magnetic declination, and of its rate of variation. So many of our selected stations are on the shore-line of Tasmania, that we hope to be able to make some considerable additions to the information already acquired on these points.

With the exception of the large properties of the Van Diemen's Land Company, whose boundaries were laid down by astronomical methods, it may be said that surveying in Tasmania has been, in the past, practically based on magnetic methods. The element of uncertainty introduced into surveys by the variation of the declination may not obtrude itself in any field work for some time, but directly any attempt is made to collate the county maps with the trigonometical survey, there is reason to fear that grave discrepancies will show themselves. Surveying according to astronomical methods is in many parts of Tasmania very tedious and difficult, owing to the climate, and a more complete knowledge of the declination than is now possessed would be useful and convenient to surveyors, especially in the case of isolated surveys, and groups of surveys being made in new districts.

It is to be hoped that before long the trigonometrical survey of Tasmania will be proceeded with, so that a new map of the Island may be compiled; and it is probable that much information of value towards this end may be collected during the magnetic survey.

There are long gaps in the magnetic history of Tasmania, but when an accurate knowledge of the variation of the magnetic elements has been again attained, it may be possible, by analysing the magnetic records of Melbourne and Sydney, to reconstruct the past magnetic history of Tasmania, and form an approximately correct idea of the magnetic changes which have taken place since Lieutenant Kay first set up his instruments, in Hobart some sixty years ago.

BOTANY.

By L. RODWAY.

THE first thing that strikes the student of botany when he observes the more conspicuous vegetable growth of Tasmania is what would naturally be expected, namely, the close relationship between the flora of this and nearest extensive tract of land, the south-eastern portion of Australia. Another feature of interest is the vast number of European aliens which have established themselves, and, in the more settled centres, threaten to exterminate the native growth, at least of the herbaceous plants. We may estimate that, in Tasmania, with a fairly inclusive definition of the word species, a collector may amass about 1100 flowering plants and ferns which may be considered native, or established Out of this collection no less than 110 have been introduced from Europe, about 3 from America, 2 from Africa, and 4 or 5 from the neighbouring States in Australia and New Zealand. A phenomenon of great interest to students of distribution is that, out of our small flora, no less than 68 indigenous forms are common also to England. Of endemic species, we have the respectable total of 142. By far the greater number of the balance, 770, are confined to south-eastern Australia; about 20 per cent. spread to Queensland, New Zealand, and the eastern borders of Western Australia, while a few species extend even to South America and Japan.

Of the special features of the landscape here, as in Australia, it is dominated by the sombre Myrtaceæ; but in number of species of this order, Tasmania is poor. Of Eucalypts we have but about 13 species, against 250 for Australia, and of the whole order 29, against about 750, though it should be noted that of this large number Western Australia alone claims nearly 500 endemic species. One other order of plants gives a marked feature to the country in parts, the *Casuarineæ*, or native oaks. Their equisetum-like foliage gives them the aspect of a survival from an earlier age. The order is small, and, except *C. equisetifolia*, which spreads from Polynesia to Asia and Africa, is confined to Australia.

That ancient and keenly-interesting order *Proteaceæ* is very poorly represented in Tasmania. We possess but 24 species, and out of these 11 are endemic. Of the large genus *Grevillea*, of which Australia can boast some 173 forms, Tasmania can only lay claim to one, *G. australis*, and, in *Hakea*, to 7 out of 115; *Conospermum*, 1 out of 36; *Personia*, 2 of 70; *Banksia*, 2 of 50. Many large genera are quite unrepresented. On the other hand, of the ancient genus *Orites*, whose ancestors may be still traced in the Cretaceus period, Tasmania absorbs as her exclusive possession 4 out of the 6 existing in the present day. Also, the monotypic genera, *Bellendena*, *Agastachys*, and *Cenarrhenes*, are endemic. The *Leguminosæ* and *Compositæ* here, as elsewhere, form a preponderance of wild flora. Among the former, the Acacias constitute a graceful and beautiful portion of the shrubland so novel to the European visitor, and none of them possess this grace and beauty more than our endemic prickly mimosa, the drooping *A. riceana*. There is nothing about the *Compositæ* that calls for exceptional notice, except the feature common to the Southern Hemisphere, the numerous forms of everlastings. The asters are fairly numerous, but are mostly shrubs (*Olearias*). The wild daisies (*Brachycomes*) are mostly blue or mauve, and the Senecios occasionally are arborescent. *Abrotanella forsterioides*, which occurs only on mountain-tops, forms dense pulvinate masses, and has a superficial resemblance to moss. *Pterygopappus lawrencii* has a somewhat similar habit. *Donatia novæ-zelandiæ*, among the *Stylideæ*, and *Dracophyllum minimum* amongst the *Epacrideæ*, have also the same peculiar appearance. An order of exceptional interest in Tasmanian botany is the *Epacrideæ*. Of the 290 Australian forms, West Australia claims about 145 as endemic; of the remainder, 60 appear in Tasmania, of which 30 are recorded as endemic. The genus *Epacris*, with nominally 11 species, is ill-defined, and requires revision. The beautiful climbing *Epacris*, *Prionotes cerinthoides*, with its long crimson bells, is of more than passing interest in that its partially-bilocular anthers connect this order with the more northern *Ericaceæ*. The genus *Richea*, with simple leaves with linear venation and broad sheathing bases, is, except one species, *R. gunnii*, found sparely in the highlands in Victoria, exclusively Tasmanian. It, with the allied genera, *Dracophyllum*, *Andersonia*, and *Sprengelia*, form a decidedly primitive type of foliage for so highly-organised shrubs. *R. pandanifolia* and *D. milligani*, when well developed, grow erect and unbranched, with a head of long sword-like leaves, often many feet in length, recalling the aspect of a cordyline or a palm rather than a dicotyledon. The *Rhamneæ*, *Rutaceæ*, and *Rubiaceæ* are all fairly represented, and with a large proportion of endemic types. *Caprifoliaceæ*, on the other hand, is represented by but one common Australian species, *Sambucus gaudichaudiana*. *Rosaceæ* again, as in Australia, is but poorly represented; still, we have two interesting endemics, a *Geum*, *G. renifolium*, with reniform leaves and large strawberry-like flowers. Unfortunately, it occurs only towards the summit of Adamson's Peak and La Perouse. It appears, however, not very difficult to acclimatise to a low altitude. The other is a Raspberry, *Rubus gunnianus*. It is small, with a creeping habit, and bears, when well developed, a scarlet fruit nearly an inch in diameter, consisting of drupels each nearly $\frac{1}{3}$-in. The flavour is poor, and though most common towards mountain-tops, it seems to resist all efforts of cultivation. The large order, *Stylideæ*, though almost confined to Australia, is hardly to be found in Tasmania. Only one species, *S. graminifolium*, the familiar trigger-plant, with its irritable column and tall raceuse of crimson-rose flowers, is ordinarily met with. The *Cupuliferæ*, which supply the broad-leaved trees to the forests of the Northern Hemisphere, are here replaced by the *Myrtaceæ*. But, in Tasmania, we still have two Fagus of this order. *F. cunninghami*, a noble tree, with wood of an excellent quality, is abundant in rich forest land throughout the Island, and *F. gunnii*, a small Alpine tree, that occurs only at a high elevation in the West and South-West. This latter has the singular distinction of being the only deciduous indigenous species in Australia. In *Hydrocharidaceæ*, *Vallisneria spiralis*, as here found, is more robust than the European type, and the peduncles create annoyance by refusing to retract in the orthodox coil. *Elodea canadensis* has also come here from Europe, America, or somewhere. As in England, so here, only the ladies of the species have arrived, but this seems to be not at all disconcerting, and its propagation in watercourses is often more generous than entertaining. The orchids are fairly numerous; about 70 kinds, mostly of the Australian genera, *Pterostylis*, *Caladenia*, *Thelymitra*, *Diuris*, and *Prasophyllum*. Probably none are endemic; only one, *Sarcochilus parviflorus*, epiphytic. Two, *Gastrodia sesamoides* and *Dipodium punctatum*, are, doubtless, parasitic on roots of higher plants, but the connection has never been traced. Amongst the *Iridaceæ*, *Hewardia tasmanica* is of unusual interest, in so far that the pistil is only partially immersed in the floral tube; this feature is responsible for this plant usually being placed amongst the lilies. The flower is rather nice, deep chocolate, purple, or pale yellow, and about 2 inches across, but it does not care to depart from its native habitat, the highlands of the West and South-West.

Among the *Burmanniaceæ* there is one interesting little beast, a *Thismia*, that is sparely found in gullies of Southern Tasmania. It has no immediate relative nearer than Borneo or Java. Its presence is a decided puzzle. Such an ephemeral saphrophyte could hardly have been transmitted over long distances by bird-assistance, besides its immediate relatives are not only far off, but not identical. The lilies do not call for special attention in such a restricted space. The pond-weeds, duck weeds, and other fresh-water plants, as might be expected, are, as elsewhere, of the commonly-distributed types of the Old World, but the *Restiaceæ* and *Centrolepideæ*, so common in Tasmania, belong to a type of plants decidedly Southern Hemispheric, and probably the remains of a former type. The perianth is still there, but primitive and uncertain; the leaves are reduced and sheath-like, and the whole type gives one the idea of an early effort thrust aside by the more robust development of the sedges.

The sedges, or *Cyperaceæ*, an order of keen interest, must be passed for want of space, except to allude to the paucity of species of *Cyperus*, two only occurring here, *C. lucidus* and *gunnii*. *Fimbristylis* is entirely absent, but *Lepidosperma* makes its presence recognised by some nine or ten species.

Of the grasses, Tasmania is very poorly off for indigeneous species, 45 forms, and of these, only 2, *Microlæna tasmanica* and *Deyeuxia gunniana*, are endemic; but we make up for it, on the other hand, by the numbers of aliens, chiefly European, that are steadily dispersing themselves far and wide. *Anthoxanthum odoratum* and *Holcus lanatus*, above all others, are making themselves very much at home. It is surprising that, with so easily-transmitted species as grasses, only six forms, *Imperata arundinacea*, *Aira cæspitosa*, *Trisitum subspicatum*, *Glyceria fluitans*, *Festuca duriuscula*, and *Phragmites communis*, should be common alike to Europe and Tasmania.

The conifers of Tasmania are of great interest to the botanist. We have no true pines or firs. We have one genus, *Arthrotaxis*, belonging to the *Taxodium* section of *Pinoideæ*; it contains three species, all confined to Tasmania. Unfortunately, it lives only at a considerable elevation, and objects to cultivation. *Callitris*, of which we have two species, *C. rhomboidea*, distributed also to South and East temperate Australia, and *C. oblonga*, confined to Northern Tasmania, together with the curious little shrub, with minute crowded 4-rowed leaves, *Fitzroya archeri*, belong to the Cypress section. The remainder are all yews. *Dacrydium franklinii*, a noble tree of the West and South-West, that yields the valuable Huon pine, has minute overlapping leaves, and as minute few-flowered cones. It is an excessively slow grower, and inhabits only low-lying swamps; wherefore, its age of usefulness is limited. *Phyllocladus rhomboidalis*, the only Tasmanian representative of the New Zealand genus, is a useful timber-tree, but is seldom found of much size. The leaf-like *Cladodia* are somewhat the shape of the leaf segments of *Apium graveolens*, whence the tree is locally known as celery-topped pine. *Podocarpus alpina* is small and procumbent, with yew-shaped leaves and red fleshy peduncles to the solitary seeds; *Microcachrys tetragona* is procumbent, leaves minute four-rowed, and the cone many-seeded, the bracts crimson and fleshy, the cone having the appearance of a small crimson mulberry $\frac{1}{2}$ in. long; *Pherosphæra hookeriana* is very similar to *Dacrydium franklinii*, only dwarf, and the cones have many scales of cartilaginous consistency. These three are Alpine and endemic. In ferns, though we cannot approach New Zealand, Tasmania is fairly well off. We have about 70 species; most of them are confined to New Zealand and Australia. None are endemic. *Hypolepis tenuifolia* and *Polypodium punctatum* run absolutely into one another in our bush; also do *Asplenium bulbiferum, laxum, hookerianum*, and *flaccidum*, and some forms approximate very nearly *A. obtusatum*. Of tree-ferns, we have *Dicksonia antarctica*, *Alsophila australis*, and *Cyathea cunninghami*, and *Todea barbata* sometimes assumes that form. *Pteris aquilina, Asplenium trichomanes, Gymnogramme rutæfolia, G. leptophylla, Aspidium aculeatum, Cystopteris fragilis, Hymenophyllum tunbridgense*, and *H. wilsoni*, occur also in Europe.

Space will not permit even a cursory glance at the lower cryptogams; nor would such a glance be of any value, if it did.

NOTE ON THE BIRDS OF TASMANIA.

By Colonel W. V. Legge, F.L.S., &c.

(President of the Australian Ornithological Union.)

Compared with tropical countries, or other regions of similar area, the Island of Tasmania cannot be said to be rich in bird life. There are two apparent causes for our limited *avifauna*. First, the comparative paucity of fruit-bearing flora and insect-life; secondly, our island being the terminal point of the Australian "region," and separated from it by a strait, does not come in for its share of distribution of species, nor its proportion of northern migrants, which do not wander further than the southern parts of the continent. If, therefore, we confine ourselves to land-birds proper, and eliminate the numerous species of Petrel recorded as inhabiting our seas, the Penguins, the Gulls, and Terns (*Gaviæ*), the geese and ducks (*Anseres*), the Plovers and snipe-like birds (*Limicolæ*), and, finally, the Herons (*Ardeidæ*), there remains but a small list, even if we include the Rails, Coots, Cormorants, and Grebes. To the casual observer, however, who may wander through the open, settled country in the South, Midlands, Western, and Coast districts (not including the West), our feathered friends would seem to be fairly numerous; for it is in territory of this sort that the majority of our species are to be found. It suits the habits, and provides food, for the parakeets, the various honey-eaters, small fly-catching birds (among which the showy chat-robins are conspicuous), tree-tits, *Acanthiza*, the diamond birds (*Dicæidæ*), and various other small Passerine birds, frequenting open country in preference to forest. On the other hand, in the dense and lofty forests, birds are few and far between, except in small tracts of land bordering creeks and rivers in the gullies, which are clothed with luxuriant scrub, and where insect life is more abundant. Again, if we penetrate the dense mountain forests of myrtle (*Fagus cunninghami*), in the West of the island, we find the almost impenetrable scrub and tangled undergrowth absolutely unfavourable to bird life, and miles of this true and most formidable "jungle" may be struggled through without a single species being met with. Very little, indeed, is known as yet concerning the *avifauna* of the densely-clothed mountains of the western half of the country, where the dark and humid forests which fill the gullies and cover the sides of the ranges are suited to the habits of such birds only as the scrub-wren (*Sericornis humilis*), migratory fly-catchers (*Myiagra*), one or two of the thick-heads (*Pachycephala*), also the forest-loving honey-eater (*Melithreptus*), and, finally, the black crowshrikes, or magpies, whose far-reaching notes always betray their presence. In addition to these denizens of the trackless Western forests, we find the bold and lofty mountain-tops, which stand out of the wilderness in lonely grandeur, furnishing a home for certain raptorial species, such as the White and the Australian goshawks, the Black-cheeked Falcon, and the Hobby (*Falco Lunlatus*), while around the borders of the solitary tarns and lakes, which sparkle on their plateau summits, the ubiquitous Pipit (*Anthus australis*) is usually found, with, near at hand, one or two wandering honey-eaters, if the Alpine flora happens to be in flower.

In the Midlands, already referred to in connection with the Passerine birds above-mentioned, we have the stronghold of the few species of plover found in Tasmania, accompanied in summer by the migratory Golden Plover, which visits us from Northern Asia; and, round the large lagoons and -salt-pans characteristic of the district, the Double-banded Dottrel, and some rare species of waders are occasionally met with. Higher up on the open stock-runs, with alternating plains and scattered timber-tracts, the marsh Harrier (*Circus assimilis*), the Brown Hawk (both also common in the lowlands), and many of the commoner low-country species are usually seen; and here, too, that grand but predatory bird, the Wedge-tailed Eagle, the *bête-noir* of the pastoralist, is sure to be seen, either perched on some lofty tree or soaring at immense heights above the landscape.

In 1845, a carefully-compiled list of Tasmanian birds was submitted by the Rev. J. T. Ewing, at a meeting of the Royal Society, and published in its Proceedings for that year. Mr. Ewing was a keen observer of birds and their habits, and was a contemporary of Gould's while this great naturalist was in Australia. His list was exclusively compiled from Gould's work, supplemented by a few species observed by himself. A Tit found by Gould in Tasmania was named after Ewing (*Acanthiza ewingi*), but it has since been considered identical with the well-known "Brown-tail" (*A. diemenensis*). It is not, however, certain that this is correct, as further research may lead to the rediscovery of Ewing's Tit. Subsequent to the publication of Ewing's list others have been printed, and used for reference, but up till late years scarcely any additions were made to the 169 birds enumerated in the first-named.

In 1886, a "Systematic List" was drawn up by myself, the various orders, families, and sub-families into which our birds are divided being classified on the same system as that adopted in my "Birds of Ceylon." This list has now been revised, and included in this "Note." The now universally-received nomenclature of the "British Museum Catalogue" has been used, and the vernacular names adopted in the Australasian Association List of 1898 given to our birds. It is to be hoped that, in future, naturalists and collectors will adhere to the names in question, which are the result of much thought and care on the part of the compilers.

If we compare the number of the members of the various families and orders given in the list with those inhabiting the continent, we see at a glance how far the Australian *avifauna* is represented in our Island:—Birds of prey are fairly numerous, the proportion of species in Tasmania being 12 to 27 in Australia, not inclusive, however, of the owls, which are only 3 to 14; fly-catchers (*Muscicapidæ*) number 8 species out of 67, which is a poor representation, one, the Fantail, being peculiar to the Island. Honey-eaters (*Meliphagidæ*) are also indifferently represented, our quota being 10 out of 82. In the parrot "order," Tasmania has 12 species out of 59. Passing to shore birds (plovers, dotterels, curlews, &c.), we find 23 in Tasmania out of a total of 46 recorded for Australia, which is a better representation than that of any order but petrels, of which we have 27 species out of 38 as yet noted from Australasian seas, this being accounted for by the fact that these birds are wanderers over all the Southern Ocean.

In some instances, for simplification, genera adopted in the British Museum Catalogue have not been made use of in the following List:—

SYSTEMATIC LIST OF TASMANIAN BIRDS.

Order ACCIPITRES.

Suborder **Falcones.**

Family FALCONIDÆ—(11 species).

Subfam. ACCIPITRINÆ.	Circus Gouldi, *Bonap.*	Allied Harrier (Swamp-hawk).
	Circus assimilis, *Jard & Selby.*	Jardines Harrier.
	Astur Novæ Hollandiæ, *Gmelin.*	White Goshawk.
	Astur approximans, *Vigors & Horsf.*	Australian Goshawk.
	Accipiter cirrhocephalus, *Vieillot.*	Sparrow-hawk.
Subfam. AQUILINÆ.	Uroætus audax, *Latham.*	Wedge-tailed Eagle.
	Haliætus leucogaster, *Gmelin.*	Grey-backed Sea Eagle
Subfam. FALCONINÆ.	Falco melanogenys, *Gould.*	Black-cheeked Falcon.
	Falco lunulatus, *Latham.*	Australian Hobby.
	Hieracidea Orientalis, *Schlegel.*	Brown Hawk.
	Cerchneis cenchroides, *Vig. & Horsf.*	Australian Kestrel.

Suborder **Pandiones.**

Pandion leucocephalus, *Gould.*	Australian Osprey.

Suborder **Striges.**

Family BUBONIDÆ—(2 species).

Subfam. BUBONINÆ.	Ninox boobook, *Latham.*	Brown Hawk-owl.
	Ninox maculata, *Vig. & Horsf.*	Spotted Hawk-owl.

Family STRIGIDÆ—(1 species.)

Strix castanops, *Gould.*	Tasmanian Barn-owl.

Order PICARIÆ.

Family CUCULIDÆ—(6 species).

Subfam. CUCULINÆ.	Cuculus pallidus, *Latham.*	Pallid Cuckoo.
	Cuculus flabelliformis, *Latham.*	Fantailed Cuckoo.
	Chalcococcyx plagosus, *Lath.*	Bronze Cuckoo.
	Chalcococcyx basalis, *Horsfield.*	Narrow-billed Bronze Cuckoo.
		Cuckoo.
	Chalcococcyx lucidus, *Gmelin.*	Broad-billed Bronze
Subfam. PHÆNICOPHAINÆ.	[a] Scythrops Novæ Hollandiæ, *Lath.*	Channel-bill Cuckoo.

Family ALCEDINIDÆ—(2 species).

Subfam. HALCYONINÆ.	Halcyon sanctus, *Vig. & Horsf.*	Sacred Kingfisher.
Subfam. ALCEDININÆ.	Alcyone azurea, *Latham.*	Blue Kingfisher.

Family CYPSELIDÆ—(1 species).

Chætura caudacuta, *Lath.*	Spine-tailed Swift.

Family CAPRIMULGIDÆ—(2 species).

Subfam. STEATORNINÆ.	Podargus Strigoides, *Latham.*	Frogmouth (More-pork).
Subfam. CAPRIMULGINÆ.	Ægotheles Novæ Hollandiæ, *Lath.*	Little Night Jar.

Order PASSERES.

Section A. **Thrush-like Passeres.**

(10 *primaries*, 1*st small.*)

Family CORVIDÆ—(4 species).

Subfam. CORVINÆ.	Corvus coronoides, *Vig. & Horsf.*	Australian Raven.
	Corone Australis, *Gould.*	White-eyed Crow.
	Strepera fuliginosa, *Gould.*	Black Magpie.
	Strepera arguta, *Gould.*	Hill Magpie.

Family DICRURIDÆ.—(1 species).

Chibia bracteata, *Gould.*	Drongo.

Family CAMPOPHAGIDÆ—(2 species).

Graucalus parvirostris, *Gould.*	Summer Bird.
*Lalage tricolor, *Swainson.*	White-shouldered Caterpiller-eater.

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[a] Accidental.

Family PRIONOPIDÆ. (2 species).

	Collyriocincla rectirostris, *Jard & Selby.*	Whistling Shrike-Thrush.
	[a] Grallina picata, *Strick.*	Magpie Lark.

Family LANIIDÆ— (5 species).

Subfam. GYMNORHININÆ.	Gymnorhina hyperleuca, *Gould*	Magpie.
	Cracticus cinereus, *Gould.*	Butcher-bird (Jackass).
Subfam. PACHYCEPHALINÆ.	Pachycephala olivacea, *Vig & Horsf.*	Olive Thickhead.
	Pachycephala gutturalis, *Lath.*	White-throated Thick-head.
	Pachycephala glaucura, *Gould.*	Grey-tailed Thick-head.

Family—MUSCICAPIDÆ—(8 species).

Subfam. MUSCICAPINÆ.	Rhipidura Diemenensis, *Sharpe.*	Fantail.
	Myiagra rubecula, *Lath.*	Leaden Flycatcher.
	Myiagra nitida, *Gould.*	Satin Flycatcher.
Subfam. SAXICOLINÆ.	Petræca Leggii, *Sharpe.*	Scarlet-breasted Robin.
	Petræca Phœnicea, *Gould.*	Flame-brested Robin.
	Petræca Rhodinogaster, *Drapiez*	Pink-brested Robin.
	Petræca vittata, *Quoy et Gaimard.*	Dusky Robin.
	Malurus Gouldi, *Sharpe.*	Long-tailed Warbler (Blue Wren).

Family TURDIDÆ—(3 species).

Subfam. TURDINÆ.	Geocichla macrorhyncha, *Gould.*	Ground Thrush.
Subfam. SYLVIINÆ.	Acrocephalus Australis, *Gould.*	Reed Warbler.
Subfam. EPHTHIANURINÆ.	Ephthianura albifrons, *Jard & Selby.*	White-fronted Chat.

Family TIMELIIDÆ—(8 species).

Subfam. CRATERPODINÆ.	Cinclosoma punctatum, *Lath.*	The Ground Bird (Ground Dove).
Subfam. TIMALIINÆ.	Calamanthus ful nosus. *Vig & Horsf.*	Striated Field Wren
Subfam. BRACHPYTERINÆ.	Megalurus gramineus, *Gould.*	Grass Bird.
	Stipiturus malachurus, *Shaw.*	Emu Wren.

[a] Accidental.

Subfam. ACANTHIZINÆ.	Sericornis humilis, *Gould.*	Brown Scrub Wren.
	Acanthornis magna, *Gould.*	White-breasted Scrub Wren.
	Acanthiza Diemenensis, *Gould.*	Brown-rumped Tit (Brown Tail).
	Acanthiza chrysorrhœa, *Q. & G.*	Yellow-rumped Tit (Yellow Tail).

Family MELIPHAGIDÆ—(10 species).

Subfam. MELIPHAGINÆ.	Acanthorhynchus tenuirostris, *Lath.*	Spine Bill.
	Melithreptus validirostris, *Gould*	Strong-billed Honey-eater.
	Melithreptus melanocephalus, *Gould.*	Black-headed Honey-eater.
	Glycyphila fulvifrons, *Lewin*	Tawny-crowned Honey-eater.
	Ptilotis flavigularis, *Gould.*	Yellow-throated Honey-eater.
	Meliornis Novæ Hollandiæ, *Lath.*	White-bearded Honey-eater.
	Meliornis Australasiana, *Shaw.*	Crescent Honey-eater.
	Manorhina garrula, *Lath.*	Garrulous Honey-eater (Miner).
	Acanthochæra inauris, *Gould.*	Wattle-bird.
	Acanthochæra mellivora, *Lath.*	Brush Wattle-bird.

Section B.

Swallow-like Passeres.

(9 Primaries.)

Family ZOSTEROPIDÆ—(1 species).

Zosterops cærulescens, *Lath.*	White-eye.

Family DICÆIDÆ—(3 species).

Pardalotus punctatus, *Shaw and Nodder.*	Diamond Bird.
Pardalotus affinis, *Gould.*	Yellow-tipped Diamond Bird.
Pardalotus quadragintus, *Gould.*	Forty-spotted Diamond Bird.

Family HIRUNDINIDÆ—(2 species).

Subfam. HIRUNDININÆ.	Hirundo neoxena, *Gould.*	Australian Swallow.
	Petrochelidon nigricans, *Vieill.*	Tree Martin.

Family FRINGILLIDÆ.

Subfam. FRINGILLINÆ.	Zonæginthus bellus, *Lath.*	Fire-tailed Finch.

Family MOTACILLIDÆ—(1 species).

Anthus Australis, *Vig & Horsf.*	Pipit.

Section B.

Starling-like Passeres.

(10 Primaries, 1st Rudimentary).

Family ARTAMIDÆ—(1 species).

Artamus sordidus, *Lath.*	Wood Swallow.

Order PSITTACI.

Family CACATUIDÆ—(3 species).

Subfam. CACATUINÆ.	Cacatua galerita, *Latham.*	White Cockatoo.
	Calypturynchus xanthonotus, *Gould.*	Black Cockatoo.
	Callocephalon galeatum, *Latham.*	Gang-gang Cockatoo.

Family PSITTACIDÆ—(6 species).

Subfam. PLATYCERCINÆ.	Platycercus flaviventris, *Temminck.*	Green Parrakeet.
	Platycercus eximius, *Shaw.*	Rosehill Parrakeet.
	Neophema venusta, *Temminck.*	Blue-banded Grass Parrakeet.
	Neophema chrysogastra, *Latham.*	Orange-bellied Grass Parrakeet.
	Nanodes discolor, *Shaw.*	Swift Parrakeet.
	Pezoporus formosus, *Latham.*	Ground Parrakeet.

Family TRICHOGLOSSIDÆ—(3 species).

Subfam. TRICHOGLOSSINÆ.	Trichoglossus, Novæ Hollandiæ, *Gmelin.*	Blue-bellied Lorikeet.
	Glossopsittacus concinnus, *Shaw.*	Musk Lorikeet.
	Glossopsittacus pusillus, *Shaw.*	Little Lorikeet.

Order COLUMBÆ.

Family GOURIDÆ—(2 species).

Phaps chalcoptera, *Latham.*	Bronze-wing.
Phaps elegans, *Temminck.*	Brush Bronze-wing.

Family TRERONIDÆ—(2 species).

[a] Lamprotreron superbus, *Temm.*	Superb Fruit Pigeon.
[a] Lopholaimus antarcticus, *Shaw.*	Topknot Pigeon.

Order GALLINÆ.

Family TETRAONIDÆ—(2 species).

Coturnix pectoralis, *Gould.*	Stubble Quail.
Synöicus Diemenensis, *Gould.*	Great Brown or Swamp Quail.
Synöicus Australis, *Latham.*	Brown Quail.

[a] Accidental.

Family TURNICIDÆ--(1 species).

Turnix varius, *Latham.*	Painted Quail.

Order FULICARIÆ.

Family RALLIDÆ--(8 species).

Porphyrio melanotus, *Temm.*	Blue Coot.
Tribonyx Morticri, *Sclater.*	Native Hen.
Fulica Australis, *Gould.*	Coot.
Hypotœnidia phillipinensis, *Cuvier.*	Pectoral Rail.
Hypotænidia brachypus, *Swainson*	Short-toed Rail.
Porzana fluminea, *Gould.*	Spotted Crake.
Porzana palustris, *Gould.*	Little Crake.
Porzana tabuensis, *Gmelin.*	Red-backed Crake.

Order LIMICOLÆ.

Family ŒDICNEMIDÆ--(1 species).

Burhinus grallarius, *Latham.*	Stone Plover.

Family CHARADRIIDÆ—(22 species).

Sub-Fam. HÆMATOPODINÆ.	Hæmatopus longirostris, *Vieill.*	White-breasted Oyster Catcher.
	Hæmatopus unicolor, *Wagler.*	Sooty Oyster Catcher.
Subfam. LOBIVANNELLINÆ.	Lobivanellus lobatus, *Latham.*	Wattled Plover (Spurwing.)
Subfam. CHARADRIINÆ.	Squatarola Helvetica, *Linn.*	Grey Plover.
	Charadrius fulvus, *Gmelin.*	Golden Plover.
	Ægialitis bicincta, *Jard. & Selby.*	Double-banded Sand Plover.
	Ægialitis monacha, *Geoffroy.*	Hooded Sand Plover.
	Ægialitis ruficapilla, *Temm.*	Red-capped Sand Plover.
	Zonifer tricolor *Vieillot.*	Black-breasted. Plover.
Subfam. SCOLOPACINÆ.	Gallinago Australis, *Latham.*	Australian Snipe.
	Limosa uropygialis, *Gould.*	Barred-rumped Godwit.
	Glottis nebularius, *Gunnerus.*	Green-shank.
	Tringoides hypoleucos.	Common Sand-piper.
	Tringa subarquata, *Guldenot.*	Curlew Stint.
	Tringa accuminata, *Horst.*	Marsh Stint.
	Tringa ruficollis, *Pallas.*	Red-breasted Stint.
	Strepsilas interpres, *Linn.*	Turnstone.
	Numenius cyanopus, *Vieillott.*	Australian Curlew.
	Numenius phæopus, *Linn.*	The Whimbrel.

Subfam HIMANTOPODINÆ.	Himantopus leucocephalus, *Gould.*	White-headed Stilt.
	Cladorhynchus pectoralis, *Dubus.*	Banded Stilt.
	Recurvirostra rubricollis, *Temm.*	Red-necked Avocet.

Order GAVIÆ.

Family LARIDE—(8 species).

Subfam. STERNINÆ.	Sterna (Hydroprogne) caspia, *Pallas.*	Caspian Tern.
	Sterna poliocerca, *Gould.*	Bass's Straits Tern.
	Sterna frontalis, *Gray.*	Black-billed Tern.
	Sterna nereis, *Gould.*	White-faced Ternlet
Subfam. LARINÆ.	Larus (Gabianus) pacificus, *Latham.*	Pacific Gull.
	Larus Novæ Hollandiæ, *Stephens.*	Little Gull.
Subfam. STERCORARIINÆ.	Megalestris Antarctica, *Lesson.*	Antarctic Skua.
	Stercorarius crepidatus, *Banks.*	Richardson's Skua.

Order TUBINARES.

Family DIOMEDEIDÆ—(6 species).

Diomedea exulans, *Linn.*	Wandering Albatross.
Thalassogeron cautus, *Gould.*	White-capped Albatross.
Thalassogeron culminatus, *Gould.*	Flat-billed Albatross.
Diomedea melanophrys, *Temm.*	Black-browed Albatross.
Thalassogeron chlororhynchus, *Lath.*	Green-billed Albatross.
Phœbetria fuliginosa, *Gmelin.*	Sooty Albatross.

Family PUFFINIDÆ*—(16 species).

Subfam. FULMARINE.	Ossifraga gigantea, *Gmelin.*	Giant Petrel.
	Daption capensis, *Linn.*	Cape Petrel.
	Haloboena cœrulea, *Gmelin.*	Blue Petrel.
	Prion desolatus (turtur), *Banks.*	Dove Prion.
	Prion ariel, *Gould.*	Fairy Prion.
	Prion Banksi, *Smith.*	Banks' Prion.
	Prion vittatus *Illiger.*	Broad-billed Prion.
Subfam. PUFFININE.	Majaqueus equinoctialis, *Linn.*	Spectacled Petrel.
	†Priofinus cinereus, *Gmelin.*	Grey Petrel.
	Pterodroma macroptera, *Smith.*	Long-winged Petrel
	Pterodroma atlantica. *Gould.*	Atlantic Petrel.
	Pterodroma Solandri, *Gould.*	Solander's Petrel.
	Œstrelata Lessoni, *Garn.*	White-headed Petrel.
	Œstrelata leucoptera, *Gould.*	White-winged Petrel.
	Puffinus tenuirostris, *Brandt.*	Short-tailed Petrel (Mutton Bird).
	Priocella glacialoides, *Smith.*	Silver-grey Petrel.

* I have not included Forster's Petrel. I am not aware of it having been procured in Tasmanian seas.

† Grey Petrel more suitable than "Brown."—("Vernacular List.")

Family PROCELLARIIDÆ—(6 species).

Subfam. Oceanitinæ.	Garrodia nereis, *Gould.*	Grey-backed Storm Petrel.
	Cymodroma melanogastra, *Gould.*	Black-bellied Storm Petrel.
	Cymodroma grallaria, *Vieill.*	White-bellied Storm Petrel.
	Pelagodroma marina, *Lath.*	White-faced Storm Petrel.
	Oceanites oceanicus, *Kuhl.*	Yellow-footed Storm Petrel.
	Halodroma urinatrix, *Lath.*	Diving Petrel.

Order STEGANOPODES.

Family PELECANIDÆ—(1 species).

Pelecanus conspicillatus, *Temm.*	Pelican.

Family PHALACROCORACIDÆ—(4 species.)

Phalacrocorax (novæhollandiæ) carbo, *Linn.*	Common Cormorant.
Phalacrocorax lecuogaster, *Gould.*	White-breasted Cormorant.
Phalacrocorax melanoleucos, *Vieill.*	Little Cormorant.
Phalacrocorax strictocephalus.	Little Black Cormorant.

Family SULIDÆ—(1 species).

Sula serrator, *Banks.*	Australian Gannet.

Order ANSERES.

Family ANATIDÆ—(14 species).

Subfam. Cygninæ.	Cygnus atratus, *Lath.*	Black Swan.
Subfam. Anserinæ.	Anseranas semipalmata, *Lath.*	Pied Goose.
	Cereopsis Novæ Hollandiæ, *Lath.*	Cape Barren Goose.
	Chenonetta jubata, *Lath.*	Maned Goose.
	Dendrocycna Eytoni, *Gould.*	Eyton's Tree Duck.
	Tadorna tadornoides, *Jard. & Selby.*	Ruddy Sheldrake.
Subfam. Anatinæ.	Stictonetta nevosa, *Gould.*	Freckled Duck.
	Anas superciliosa, *Gmelin.*	Wild Duck
	Anas castanea, *Eyton.*	Chestnut-breasted Duck
	Spatula rhynchotis, *Lath.*	Australian Shoveller.
	Malacorhynchus membranaceus, *Swains.*	Membranaceus Duck.
	Erismatura Australis.	Blue-billed Duck.

Subfam. FULIGULINÆ.	Nyroca Australis, *Gould.*	White-eyed Duck.
Subfam. ERISMATURINÆ.	Biziura lobata, *Shaw.*	Musk Duck.

Order HERODIONES.

Family ARDEIDÆ—(6 species).

Notophoyx Pacifica, *Lath.*	Pacific Heron.
Notophoyx Novæ Hollandæ, *Lath.*	White-fronted Heron.
Demiegretta sacra, *Gmelin.*	The Reef Heron.
Herodias Timoriensis, *Lesson.*	White Egret.
Nycticorax Caledonicus, *Lath.*	Night Heron.
Botaurus poicilopterus, *Wagler.*	Bittern.

Order PYGOPODES.

Family PODICIPIDÆ—(3 species).

Podiceps Cristatus, *Gould.*	Tippet Grebe.
Podiceps Nestor, *Gould.*	Hoary-headed Grebe.
Podiceps Novæ Hollandiæ.	Little Grebe.

Order IMPENNES.

Family SPHENISCIDÆ—(3 species).

Catarractes chrysocome, *Lath.*	Crested Penguin
Eudyptula minor, *Forster.*	Little Penguin.
Eudyptula undina, *Gould.*	Fairy Penguin.

THE RECENT MOLLUSCA OF TASMANIA.

By MARY LODDER.

TASMANIA may be considered fairly rich in recent molluscan species, as she possesses nearly 700 marine forms, with about 100 terrestrial and fresh-water kinds besides. Very many of the species in all branches are extremely small, requiring much careful search in order to obtain them, and microscopical examination to reveal their characteristics, their beauties of form, sculpture, and colouring. But such work is well repaid by the results, whilst, doubtless, there are still various species to be discovered in the less well-known parts of the island, for many of the recognised forms are very local in their habitats, and, in numerous cases, their minuteness renders them so difficult to find that even an experienced collector may overlook them. On the other hand, some of the marine species afford a strong contrast by the great size to which they attain, the most remarkable being *Voluta mamilla* (Gray), which is a foot long when full grown, and broad in proportion; but adult specimens are rarely found in good preservation. The young examples are much prettier as regards colour and markings, having brown bands and dashes on a creamy-yellow ground externally, while the interior is of a rich yellow, and highly enamelled; the large mamillary nucleus (which was thought to be a deformity in the first specimen discovered) is always a striking characteristic, giving a curious appearance to the very young shells. This species is chiefly found on the North Coast, where *V. fusiformis* (Swainson) and *V. undulata* (Lamarck), with the rarer *V. papillosa* (Swainson) are also to be had.

Megalatractus maximus (Tryon) is another fine shell, also somewhat scarce in perfect condition. The finest specimen I have seen was in the collection of the late Mr. C. E. Beddome, who dredged it in the Derwent; it measured 7½ inches in length, and 2¾ inches in breadth. *Triton spengleri* (Chemnitz) attains a length of 5 inches, its solid structure and thick varices making it a weighty shell. *Cypræa umbilicata* (Sowerby) is another remarkable shell found on the North Coast, but not very plentifully nowadays, its size and elongated form distinguishing it from any other recent *Cypræa* found in Tasmania, whilst it resembles the fossil *C. eximia* (Sowerby), which occurs at Table Cape and elsewhere in this Island; but *C. umbilicata* is much larger.

The well-known "Mutton-shells"—one would be hardly complimentary to the goddess in calling the large representatives of the *Haliotidæ* "Venus' Ears," the name that some of the smaller species bear in Europe—may also be numbered among the giant molluscs of our shores. *Haliotis albicans* (Q. and G.), with *H. naevosa* (Martyn), probably afforded many a good feed for the aborigines in days gone by. Some white folks profess a liking for this "marine mutton," but opinions differ as to the desirability of adding such an item to the usual bill of fare. Scallops, mussels, and "Warreners" are more favoured, while many other species would probably be found very good if one had but the courage to try them. Oysters, which, apparently, were plentiful in the days of the aborigines, are sadly scarce now. A former resident of Stanley, Circular Head, told me of an enormous number having once been washed up on the beaches in that neighbourhood, when he was a boy.

Fasciolaria coronata (Lamarck), *Siphonalia dilatata* (Q. and G.), *Ranella argus* (Gmelin), *Purpura textiliosa* (Lamarck), *Conus anemone* (Lamarck), *Scutus anatinus* (Donovan), *Murex triformis* (Reeve), *Nerita punctata* (Q. and G.), *Cassis achatina var. pyrum* (Lamarck), *C. semigranosa* (Wood), *Columbella semiconvexa* (Lamarck), *Cypræa angustata* (Gmelin), *Trivia australis* (Gray), *Marginella muscaria* (Lamarck), *Turritella tasmanica* (Reeve), *Phasianella australis* (Gmelin), *P. ventricosa* (Q. and G.), *Turbo undulata* (Martyn), *Cantharidus badius* (Wood), *Cantharidus fasciatus* (Menke), *Calliostoma meyeri* (Menke), *Clanculus undatus* (Lamarck), *C. limbatus* (Q. and G.), *Patella limbata* (Philippi), *Acmæa crucis* (Tenison-Woods), *A. alba* (Ibid), *Subemarginula rugosa* (Q. and G.), *Macroschisma weldii* (Tenison-Woods), *Megatebennus trapezinus* (Sowerby), *Mitra glabra* (Swainson), and many other species of these, and other genera of *Gasteropoda*, are to be found more or less in profusion.

Of *Polyplacophora*, *Chitons*, we have several species, the prettily-marked *Ischnochiton crispus* (Reeve) and *Chiton pellisserpentis* (Q. and G.) being abundant. The handsomest representative of the order is the scarce *Callochiton lobatus* (Carpenter), with its smooth shell and broad mantle of dark reddish-brown contrasting well with the rich orange colour of the animal.

Of the naked, or shell-less, mollusca, there are a few that have been described, and many yet to be identified. *Allportia expansa* (Tenison-Woods) is a curious and interesting form that is rather plentiful among the rocky pools at low water. Of the *Doris* family, there are surely many, and of *Onchidium* at least one, species to be found in similar situations.

Of the class *Scaphoda*, two species of *Dentalium* and one of *Cadulus* are recorded, whilst no *Pteropoda* are as yet listed for Tasmania, I believe. Of *Cephalopoda*, we have some ten known species, the internal shells, or, more familiarly known, "Cuttle-bones," of the *Sepiæ*, being plentiful on the beaches; while the shell of the curious little *Spirula peronii* (Lamarck) is not uncommon at times on the East Coast. The beautiful "Paper Nautilus," *Argonauta nodosa* (Solander), is occasionally found on the mainland of Tasmania, but is more plentiful on the islands in Bass Straits, where it is said to come in shoals about every five or seven years, though it is difficult to obtain the larger specimens, as the gulls break them so often in their eagerness to devour the animal.

The largest of the *Pelecypoda* is *Pinna tasmanica* (Tenison-Woods), which is found a foot long, and sometimes covered with barnacles (*Serpulæ*) and fair-sized oysters. The young specimens are very pretty, of a pale greenish or horny tint, semi-transparent, with curiously raised fluted scales at the broader end. *Venus lamellata* is a beautiful shell when its pink frills are perfect. *Cochlodesma angasi* (Crosse and Fischer) is sometimes plentiful, and of a large size, on the sandy beaches, but the gulls are fond of these too. *Anatina creccina* (Valenciennes) is also to be found in the North; *Mactra rufescens* (Lamarck) is often so abundant at Port Sorell that it becomes a weariness to the collector; *Venus gallinula* (Lamarck), *V. roborata* (Hanley), *Tapes fabagella* (Deshayes), *Gari zonalis* (Lamarck), *Tellina albinella* (Ibid), *Dosinia cœrulea* (Reeve), *D. grata* (Deshayes), *Cytherea rutila* (Sowerby), *C. diemensis* (Hanley), *Crassatella kingicola* (Lamarck), *Cardium tenuicostatum* (Ibid), *Barbatia carpenteri* (Dunker), *Axinœa striatularis* (Lamarck), *Mytilus ater* (Frauenfeld), *Modiola australis* (Gray), *Vulsella ovata* (Lamarck), with five species of *Pecten*, are among the most attractive of the bivalves usually to be found on the Tasmanian beaches. *Trigonia margaritacea* (Lamarck) is somewhat local, Bruni Island being a good place for it. The rare *Choristodon rubiginosum* (Adams and Angas) occurs in the East and South. Several species of *Myodora* are also found, and *Panopœa australis* (Sowerby) is at times found alive on the East Coast, while *Spondylus tenellus* (Reeve) occurs on the North Coast, but seldom as a perfect shell.

Of *Brachiopoda*, the best known is the so-called "Roman Lamp," *Waldheimia flavescens* (Lamarck), which is washed up amongst seaweed on the Northern beaches, and is also found alive in rock-pools in favourable situations, where the tiny *Megerlina lamarckiana* (Davidson) is also found clinging in numbers to the under-sides of the stones. *Terebratella rubicunda* (Solander) has been introduced into the Derwent amongst oysters from New Zealand.

Among the terrestrial, or pulmonate, *Gasteropoda*, *Bulimus dufresnii* (Leach) is one of the most widely-distributed, varying greatly in size and texture, according to the locality. *B. tasmanicus* (Pfeiffer) is our sole arboreal species, being found on wattles and boobyallas on the East Coast only. *Helix launcestonensis* (Reeve), from the Scottsdale district, is the finest representative of the genus in Tasmania; *H. stephensi* (Cox) being another good one. The European *H. aspersa* (Muller) and *Zonites cellarius* (Muller) are plentiful in some of the gardens in Hobart and Launceston. There are two *Vitrinas*, of which *V. verreauxi* (Pfeiffer) is the most widely distributed throughout the Island. One tiny species of *Pupa*, *P. lincolnensis* (Angas), found also in Australia, has been discovered, near Swansea, by Mr. R. M. Johnston. The small grey slug, *Limax legrandi* (Tate), is abundant in the North, and there are some very large spotted slugs, notably, *Cystopelta petterdi* (Tate), with various smaller kinds in different parts of the Island. Of fresh-water mollusca, there are several minute forms that are of interest, especially the curious little *Gundlachia*, of which two species are recorded for Tasmania; the genus is only found in Trinidad and Cuba besides. There are some forms of *Amnicola* and *Hydrobia*, one of which, *Potamopyrgus*, is common with New Zealand only. *Ancylus irvinæ* (Petterd), from the Great Lake, is an unusually large form, while *Physa eburnea* (Sowerby), from lagoons near Ross, is a fine shell. *Unio legrandi* (Petterd) and *U. depressus* (Lamarck) inhabit only the rivers that empty themselves eventually into the Tamar.

Most of the land shells are peculiar to Tasmania, whilst many of the marine species are common to Australia, especially the Southern and Eastern shores of the continent; and some have a world-wide distribution, whilst a few appear to be found now in a semi-fossil state only, such as *Potamides ebeninum* (Bruguière), *Ranella epitrema* (Tenison-Woods), and *Arca trapezia* (Deshayes). The rare *Astele subcarinata* (Swainson) was first described from Tasmanian specimens, and on one occasion, at least, in recent years it has been washed up in abundance at Marion Bay. The beautiful *Modiola arborescens* (Chemnitz) was thrown up plentifully on the Port Sorell beaches, North Coast, a few winters ago, not having been seen there before, though occasionally it had been dredged in D'Entrecasteaux Channel. The type specimens came from the West Indies; the species extends to China also. *Ianthina communis* (Lamarck) and *I. exigua* (Ibid), the violet floating sea-snails, are sometimes washed on to Tasmanian shores.

ADDITIONS TO TASMANIAN FLORA.

By. L. Rodway.

Before the year closes I am anxious to place on record a brief description of three interesting plants. Of these two are new species, the other doubtless introduced.

Ranunculus setaceus. ns — A small glabrous, tufted perennial with numerous, fairly stout, long, fibrous roots. Leaves numerous setaceous, but slightly flattened, simple or with one pair of filiform simple lobes towards the apex, 1—3 in. long, apices sometimes tipped with glands, base rather broad sheathing. Flower solitary on a slender peduncle, always shorter than the leaves, sometimes very short. Flower rather small, yellow, sepals broadly ovate, erect, pointed, 1½ lines long. Petals scarcely exceeding the sepals, usually 5—6, very narrow, oblong, blunt, gland about the middle. Stamens very variable in number in proportion to robustness of habit. Achenes not numerous, somewhat flattened, smooth, style slightly curved ; ripe achenes more swollen with a sharply recurved style ; receptacle short, conical, beset with bristles. Not at all or sparsely stoloniferous.

In mud and under water in and about pools on the Ironstone Range, alt. 3,000ft.

The plant flowers freely under water, and does not when permanently submerged depart in any manner from the sub-aerial form.

I have described this plant as a new species only after mature consideration. Its relationship to *R. rivularis,* Banks. *et* Sol., is undoubted, but if it is taken as an extreme variety of that species where are we to draw the line? This plant is very close to *R. millani,* F. V. M. and *R. robertsoni,* B., and if these are included with *R. rivularis* we shall also have to take in many New Zealand and S. American plants. Even with this extensive clubbing the species would be still ill-defined, and the mass of varieties would be unworkable.

Pseudanthus tasmanicus. ns—A prostrate, wiry, much-branched spreading undershrub, 1—2 ft. long. Diœcious. Young parts tuberculato-hispid. Leaves alternate, broadly ovate to orbicular, sometimes with a small blunt point, other times slightly emarginate, 1—2 lines long on a slender petiole of similar length. Stipules scarious, sheathing blunt, often abruptly truncate ½—1 line long. Male flowers solitary in the upper axils, pale green. Perianth lobes equal or nearly so, ovate, blunt, 1 line long; pedical slender, 1 line long. Stamens 8, filaments slender, $\frac{3}{4}$ line long, anthers pink, broadly ovate small. Pistil rudimentary, but well developed. Female flower similar to the males, but the perianth lobes slightly longer and red at the base. Staminodes small, 8. Pistil flask-shaped, longer than broad obscurely, 3-lobed, tapering into a short style; stigma capitate, tuberculate irregularly 3-lobed. Ovule solitary and occupying the entire ovarian cavity at time of flowering. Fruit not seen.

Among and about basalt rocks on the shores of Lake Lucy Long on the Ironstone Range and on the banks of the South Esk, near Avoca.

Rumex dumosus, A. Cunn.—Basal leaves few, soon withered, oblong narrow pointed, constricted as in *R. pulcher*, petiole as long as leaf. Stem leaves sessile, small slender subtending branches and flower clusters. Stem erect, very branched and spreading. Flowers very few together in distant clusters, often solitary, pedicels slender 1—2 lines long. Inner perianth segments becoming rigid, acute, and reticulated bordered with few, usually 2, prominent spines, not developing a tubercle.

Occasionally found on the roadsides in many parts of Tasmania, and probably introduced from the mainland, where it occurs in south-eastern districts. It is confined to Australia, unless it is, as Von Mueller considered, a form of *R. flexuous*, Sol., of New Zealand. This dock may easily be taken for *R. pulcher or R. brownii*, from both of which it differs, however, in the much more branched habit, few flowers in the clusters, and few spines to the margins of the mature inner perianth lobes.

SOME ACCOUNT OF THE WORK AND WORKERS OF THE TASMANIAN SOCIETY AND THE ROYAL SOCIETY OF TASMANIA, FROM THE YEAR 1840 TO THE CLOSE OF 1900.

By Alex. Morton,

Secretary Royal Society of Tasmania.

When the Scientific History of Australasia shall come to be written, it will be seen how large a share Tasmania has taken in the world of Science, and how valuable have been her contributions to its knowledge. Very early in the history of the British Settlement in Tasmania, a systematic attempt was made to classify its Flora, with the special object of discovering what edible roots or fruits were to be obtained; and this, though perhaps undertaken with a view rather to the utilitarian than the purely scientific results, was of use to the investigators who followed in the same line.

The scattered work of individual observers was first focussed in a Society, founded by Sir John Franklin in 1841, which was called at first the Philosophical, and soon afterwards the Tasmanian Society. The meetings were held at Government House, then the most central place in the city, and the roll of names on its list of members contained such names as Sturt, Leichhardt, Sir Thomas Mitchell, Captains Ross and Crozier, and many others well known to fame. In the first volume of proceedings I find the name of Dr. (now Sir) James Agnew, with Port Phillip as his address. Ever since then his name has been identified with the work of scientific societies in Hobart, and his liberality in connection with them is too well known for me to do more than allude to it here in passing.

The four departments of Zoology, Botany, Geology, and Meteorology, were the first to receive the attention of the Society, while Geography, in the face of the new discoveries being made daily, soon claimed a large share of attention.

The first Journal, published in 1843, has compressed in its pages so much that has gone to the making of history, as to make one wonder if the times seemed as remarkable to those who lived in them, as they do to us now.

John Gould, then in Sydney preparing for his great work on the "Birds of Australia," contributed a paper on the habits of the brush turkey, which had been studied, apparently to little effect, before he turned his attention to its classification.

An article by Dr. Hooker on the fossil wood found at Macquarie Plains reminds us that the eminent surgeon was even then preparing to give the world the results of his examination of the Flora of Tasmania.

The catalogue of edible fruits and roots, compiled by Mr. James Backhouse, finds its place here, considerably added to by Mr. Ronald Gunn, whose work has left scarcely anything to be done in this direction. There are descriptions of the birds and some of the fish of Tasmania, an article or two on the advantages of irrigation in the colony, and a list of native words compiled from documents in the Colonial Secretary's office by that remarkable adventurer, Jorgen Jorgenson, the Convict King.

A battle between the observers of the Ornithorhyncus as to whether that extraordinary specimen were to be classed as oviparous or viviparous was then at its height, and a careful paper in this journal gives all the reasons for preferring to believe it viviparous, but no dawn of belief that it might yet be found to have some of the characteristics of both seemed to have visited the mind of anyone. A legendary tale of the Australian Blacks, one of those collected by Mrs. Parker, shows that the Aborigines, untroubled by scientific considerations, had decided that it was a cross between the kangaroo rat and the duck, laying its eggs like the duck, and then caring for them like a kangaroo rat.

Perhaps of even greater interest to us at the present time is the fact that the return of the ships Erebus and Terror from their expedition to the Antarctic regions is recorded in this volume, with a report of the work done by Captains Ross and Crozier and those associated with them. Lieut. Kay, of the Terror, remained here in charge of the meteorological station, and did a great deal of work in connection with the magnetic survey of Tasmania. Both subjects—that of Antarctic exploration and the magnetic survey of Tasmania—have been very much shelved subjects from that time until the last year or two.

The late Mr. James Barnard was one of the earliest members of the Society, and though, perhaps not a specialist in any particular subject, was devoted to furthering the aims of all the workers, and continued his interest in this Society until its dissolution, and was a member of the Royal Society until his death.

The Rev. T. J. Ewing early made a list of the birds of Tasmania, and was one of the most useful members.

Dr. Richardson began the classification of the fishes in Tasmanian waters, which has since been carried on by other workers, and completed by Mr. R. M. Johnston.

That brilliant scholar and eminent divine, the Rev. Dr. Lillie, contributed an introductory paper to the first volume of the proceedings, and took a keen interest in the work of the various branches, into which the energies of members were directed. He was for a time Hon. Secretary of the Royal Society, and did much while in that position to further its highest aims.

The famous geologist, Count Strzelecki, who walked a distance of 7,000 miles in investigating the geological conditions of Australia and Tasmania, gave some account of his journeyings to this Society, and described many little known parts of the island. The Count examined a natural mineral water found near Circular Head, and observes, among other things, that it is sufficiently nauseous to be of medicinal value! Count Strzelecki, in 1845, published the first systematic sketch of the geology and general physical character of Australia and Tasmania.

A series of very interesting articles, by Captain Cotton, on irrigation, and one on a newly discovered steam digging machine, remind us that then, as now, there were not wanting those who saw the advantages that would accrue to Tasmania if a more enterprising spirit were manifested by the residents.

It is difficult, in looking over volumes in which every word is of historic interest, to leave out any item, but that would need so much more time than I have at my disposal that I must be content to make a selection, not perhaps the best that could be made, but one that is possible to compress into the limit of time available. For a like reason, while there are many names of useful workers left out of this short chronicle, it is not to be supposed that they were not worthy to be all on the roll of honour, but the inexorable demands of time forbid.

The second volume contains a fuller account of the Antarctic Expedition, and of the landing in two places, and taking possession in the name of Her Majesty the Queen, of the whole Antarctic Continent. It has not yet become a summer resort!

We are reminded that in the time of Sir John Franklin the "Beagle," with Darwin on Board, called at Hobart, and the great man had opportunities of observing the many interesting things in so new a country. One of the things that filled him with surprise was, that the steamer in which he went to Kangaroo Point had been entirely built in the colony.

A paper contributed by Dr. Agnew, on the poison of snakes, marks not his first membership, but his first active work for the society. His name appears in the first list of members, with residence:—Port Phillip. His first paper was written from Saltwater River, Tasman Peninsula, where as medical officer to the government he had leisure to observe the poisonous apparatus of the venomous reptiles of that country retreat. Some very useful remarks on the nomenclature and classification of rocks in new countries, by the English geologist, Mr. J. B. Jukes, set forth clearly the grouping on which geologists should found their method of classification.

The Rev. T. J. Ewing, whose list of birds is contained in the first volume, is represented in the second by a paper on the statistics of Tasmania, from which it may be of interest to make a few extracts. The three years under review are from 1838 to 1841. The revenue from the customs increased during the three years from £70,000 to £85,000, an increase of 21 per cent. The post office revenue rose from £4,300 to £6,500, or 25 per cent. The total revenue, including sales of Crown lands, rose from £144,562 to £237,381. The average value for the three years of the imports was £665,535, for a population which, including convicts, only numbered 50,000 souls. The sheep in 1841 amounted to 1,167,737; the horses numbered 12,000; horned cattle, 90,000. There were 1287 marriages during the period.

The Rev W. Colenso, an enthusiastic naturalist, contributed valuable notes of a trip in New Zealand, during which he collected more than 1000 specimens of natural history.

The picturesque museum at Ancanthe, built by Lady Franklin, contained not only specimens of natural history, but a good library containing books classified as follows:—(*a*) Works illustrative of Tasmania and the neighbouring colonies; (*b*) Works written by persons who had been, or were then, residents of Tasmania; (*c*) Works written and published in Tasmania, provided they were of such a character as would not be objected to by the Trustees. The collection contained besides many other interesting books, some of the volumes of the splendid work Gould's Birds of Australia, Mr. Westgarth in a paper on Port Phillip, then little known, describes its geological formation, but gives no hint of the alluvial richness that, in a few years, so transformed that country.

In the summer of 1838 the Rev. W. Colenso, whose papers on New Zealand form a most interesting part of this second volume, was fascinated by the description given by the Maories of the gigantic bird they called the Moa. They insisted that it lived in a cavern on the side of a mountain, that it subsisted on air, that it was guarded by two immense reptiles, and that if anyone ventured near it he would be trampled on and killed by the monster. Mr. Colenso procured some bones, and after careful examination he concluded that it was an extinct species. His paper is a piece of clear and almost convincing piece of reasoning, but was disagreed with by Professor Owen, who thought the bones, after examination, to be so recent that he expressed the hope that the animal might yet be seen striding about in the "Zoo." The Wellington Valley in New South Wales was just then attracting considerable attention on account of the fossil bones of a giant extinct animal, a Mastonodontoid pachyderm, which Professor Owen describes in this volume. This discovery was especially of interest as suggesting a more humid climate than that now common to Australia, for these creatures were frequenters of marshes, swamps, and lakes. The Aborigines of Tasmania were studied by several members, and Archdeacon Davies wrote of their ways in a careful paper or two.

This was, *par excellence*, the time for exploration. The vast new country, with untold wealth and unknown natural resources, attracted the attention of all those adventurous spirits who love to have the pleasure of treading where no foot of civilised man has before trodden. At this time Leichhardt was in the north exploring the country between Moreton Bay and Port Essington before that last journey of his, the plan of which was sketched with such sanguine anticipation of success, but from which no whisper has yet come to tell us whether it is well with him.

Sir Thomas Mitchell was continuing his investigations in the region of the Darling and the Bogan, while Captain Sturt was battling with heat, drought, and scurvy, in heroic efforts to penetrate the secrets of the central part of the dark continent. The account of his work, given in this volume, is pathetic reading.

One member whese name appears very often in the proceedings, is Mr. Ronald C. Gunn, of Launceston, whose work for the Society was of a very extensive character. He was made a Fellow of the Royal Society, London, an honour never since bestowed on a Tasmanian. He was an indefatigable worker, and did much for the scientific development of his adopted country. He and Dr. Grant were the first to send to London live specimens of the Tasmanian Tiger, a notice of which appeared in the London *Times* of May, 1850.

In the third volume of the Tasmanian Journal the name of the Rev. W. B. Clarke appears for the first time. This eminent geologist, the first in Australia to predict the finding of gold, wrote to this Journal on the subject of the fossils of the silurian age in New South Wales. Incidentally he mentions that his collection of N.S.W. fossils exceed 1,000. When we remember the difficulty of collection we can appreciate the labour involved in gathering so many specimens. Two quotations from the minutes of the Society will give a good idea of the thrilling interest of some of the meetings.

March 24, 1847.—Read (*inter alia*) Sir T. Mitchell's account of his journey into the N.W. interior of New South Wales.

April 7, 1847.—Read Captain Sturt's journal of his exploration in the interior of New Holland from South Australia.

The difference between these two narratives is widely marked, one, that of Sir Thomas Mitchell, being a cheerful story of pleasant wanderings over fine country, while that of Captain Sturt is a brave man's description of tragic battling with heat, want of water, and sickness. In one place the thermometer, graduated to 127, burst in the shade, while at the breath of the hot wind the leaves fell off the trees.

The Society also published an account of Leichhardt's overland journey to Port Essington, and a sketch of the plan of the unfortunate traveller's last journey. For that expedition a sum exceeding £1,500 was raised by public subscription, and supplemented by a grant of £1,000 from the Government of N.S.W.

Dr. Leichhardt started on this expedition with the warmest wishes of the Australian community. It makes one sorrowful, even now, to think that the heroic band stepped out of sight in the silence of the great lone land, and no seeking has ever been rewarded with even a fragment of knowledge of how they all met their deaths.

That good friend of the Society, Sir Joseph Hooker, contributes some papers on the conifere of the island, and credits Mr. R. C. Gunn with the discovery of more than half of the conifere of the whole colony. A most exhaustive paper on the Microscopic life found at the ocean washing the South Pole, was given by Professor Ehrenberg, in Berlin, and then sent by him to the Tasmanian Society, a little incident showing that the Society was well and favourably known in the scientific centres of the world.

A name which was long and honourably associated with the Society was that of Dr. Milligan. The third volume contains a paper by him on the fossils of the country between Hobart and Launceston. All his contributions were marked by much care to obtain scientific accuracy. In 1849 the Tasmanian Society lost its separate existence and became merged in that which is represented here to-night. Exit, therefore, the Tasmanian Society, having honourably fulfilled its mission.

On the 14th Oct., 1843, the Royal Society of Van Diemen's Land foi Horticulture, Botany, and the Study of Science, was formed with the help of Sir Eardley-Willmot, Bart. Its first work was the holding of two Horticultural Shows, which were very successful, but a Horticultural Society being after that formed by the professional gardeners of Hobart, the shows were discontinued, and exhibits were instead sent to the shows of the new society. HerMajesty the Queen became the patron of the Society; the Government placed a large part of the garden in the Domain at the disposal of the members, and made a grant of £400 a year, for the purpose of paying its officers and promoting its objects generally. At the end of 1845 the Secretary resigned, and Sir Eardley Wilmot, then Lieut.-Governor, fought strenuously to raise the Society from a horticultural to a more scientific one, as being more in accord with the idea of a Royal Society, to which Her Majesty had given her patronage. He opposed the appointment of any secretary who should be a mere clerk, and said the Secretary of a Royal Society should not only be able to meet the members on terms of equality, but should be a man who could be on a par with men of science anywhere. As a suitable man was not at the moment to be found, one of the vice-presidents, the Rev. Dr. Lillie, undertook the duties gratuitously for a time, and eventually Dr. Milligan was appointed, whose devotion and attainments made the Society what it has since remained—an honour to Tasmania and Australasia.

For a time the principal interest centred round the Gardens, but in 1846 it was decided to begin a collection of natural history specimens for a museum. A room in the Legislative Council Chambers held the beginnings of this museum, and in 1849 the Government granted a sum of £100 towards its support, from which time the Museum was formally recognised, and its usefulness has grown apace, until the very popular institution of which I have the honour to be Curator holds a firm place in the affections of the people of Tasmania. The first Journal of the Proceedings of the Royal Society was published in 1851, and the statistics of the colony, dealt with by Mr. James Barnard, afford interesting data for comparison with those of to-day, especially those of education. The Church of England had 35 schools on the penny-a-day system, the Roman Catholics 4, and in these denominational schools 1812 children were educated. In the Government Board Schools 1,080 children were taught, and 194 in infant schools; while 460 children attended the

Queen's Orphan Schools, of whom 396 were the offspring of convicts, and were taught at the expense of the British Government; 64 were the children of free parents, and were paid for by the Tasmanian Government. It was estimated that, including those taught in private schools, the number of children under instruction amounted to 6,214, a number which may be considered as fairly satisfactory. There was then no daily newspaper published in Tasmania, but four were published in Hobart twice weekly, and two once a week. Three were published in Launceston. The total imports exceeded the exports by $17\frac{1}{2}$ per cent.

The introduction of salmon into Tasmanian waters afforded some discussion, and was introduced in a paper by Captain Stanley, in which the opinion of Mr. Young, the manager of the Duke of Sutherland Salmon Fisheries, is quoted, and his advice given. Mr. Young says:—"I hope that you will get a suitable vessel, so that you can with safety carry the young salmon, but in case you should not succeed in getting it in every respect fitted for their safety, I would not advise you to proceed with it at all. Were you to make an ill-prepared job of it and not succeed, it would deter yourself and others from the attempt for a long time (for, assuredly, it will at some time be done successfully)." Mr. P. S. Seager has, with much trouble, written a history of the salmon experiments in Tasmania, which has been read before this Society, and will, perhaps, be familiar to most of you; but it ought to be mentioned, in passing, that the last and very successful shipment in the year 1888 was brought out at the sole expense of Sir James Agnew, by Sir Thomas Brady, then Inspector of Fisheries in Ireland.

That perennial subject, the weather, of course came up for discussion, and some valuable statistics were forthcoming on this interesting topic. There were 14 days in 1847 on which a hot wind blew, and on two days especially the air was like a heated furnace. The thermometer registered 103deg. in the shade, and later 100deg. The next year was remarkable for intense cold in the months of November and December.

At this time coal was being discovered in every direction—at Schouten Island, Port Arthur, Mersey and Don Rivers, and many other places; and Dr. Milligan was requested by the Government to report on them. This first volume has some of these reports, and specimens were sent to the Museum of Practical Geology, London, for analysis by Sir H. De La Beche. Though he did not think so highly of them as Dr. Milligan did, yet the discovery of coal in so many parts of Tasmania was a matter of the highest importance to the future of the colony. Even then, with four steam vessels on the Rivers Derwent and Tamar, it was a great consideration to obtain coal at a cheaper rate than it could be imported from Newcastle, England.

The Bridgewater Causeway and Bridge were the subject of an article by the Director of Public Works, Mr. W. P. Kay. The work of making the Causeway occupied nine years, at an average expenditure of £4,500 per annum, and the cost of the bridge was £7,580. The solid contents of the causeway filled into the river was computed at 560,000 cubic yards, and must have cost about 1s. 5½d. per cubic yard. The cost of convict labour does not seem to have been less than that of free, if the money spent on the Causeway may be taken as a criterion. We, in these more prosaic times, when the more important discoveries in botany and natural history have all been made, can hardly realise the great interest of those early meetings, when so much was new and sometimes with no parallel in the old.

Various kinds of manna were found on many of the trees in the new world, and one was discovered by Mr. Robert Kay which differed from all known kinds, and was considered to be an exudation from the mallee (Eucalyptus Dumosa). The aborigines in the North-west of Australia, where this manna was found, believed that Bhami, their hero-god, who had been taken by the spirits to the land of fadeless flowers, had sent this manna as a substitute for the honey that, owing to the drought and the absence of flowers, had for some seasons failed them.

Sir William Denison, whose practical engineering skill was of the greatest use to the colonists during his governorship, contributed among many others, an interesting paper on the construction of dams, with a view to irrigation. It is a little remarkable, when we remember how often the necessity of irrigation was pressed on the attention of the people in those early days, that no more impression was apparently made on the minds of those to whom such a system would have meant riches. We have abundant proof that Tasmania was not, on the whole, unprogressive at this time, but the people were slow to realise that science in agriculture is of the first importance.

The remarks of Dr. Agnew on the snakes of Tasmania, mentioned in connection with the Tasmanian Society, had stirred the observing power of several others, and a number of experiments were made on the relative virulence of various species of snakes, the results of which were communicated to the Royal Society by Major Cotton.

On 18th September, 1848, Dr. Nixon, Bishop of Tasmania, was elected a Fellow, and the first contribution I notice from him is one on the productiveness of Mummy wheat. From one ear received from Lady Franklin more than 7,000 ears had been taken the next season.

Obsidian buttons have lately been the cause of some speculation at the meetings of the Society; and it will interest some to know that as early as December, 1851, a specimen of this curious substance was exhibited by Dr. Officer. The report says:—"Dr. Officer showed an obsidian looking substance, having much the form of a common bung of a cask, or cork of a wide-mouthed bottle, flattened and rounded on the top and bottom (where it betrays the action of weather), and having a number of well-defined impressions round the sides, as if so compressed or pinched in while semi-fluid. This remarkable substance is said to be found on the natural surface of the pasture lands of Victoria; inquiries have been set on foot by Dr. Officer to trace, if possible, its origin."

An announcement is made at the annual meeting in January, 1853, of the removal of the Museum and Library, as well as the meetings of the members, from the rooms forming part of the Legislative Council Chambers to a hall in Harrington-street (now the Athenæum Club). This was an expensive undertaking, as formerly the rooms had been obtained rent free, while the rent of the new building was £60 per annum, with rates and taxes. The inconvenience, however, only had the effect of stimulating the members to renewed exertions in the direction of obtaining a permanent home for the increasing collection. The report of the Council says:—"The Council consider that the first step should be to apply to the Crown for a grant of a suitable piece of ground as a site, upon which, as a basis, then to proceed to raise by public subscription or otherwise a sum of money adequate to the speedy execution of so much of the plan of an extended edifice as the immediate and not very remote exigencies of the case may demand." A site was granted by the Government for the erection of a Museum, about £2,000 were raised by subscription, and the first part of a fine building erected, which contained three rooms, of which only two were then used, one for a library, another for the Museum collection. There was no lack of public spirit in those days: The facilities of communication were increasing in both Hobart and Launceston. Many ships were put on the berth to load produce for California. There were several steamers employed on the Derwent and Tamar, one of them the redoubtable Kangaroo, and a steam service between Hobart and Launceston was being seriously discussed. There were 14 stage coaches running on the main and branch roads of the colony, eight of which started from Hobart, five from

Launceston. Sir William Denison, whose interest in the society was very great, was responsible for many papers on agricultural subjects, and had some experimental plots prepared in the paddock in front of the present Government House to determine the best way to sow potatoes for large crops. He also had some observations on the best way to grow turnips, which seemed to be full of practical common sense.

When one remembers that from 1849 to 1854 the period of unrest and excitement in consequence of the discovery of gold were at their height, one can the better appreciate the devotion shown by those who remained at their ordinary avocations, and gave so much in time and money to further the cause of science and education in the land of their adoption. It was, however, impossible that the Royal Society should not feel some reflex of the tide of excitement which was turning the heads of so many in the community. Yet their work seems neither to have been left undone, or done badly, in the stress of the times. Every subject that was at all likely to educate the people, either in agriculture or engineering, in social science, or in manufactures, was taken up in a spirit of readiness and helpfulness, that must have been of the greatest use in a new community, and that marked it as an educative force in all directions. Natural History was, of course, not neglected. The discoveries of giant extinct marsupials, whether in New South Wales or elsewhere, were reported to the Journals of the Society, and aroused much intelligent interest. Reverting for a moment to the gold discovery, I am reminded that gold was discovered in California in 1847, but in 1846 Sir R. Murchison, who two years before that stated that no gold had been discovered in Australia, though he expected it would eventually be found there, received from New South Wales a small parcel containing gold in quartz, as a proof that his expectation had been realised. Some Cornish miners were advised by him to go and seek for gold in the alluvial of New South Wales, and in 1848 he interviewed Earl Grey, then Minister for the Colonies, informing him of the strong ground he had for believing in the existence of large bodies of gold ore, in quartz, at that remote spot; but Earl Grey took no steps in the matter, as he thought that the discovery of gold would be very embarassing to the interests of a wool country. He had yet to learn how adaptable a wool country may be to other forms of industry.

A medical paper was contributed by Dr. Bedford on the treatment of Scarlet Fever, which attained the dimensions of an epidemic during the years 1852-3. His recommendation of Belladonna, as a preventive and cure, is interesting, but I do not know whether subsequent experiments in its use modified the opinion of its efficacy.

The important subject of drainage, which can never be properly dissociated from water supply, was discussed in a paper by Sir William Denison. One of the conclusions at present of interest, was that for a really efficient system of drainage the supply of water must be very much increased, preferably by tapping the grand supply of the upper Derwent.

The losses and gains to Tasmania in consequence of the gold rush were noted by Mr. James Barnard in a paper on the statistics, published in the proceedings for 1852.

The population loss is set down at over 8000. During the period 1851-3 inclusive, the average value of the imports, per head of the population was £18 19s. 9d., and of the exports, £19 15s. 4d.

The balance of trade, upon the calculation of the same period of three years, was £156,505 in favour of the colony; clearly denoting under the feverish and exciting conditions of the times, the healthy state of the commerce of the little island. The quantity of gold exported in the same period amounted to the large total of 212,000oz., but most of this was first brought over from Tasmania by the lucky diggers. It was valued at £714,870.

Wages rose to an enormous amount, in consequence of the scarcity of labour, painters and plumbers getting up to 16s. per day. Mr. Barnard says: "The houses uninhabited two months before the gold discoveries were 599, or five per cent of those built; the first effect of these discoveries was to create the belief that there would be a general desertion of houses by people of every grade rushing off to the diggings. House property at the onset was greatly depreciated, and sold—and that with difficulty—at a nominal price. In a short time, however, there came an unlooked for reaction. The streets of Hobart and Launceston by the end of the year began to swarm with lucky diggers and numerous visitors, the former bent upon enjoying the fruits of their success with their friends, the latter to take up their abode more or less permanently, attracted by our superior climate, and our more quiet, better protected towns. The demand for dwellings at once exceeded the supply, and soon there was not a house to be had without a scramble, rents rising 300 or 400 per cent."

At a meeting held on the 9th April, 1854, the first report of the Victorian Government Botanist, Dr. Mueller, was laid on the table. In this quiet way a name was introduced into the annals of Tasmanian science which for many years was honoured in all the colonies as that of a man with a rare devotion to duty, a great amount of knowledge, which was always at the service of even the humblest votary of his beloved science, and a modesty and simplicity of life sufficiently uncommon as to be remarkable. All the scientific societies in Australasia owe much to his faithful work. The volume for 1853 contains the first of a large number of papers by Dr. Milligan on the Aborigines of Tasmania, their number, their traditions, and their language.

Dr. Erichsen contributes a paper on the insect fauna of Tasmania, which has particular reference to the geographical distribution of insects.

Mr. Morton Allport was one of the untiring workers whom the Society had the good fortune to number among its members. In all, he wrote 24 papers on various subjects, and was one of the most enthusiastic among those who believed that the introduction of the Salmonide into Tasmanian waters could be accomplished, and that it would be a great advantage to the colony when that had been done. His death, at the comparatively early age of 46, deprived Tasmania of a good citizen, and the Royal Society of one of its most faithful and persevering friends.

Various contributions to our knowledge of Tasmanian Botany appear under the name of Dr. Mueller. The coal seams were at this time beginning to be worked with great zeal, but unfortunately with little knowledge, and the result was in many cases disappointing. The history of a new country always contains the record of many mistakes, and they are not only in the region of science and manufacture. Among papers of interest further afield may be mentioned one on the census in the United States, which is full of facts collated in a charming manner, and one by Dr. Carpenter, read at the Royal Society of Great Britain, on the influence of suggestion in modifying and directing movements independently of the will. The vast subject of hypnotic suggestion, was even then, receiving the attention of medical students, and as a science does not seem to have advanced much since that time.

The new and fascinating method of taking sun pictures was the cause of a thoughtful paper on the subject, in which the process was explained with a clearness that must have started many an experimenter in the island on the path of the amateur photographer.

The vexed question whether the Desmidiacie were really belonging to the animal or vegetable kingdom, is discussed with much clearness by Mr. Harrap, at a later date, and the arguments on which he differed from Professor Ehrenberg and others logically stated.

These questions of the exact position of the wonderful links between the kingdoms is at all times one of absorbing interest, and then, as now, opinion was divided about some of them. The number of these beautiful alge found in Tasmania then amounted to 38.

Dr. Downing gave some account of Norfolk Island, which was written in a chatty style, and contained a good deal of information about the climate, natural productions, and geological characteristics.

Three recent discoveries, each important, mark off the year 1865 as noticeable, and they are all referred to by Dr. Hall in an address to the physical section of the Society. One was the separation of the illuminating from the heat-giving rays of the sun, discovered by Professor Tyndall, and which was the beginning of many discoveries in refraction that cannot be mentioned for want of time. The second was full of promise that has not, so far, been realised, except to a limited extent. It was the discovery of magnesium wire and its high illuminating power. It is useful, doubtless, but it has not superseded gas or electricity, as was at one time fondly hoped. The third was Baron Liebig's discovery of a substitute for mother's milk, and did much to reduce the mortality of infants during the first year of life, but if mothers more fully understood the importance of the subject it would be more used than it is at present. Even now the infant mortality is far too high for the enlightenment of the age. I mention these to show how alert the members were then, as now, to notice what was going on in the world outside Tasmania, and to utilise that knowledge for the benefit of their fellow-citizens. In May, 1865, the attention of the Society was directed to the necessity of some method of establishing a time signal which should give the time regularly so as to be available for the whole of Tasmania. The first duty of fixing a time signal was soon after undertaken by Colonel Chesney, who arranged for three guns to be fired at 4 p.m. on the first Thursday in every month, or, if that day proved wet, they were fired on the first fine day following. In 1867 the Museum, three rooms of which had been built, contained a sufficient collection to justify bringing into use the upper room, and various kind friends gave much time to the arrangement of the specimens in the best way then considered possible. One cannot speak of their labour with other than gratitude, even though the classification had been of the primitive order.

The practical aspect of every new discovery commended it or the reverse, to the notice of many of the Fellows, and the possibility of a manufacture of paper from the Esparto grass, which, it was believed, would grow well in Tasmania, drew a discussion on the subject, and Mr. James Barnard took great pains to set before the Society all the available information on the subject, including plans and cost of machinery.

Political economy came under discussion for the first time in 1872, when Mr. E. C. Nowell read a paper on the subject with special reference to the unemployed. For the first time the colony was experiencing the fact that there is such a thing as a labour problem, and it has not left us since. Occasionally papers were read on the beetroot industry, and all the scientific and practical information necessary to start a beet factory are to be found in the records of the society; but the production of sugar from beetroot is not yet one of our established industries.

The name of the Rev. J. E. Tenison Woods appears for the first time in the reports as a contributor in 1874, but the reverend geologist had then been a corresponding member for many years. His great services to the people of Australia generally and his devotion to science made him a contributor whose papers were valued, and whose personality was honoured in all the scientific societies on this side of the equator, while his name and that of the Rev. W. B. Clarke were familiar as household words in all parts of the world. In 1872 the Council acquired a large wooden building, which was I think used as a store, and all the specimens, for which there was no room in the Museum, were placed there From this time onward the proceedings of the Society are familiar to many of the present members of the Society that a recapitulation of them would be unnecessary.

The obligations under which the Society lies to Mr. T. Stephens, Mr. R. M. Johnston, and the many members now here who were good friends of science since 1875 are known to all present, and their recapitulation would only seem fulsome, but an exception to this rule may be permitted in the case of the Hon. Sir James Agnew, whose connection with the Society dates from 1840, and who was the able and liberal hon. sec. of the Society from about 1861, almost to the present time, with the exception of a visit to England, when Mr. James Barnard well filled the gap until his return. From Sir Eardley Wilmot, who was a most interested President of the Society, to the present, the Royal Society has been fortunate in having as Governors of Tasmania, so many who were keenly alive to the advantages of a scientific society as an instrument for the elevation of the people. It has been well said that many tastes and one hobby make the condition of greatest happiness. To all who will, the Royal Society offers that choice of tastes and hobbies which will be of the most use to the possessor, and the most beneficial to his fellow creatures. A list of the subjects dealt with during the period of the Society's existence, shows how varied was the field of its activities, and how eminently practical was much of its work.

In June, 1874, the first contribution from Lieutenant Legge was recorded in the form of a paper on the birds of Tasmania, and accompanied by 20 prepared type specimens as the beginning of a type collection of birds. Col. Legge's interest in the Society has been constant since that time, and though, during his residence in Ceylon, he gave up his spare time to the description of the birds of that tropical country, he began on his return here to take the same place in the Society as before he left, and is now one of its best friends.

The contributions of Mr. R. M. Johnston began in 1873, and have been continued ever since. Geology, paleontology, ichthyology, and economic science have all been treated in his thorough and masterly manner, and he is a worker to whom we are all very much indebted. In 1880 Mr. Johnston came to take up his residence in Hobart, and from that time the period of most active exertions in behalf of the Society commenced. The Government published Mr. R. M. Johnston's book on the Geology of Tasmania, a work which was the fruit of years of patient observation and careful study, and is an invaluable text book. His hand book of Tasmanian Botany has also been of the greatest use to students. To convey some idea of the work done to the Society by Mr. R. M. Johnston, I give a list of the subjects contributed by that gentleman:—Pisces, 14; Conchology, 9; Botany, 4; Geology, Palœontology and Mineralogy, 45; Economic Science, 12. A total of 84 papers.

Of earlier date still, are the contributions of Mr. T. Stephens, M.A., whose papers on geological subjects have been continued from time to time for more than forty years, and whose interest in the work of the Society is unabated.

Dr. Swarbreck Hall and Mr. Francis Abbott are also two contributors, whose statistical and other papers were very numerous and instructive. For some years Dr. Hall contributed papers on the relation of the climatic condition to the health statistics of the colony, and Mr. F. Abbott's Meteorological papers were looked forward to with great interest month by month. Mr. F. Abbott, jun., the present superintendent of the gardens, followed in his father's footsteps, and though of late the pressure of other duties have prevented much work of a special nature for the Society, his membership has continued unbroken.

For many years after its establishment, the Royal Society did nothing towards advancing the historic knowledge of

Tasmania, but Mr. J. R. McClymont, M.A., and Mr. J. B. Walker, F.R.G.S., took up the subject in the eighties, and while Mr. McClymont wrote on the geographical part of the subject, Mr. Walker took up the history of settlement and of discovery with much patience and ability. His delightful English, his proved accuracy, his untiring care in collecting facts in connection with the early history of his native country, and his enthusiasm for the good of the Society, made his death last year a calamity to the Society, almost every member of which was his personal friend. The historical section owes its existence principally to His Lordship the Bishop of Tasmania and to Mr. Walker, both of whom worked with great zeal in its establishment. The various papers contributed by Mr. J. B. Walker are of so much value that the Government have granted a sum of £100 to have them gathered and printed in one volume.

There are many new workers, who, during the last few years, have devoted themselves to special branches of science, and kept up interest in the meetings by timely contributions, among whom, without disparagement to other workers, may be mentioned Mr. L. Rodway, whose botanical notes and contributions to the Flora of Tasmania have been invaluable. Mr. Rodway's forthcoming work on the Botany of Tasmania is to be published by the Government, and is arranged on a most comprehensive and useful plan, whose completeness leaves nothing to be desired.

The splendid work of Mr. Petterd, who was joined afterwards by Mr. Twelvetrees in descriptions, merits more notice than can be given to it here, for their study of mineralogy has resulted in the discovery of new and rare minerals, and they have much increased the general knowledge of the subject. Mr. Petterd has also published a monograph of the Land shells of Tasmania, a most complete work, and has also written and described many new shells, in addition to his great service in the discovery and description of minerals.

The mosses were carefully worked by Mr. A. R. Bastow when he lived in Hobart, and that interesting study has since been taken up by Mr. W. A. Weymouth.

In conchology, Miss Lodder has done good service to the Society, and has classified the specimens of Tasmanian shells in the Museum, replacing from her own collection those which were in bad order.

The work of Mr. Sprent, whose explorations in the island were carried out with utter disregard for personal comfort, should be cheerfully recognised. His interest in the collection of minerals, when the mines were just beginning to be opened up, was only an earnest of what might have been done had his life not been so prematurely ended.

Mr. C. E. Beddome was also a good friend to the science of conchology, and his own specimens and studies were always available for the use of any students.

The meteorological work of Mr. A. B. Biggs, of Launceston, has been of the greatest value, and his patient record of much observation increases very much the value of the reports of the Society.

Mr. A. Montgomery, formerly Government Geologist, contributed several papers on geological subjects, and was one of the members whose careful observation was at the service of the Society on any subject lying within the scope of his studies.

Among scores of contributors and hundreds of subjects one might go on for an hour enumerating those to whom the Society is indebted in various ways, but this necessarily imperfect sketch must conclude with a list of the main subjects treated during the time under review. Remembering the many difficulties inseparable from life in a new country, and the special conditions of the population, with the upset caused by the discovery of gold, the list of papers as a partial record of work done by scientific men in Tasmania is creditable, and we may well be proud of belonging to a Society which has so splendid a record.

Taking the subjects in order the number of papers is as follows:—

Mammalia	12
Aves	27
Conchology	44
Reptilia and Amphibia	6
Pisces	53
Insecta and Crustacea	18
Vermes	3
General Zoology	18
Botany	85
Geology, Paleontology, and Mineralogy	132
Geography	45
Ethnology	19
Astronomy and Meteorology	56
Economic Science and Education	20
General Subjects	68

Total papers, not including small papers on various subjects, 606.

It is to be hoped that this record, compiled at the end of this century, may stimulate those who carry on this work in the century to come not only to do likewise, but much more abundantly.

PRACTICABLE FORESTRY IN TASMANIA AND ELSEWHERE.

By A. Mault.

The immense extent of forest land in Tasmania has struck every visitor to the island from the time of Abel Tasman to our own day. On the visitors who came to stay as settlers, this fact made an unfavourable impression, as its signification to them was the cost of clearing land for cultivation. And this impression has coloured and affected all that has been done in the way of dealing with forest land in the State. Trees have been regarded almost exclusively as impediments to agriculture, and not as possessing any intrinsic value worth consideration. Consequently every suggestion made for forest conservation has been regarded with suspicion as possibly entailing something to be done for forestry at the expense of agriculture and settlement. It is time that this suspicion should be banished. There can be no doubt but that agriculture is the mainstay of the country, and that nothing should be allowed to hamper or obstruct it. But a proper system of forestry, instead of doing this, would really benefit agriculture by improving climatic conditions. In fact forestry need not enter into any competition for land with agriculture. Land altogether unsuitable for agriculture is very well suited for tree growing. I know great tracts of country in France that could not be let for half-a-crown an acre per annum for farming, but which yield more than thirty shillings an acre under forest cultivation. There is an immense extent of similar country in Tasmania, and some of this could be better used for forestry than for anything else. The rule to be followed in the appropriation of land for any purpose, is to appropriate it for the purpose that will yield the largest return. By all means reserve for settlement, and for agricultural and horticultural purposes, all the best of the land; when that has been done there will be plenty left for pastoral purposes and forest conservation.

With regard to forest conservation itself, there is a great deal of misapprehension. To judge by the manner in which it has been discussed in these rooms and elsewhere, one would think that the advocates of forest conservation proposed to subject the whole of the Crown woodlands in the State to a regime of conservation. Such a proposal is not only impracticable, but useless, as it would be sure to break down under its own weight of responsibility and costliness. This mistaken idea of what is proposed has arisen from a misunderstanding of what has taken place in other countries. It is true that in France, Germany, India, and other countries where a system of forest conservation exists, the system applies to all the State domains; but these countries are all old settled ones, in which the State domains form but a comparatively small proportion of the area of the whole territory. The woodlands of these domains are therefore only of such an extent as can be practically dealt with. It would be folly in Tasmania to do more than deal with a reasonable portion of its woodlands.

The first thing to be done is to determine what this proportion shall be, and to select the sites of the reserves. In making this selection, after taking care that land is not taken that is better suited for other purposes, the most important condition is position and accessibility; then the question of adaptability of the climate and soil of the locality to the kind of timber proposed to be grown and conserved must be considered. As the position of the reserves is thus so important, no time should be lost in determining this point, at least with regard to those in the more settled parts of the country. I understand that of the 12,000,000 acres of still unalienated Crown land in the State, about 175,000 acres have been proclaimed as forest reserves. This area I think quite insufficient in extent for future requirements, but it is still more inadequate when the location of the reserves is considered. Not only should there be large national reserves for industrial and commercial purposes in accessible places, but there should be smaller ones in the neighbourhood of all townships for local requirements of all sorts. The advantage — not to say the necessity—of doing this, seems to have been altogether overlooked in Tasmania hitherto, with the result that in such a simple matter as the supply of firewood the cost in many places has doubled within the last dozen years—and the firewood industry is an important one from the point of view of the general population. In many places also—especially places without railways — wood for constructional purposes has greatly appreciated in value. In some other countries greater prevision has been shown, particularly in France, where many of the communes have woodlands that are managed for them by the National Forest Department, with the result that in some of them the revenue derived is sufficient to pay for the whole cost of local government without any recourse to rating for either municipal or educational purposes. The provision of all these necessary national and local reserves can now be made with far less difficulty than in the future, and I would strongly urge that it be at once made.

There is no necessity for any further legislation to carry out my recommendation thus far. As the *Crown Lands Guide* says, "The Governor-in-Council may, by proclamation in the

Gazette, except from sale, and reserve to His Majesty such land as he sees fit for the preservation and growth of timber." Under this power 175,000 acres have, as I have before said, been reserved, but so far as I can learn no special action has yet been taken to preserve or grow timber on these reserves. So that what is required is not only that the reserves should be increased in extent, but that they should be actively and practically administered so as to fulfil the object which is the pretext of their reservation.

It will be noted that in all this, when once the reserves are proclaimed, there is no interference whatever with the present administration of Crown lands, even that part of it which deals with exploitation of timber in forest lands that are not reserved. All the present system of sawmill leases and timber licenses may be carried out as set forth from page 31 to page 52 of the *Crown Lands Guide*. I express no opinion on that system if forest reserves are more expressly withdrawn from its operation; but only wish to make it clearly understood that the forest conservation I advocate will not in any way interfere with the revenue derived by the Lands Department from its leasing and licensing regulations.

With regard to the larger forest reserves of the State, some will have to be for general purposes, and some for special; and the locality selected for each of them will, of course, depend on its purpose. As before mentioned, good arable land is not necessary—in most cases it may be said—is not desirable. Some part of every large reserve will be found to possess such better quality of soil as may be desired for the nursery that should be attached to every reserve. Usually the larger reserves, at the time of their selection, will contain trees of several kinds, and of course these kinds will be conserved to their maturity; but in the long run it will probably be found best to select for the permanent afforestation of each reserve the cultivation of the special tree that has proved the most successful in its region. Thus, in time we shall have large regional reserves of all our most marketable kinds of eucalyptus, such as blue gum, peppermint, stringy-bark, and iron-bark; of pines, such as Huon, King William, and celery-top; and of blackwood, myrtle, and other woods. At the same time persistent efforts should be made to introduce suitable foreign timber trees for the local production of industrial woods possessing qualities that are wanting in the Tasmanian ones.

With regard to the smaller local forest reserves there will probably be in many cases but a very restricted scope for selection. Still the selection should be made, even if it involved the reafforestation of land that has been partially cleared for pastoral purposes, or has never been covered with bush. In such cases probably the best initiatory process would be wattle planting, with or without some tree planting for permanent timber. Till the timber has grown to maturity, the wattle might be subject to a 13 or 15 year rotation for bark and firewood, and from the first rotation coming in the expenses of the reserve should be more than met. In the cases in which the reserve is already wooded, the regime would be similar to that of the large reserves carried out on a smaller scale.

Each reserve should have an adequate staff to properly take care of it—not necessarily an expensive staff, but one suitable to the condition and extent of the reserve. But the central administration should be virtually a school of forestry. It should consist of a properly qualified conservator, and two or three more or less qualified assistants. When the system of conservation best adapted to our conditions here is duly decided upon, it should be systematically but gradually carried out in all the reserves. The system will be based upon a thorough practical knowledge of forestry in general, and of the timber trees of Tasmania in particular. Of course in the large reserves the trees will at first be there, and the conservancy will have to decide what is the best to be done with them in their present condition—that is, to make the best of them as they are, and with the view of enabling the introduction of a proper system of rotation, which is the basis of all economical forestry. Some of the timber will require a long period of rotation, probably 100 years, and the reserve will have to be divided into a corresponding number of sections or "cantons," as they are usually called. It is evident that this cannot be done at once, for probably in all the cantons as at first defined there would be mature trees that would be spoilt if made to wait for their turn in the rotation of felling. It will be in arranging for and meeting this condition of things that the skill and discretion of the conservancy will be proved. It is not an insurmountable difficulty, and with patient perseverance it will be astonishing in what a short time a reserve will be reduced to comparative order, showing one canton in process of being cleared by the current year's felling, last year's canton being prepared for planting and in process of being planted, and those of previous years being watched, tended as required, and periodically thinned. This latter operation is timed to secure, if possible, a market according to the age of the thinning for hop poles, telegraph poles, fencing, mining timber, railway sleepers, piles, and wood for such like services, and if the waste cannot be sold as firewood or charcoal, it is burnt to disencumber the ground. Under this system by the time the last canton of a forest is felled, the trees in the first will have arrived at maturity, and the market will be kept regularly supplied with timber and wood of all sorts and kinds.

The conservancy will have to settle the questions of the proper time of felling the various kinds of timber trees, the proper manner of planting, the best method of seasoning wood, including seasoning hard woods while the trees are standing as practised in the teak forests in India, the time and manner of selling the wood, the means to be taken for protecting the forests from fire, and all such details of forest conservation. The carrying out of all its duties by the conservancy will naturally train its staff to the fulfilment of theirs, so that in time they can be entrusted with the charge of the various reserves under due direction and supervision from headquarters. The varying importance of the State and local reserves will afford means of duly recognising zeal and ability by promotion. But the importance of getting a well-trained staff emphasises the necessity of securing a thoroughly capable conservator, for there cannot be good training without a good trainer. It would be the falsest economy to get an incapable or badly trained man who could only introduce or perpetuate a bad and slovenly system.

It will naturally take some time to get the conservancy into full working order, so that it can show paying results. The length of this time will very much depend upon the conservator, and the means given him to make a proper start. This can be done by at once establishing an important local reserve at headquarters. I would suggest that the area of Mount Wellington proclaimed by the Governor-in-Council of the 25th September, 1871, as a water reserve for the supply of the City of Hobart, should be also proclaimed as a forest reserve, together with all the adjacent unalienated Crown lands. That such lands are not well adapted for ordinary settlement is, I think, shown by the fact that they are not already taken up. What the area of this reserve would be I cannot say precisely, but probably such parts of it as could be conveniently held and administered, together with the water reserve, would form a forest of five or six thousand acres, quite a sufficient area for the proper instruction and development of a School of Forestry. Such a proclamation would not interfere with the water supply of Hobart, but on the contrary further protect and increase it by the re-afforestation of much of the mountain that by fires and neglect has been left bare, and led to the continuous diminution of the rainfall there. Neither should it interfere with the enjoyment of the mountain by the people of Hobart and their visitors, but greatly increase it by adding the additional charms of judicious planting, and, by careful guarding, restrain the mischief and dirty doings of the larrikin element in our midst. On the other hand the great diversity of soil and climate to be found on the mountain with its slopes and valleys exposed to every aspect of the heavens, and shown by the wealth of its flora, point it out as eminently fitted as being the training ground of our School of Forestry. All but three of the eight woods I mentioned as the chief marketable woods of the State already grow there naturally; and the other three, with perhaps the exception of iron-bark, would probably grow if proper conditions were observed. In fact the experimental observation of what would grow, and what would not, and what conditions had to be observed, would form most useful object lessons in the course of study and practical work both with regard to native trees and to attempts to introduce European, American, and other pines and hardwoods. The scientific and technical education of the higher grades of the conservancy officers could be easily arranged for, and the results of the manual and technical training of the lower grades of forest guards should more than pay for such training when carried on so near to such a market as Hobart. But apart from this, the occupation of the mountain for this purpose would greatly add to its value in all respects, and the training could be easily and continuously supervised so as to insure an early supply of the officers required for the whole State. I am convinced that this is the best, the easiest, and the most economical method of properly inaugurating a system of forest conservancy on the State.

I need not expatiate on the necessity of taking early means of establishing this system. Forestry, like agriculture, deserves every encouragement, for like agriculture it adds, when properly carried on, to the wealth of the soil on which it is exercised by continually renewing its fertility, whereas mining, though productive of immediate large returns, permanently impoverishes the ground by taking out its wealth once for all. In a young community of course mining is encouraged, so that money may be earned, and become available in a short time. The timber treasure of the State has for the same reason been worked on the same lines as the mineral wealth—it has been allowed to be worked out without making any provision for its renewal, though such renewal is as practicable in regard to timber as it is impossible in regard to minerals. It is true that the land from which trees have been removed is sometimes improved by the removal, and fitted for other purposes; but it is rarely so in the case of land leased for saw-milling purposes, and on which felling and splitting licences are valid; for such land is usually left so encumbered with rubbish and tree stumps and so quickly overgrown with scrub as to be more difficult and costly to clear than when in primeval forest.

It is time that a new policy in regard to this matter should be adopted, or at least that a new system should be introduced to supplement the present one. The rate at which our available forests have disappeared and are disappearing is great, and continually becoming greater. As nearly as I can estimate from the replies received to my enquiries, from 70,000,000 to 100,000,000 square feet of sawn timber are produced yearly in the State, of which about one-tenth is exported. What the quantity is of unsawn and hand-sawn timber, timber used for mining, fencing, splitting, and such like purposes, wasted by splitters and burnt by bush fires, it is almost impossible to guess, quite impossible to estimate; five or six times the quantity sawn is probably far below the real quantity. So it is quite time to arrange how we are going to supply such a consumption from our available sources—that is, from accessible sources; for there are millions of acres no more accessible at present than if they were in the moon. On the other hand, there are evident signs that if we wish to secure any important share in the markets of continental Australia, and South Africa and England, we must be ready not only with an assured supply of marketable timber, but with one of properly seasoned timber. It behoves us, therefore, to prepare for action. The best preparation we can make consists in organising measures, one of the chief of which will be forest conservation. In adopting this we may dismiss all misgiving by the knowledge of the fact that no country which has adopted it has ever regretted its adoption.

NOTE ON ITACOLUMITE OR FLEXIBLE SANDSTONE.

By E. G. Hogg, M.A.

A.

The existence of flexible sandstone appears to have been known of since 1780, when specimens were brought to Europe from Brazil by the Marquis of Lavradio, Viceroy of Rio de Janeiro. The bed-rock in which the flexible sandstone occurs was found by Von Eschwege to be largely developed near Mt. Itacolumi in the State of Villa Rica, Province of Mina Garaes, Brazil, and is described by him as a fissile sandstone containing plates of talc, chlorite, and mica. This rock contains a little gold, and has been shown by Heusser and Claraz to be the parent source of the Brazilian diamond. The beds generally rest on the crystalline schists and frequently pass into conglomerates. According to Fr. Hartt (Geology and Physical Geography of Brazil, 1870) the bed-rock is probably an altered Lower Silurian formation, while Prof. O. A. Derby classes it as of Huronian age. In this bed-rock the flexible sandstone occurs in some abundance; it is distributed in such a manner as to point strongly to the conclusion that the sandstone is only flexible when it has been considerably metamorphosed. Professor Derby* states that on one side of a fissure the rock may be often found without any trace of flexibility, while on the other it is laminated and flexible. He concludes that flexibility is not an original characteristic of the rock, but is a "phase of weathering" or decay brought about by percolating waters.

Mr. R. D. Oldham, F.G.S., Director of the Indian Geological Survey,† has discussed at some length the occurrence of flexible sandstone at Kaliana, near Dadri in Jhind. [It is probable that the specimen exhibited by the Lord Bishop of Tasmania came from this locality.] Mr. Oldham states: "at Kaliána the flexible stone occurs on a hill composed of vertically bedded glassy quartzites: it is confined so far as my investigations and enquiries went, to one single spot where, for about 20 feet across the strike, and for about 30 yards along it, the rock has become flexible; near the margin of this area the flexible stone passes downwards into the ordinary quartzites, but in the centre the decomposition had extended downwards to the floor of the quarry, a depth of fully 15 feet; here, too, the rock was much softer, more decomposed and flexible than near the margin."

* Amer Journal of Science, Vol. XXIII. (1884), pp. 203, etc.

† Records of the Geological Survery of India, Vol. XXII, Part I, pp. 51, etc.

This view of the connection between the decomposition and flexibility of the sandstone is, to a certain extent, borne out by Mr. Tuomey in his Report on the Geology of S. Carolina. He observes that the itacolumite of that state "passes even in the same mass into compact quartz, to be distinguished from common quartz only by its stratified structure," and that "the passage from the arenaceous to the compact variety is gradual, and it is in this passage that it assumes the form of itacolumite" (flexible sandstone).

It must be noticed that the term itacolumite has two different significations; it is with some writers "flexible sandstone," with others the bed-rock in which "flexible sandstone" occurs.

It would appear that so far as the field relations are concerned—though more evidence on this point is much to be desired—itacolumite only becomes flexible when it has undergone a certain amount of decomposition, probably due either to weathering, or to the percolation of water or other solvent. Such weathering or solvent action may remove, either *in toto* or in part, certain of the original constituents of the rock. Of course, as a result of chemical combination, these constituents may be replaced, to a more or less extent, by other bodies.

It is worth noticing that so far as our knowledge on the subject goes, flexible sandstone only occurs in metamorphosed deposits, which are undoubtedly of very ancient origin.

B.

In this section of the note I must acknowledge how much I am indebted to the paper of Mr. Oldham, previously referred to. I now propose to give a digest, mainly drawn from Mr. Oldham's paper, of two theories brought forward to explain the peculiar properties possessed by flexible sandstone.

It seems best to refer to the generally accepted theory, *i.e.*, the theory found in recent times in many extensively purchased treatises and manuals on geology. This theory would ascribe the flexibility of itacolumitic sandstone to the talc, chlorite, and mica stated to occur in it. It is only fair to notice that the partisans of this older view were unacquainted with the modern methods of petrological analysis. This older view of the cause of flexibility can be traced to Von Eschwege, to whom is due the fanciful name of itacolumite. But apart from the difficulties depending on the physical properties—in the matter of elasticity—of mica, it appears quite clear from Mr. Oldham's paper that flexibility is exhibited by the itacolumite, even when mica is absent, or is quite subsidiary. If the cause of the flexibility lie in the presence in the slab of flakes of mica, chlorite or talc, whose planes are parallel to those of the laminations of the slab, it is difficult indeed to see how to account for the stretching of the slab when tension, and its compression when pressure, is applied. I have recently been able to examine a specimen of flexible sandstone in the possession of Mr. T. S. Hall, M.A., Acting-Professor of Biology in the University of Melbourne, and in this specimen both of the phenomena of extension and compression are present. After all, if the rock shows flexibility when mica, chlorite and talc are either entirely absent, or are quite subsidiary, it seems quite clear that the older theory must be abandoned.

The theory with which we have now to deal is, I believe, the one usually accepted amongst modern geologists. Though not without its own difficulties it is in many ways more convincing than the one due to Von Eschwege.

Mr. Oldham's view, as stated in his own words, is that: "the flexibility of the rock is due, not to the flexibility of any of its constituents, but to some peculiarity in the mode of aggregation of the individual grains of quartz and other material of which it is composed." A similar idea was put forward by Klaproth § as far back as 1785, and at a later date by the Rev. Dr. Haughton, F.R.S.

Mr. Oldham appears to have carefully examined the rock in thin microscopical slides. As a result of his labours, he states: "If a slice of flexible sandstone is examined under the microscope, by reflected light, it exhibits a structure most conspicuous in all the specimens of flexible, and equally conspicuous by its absence from all specimens of non-flexible, stone I have examined. The rock consists of irregular aggregates of grains of quartz separated from each other by fissures and crevices which extend deep into the stone and give one the impression of ramifying through its mass further than they can be actually traced. Should one of these aggregates of quartz grains be touched with a needle it will be found loose and easily moveable from side to side, but it cannot be displaced without fracture, either of itself or of the surrounding particles. In fact the rock consists of a number of irregular aggregates of quartz which hold together by projections on one fitting into hollows in another, while the clear space between them allows of a certain amount of play."

Mr. Oldham gives two plates supporting his view of the structure of the rock. Mr. Oldham then proceeds in development of his theory as follows:—"In the Kaliána rock there is, besides the quartz and accessory minerals, a certain proportion of felspathic paste, more conspicuous in sections cut transverse, than in those cut parallel to the bedding. This paste does not surround the individual grains of quartz, but occupies spaces between aggregates of grains, and it is

§ Schrift Berl. Ges. Natfur. Freunde VI., 322 (1785).

to the decomposition and removal of this paste that the flexibility of some specimens is due. In such a rock the development of a flexible structure depends on the proportion and mode of distribution of the felspathic mud."

I have, I think, stated the essentials of Mr. Oldham's theory, viz., the peculiar mode of aggregation of the quartz grains, and the removal of a certain proportion of the "felspathic mud" in which, to a more or less extent, the quartz grains are included. The partial removal of this enveloping mud creates free spaces which the quartz grains may occupy when stress is applied to the surface of the slab.

A theory, apparently identical with that of Mr. Oldham, was put forward in 1887 by Herr O. Mügge.||

Through the kindness of Mr. Morton, secretary of this Society, I recently secured a small piece of flexible sandstone, believed by Mr. Morton to have been brought from India. In external appearance it does not differ appreciably from the specimen exhibited by the Lord Bishop this evening. The microscopic slides prepared show that the rock consists mainly of quartz grains which had suffered little attrition before deposition. Biotite and muscovite are both present, but from their feeble development they can hardly be regarded as a main cause of the flexibility of the stone. In addition the slide shows the occurrence, in fair quantity, of a matrix of isotropic character containing much included matter. The inclusions are, for the most part, quartz grains of microscopic dimensions and a small amount of opaque matter, the nature of which I have failed to determine. This opaque matter is, however, so subsidiary, as to suggest that it does not play any part in the explanation of the flexible nature of the rock.

The slides appear to me to clearly show that part of the paste originally enclosing the un-and sub-rounded grains of quartz has been removed. The slides do not throw any light on the interlocking structure of the quartz on which Mr. Oldham's theory largely depends. This negative result is possibly due to the fact that my slides were not cut in the direction required to show up to advantage the interlocking structure, and the small piece of sandstone in my possession did not admit of the preparation of many slides. On consideration it does not appear clear that the "interlocking" of the quartz is the fundamental point in any theory brought forward to explain "flexible sandstone" It would seem rather that a *vera causa* is to be found in the partial removal of the matrix, whereby the quartz grains have free play to move when the slab is stressed in any manner. As regards the origin of an interlocking structure in the quartz Mr. Oldham is silent, and indeed any theory to explain this

|| Neu. Jahrb. I Band., 1887, pp. 195-7.

difficulty is very hard to formulate. Mr. Oldham, it is only fair to say, attributes much weight to the removal of the matrix in a suitable proportion. I cannot do better than again quote from his paper. "The development of a flexible structure depends on the proportion and mode of distribution of the felspathic mud; if absent or only present in very small proportion, decomposition will not extend deep into the rock, the quartz grains will be detached and fall off, leaving the undecomposed rock with a mere film of weathered stuff on the surface; if it is too evenly distributed, the quartz grains will not be in sufficiently intimate contact with each other, and as the rock weathers it will decompose into grains of sand easily detached and removed; if finally it should be suitably distributed, but too large in amount, the voids left by its removal will be so large that the quartz aggregates will not interlock with each other."

Mr. Oldham goes on to state, "the number of conditions which must be fulfilled satisfactorily accounts for the rarity of flexible sandstone, and to a certain extent for the capriciousness of its distribution in rocks which are of the same age and have, to all appearance, the same composition and structure."

With this statement of Mr. Oldham I am quite in accord; the removal of the matrix in just a suitable proportion seems necessary. With regard to the isotropic matrix, it would appear that we have to look to a double metamorphism. The rock was, we will assume, a normal sandstone initially; intense heat may have led to a partial fusion whereby the external surfaces of the quartz grains may have been transformed into a glassy material; at a later date solvent action may have removed this matrix in such suitable proportion as to give flexibility without disintegration. This is, of course, mere hypothesis, but the importance of explaining the isotropic base of the rock is at least as serious as the interlocking structure of the quartz.

Mr. Oldham, in support of his view, attaches much importance to the appearances presented by the flexible sandstone near Chárli, south of the Pemganga River in Berar. He states "it is an ordinary soft sandstone of rounded grains of quartz with a little felspar, held together by a cement of carbonate of lime, which forms 35·9 per cent. of the whole mass. Here there is no comparatively soluble material whose removal leaves the rest of the rock as a mass of irregular aggregates interlocking with each other, for on removal of the cement by solution, the rock falls into sand. But if the fractured surface of the rock is examined, an abundance of sheeny patches point to a crystallisation of the cementing matrix, and these planes afford a number of planes along which solution proceeds with greater rapidity than elsewhere, and as a result the rock becomes divided into irregular aggregates of sand and calcite."

It seems to me that the sample of the Chárli sandstone needs much consideration before it can be regarded as a real support to Mr. Oldham's views as to the flexibility of the Kaliána rock. The difference between the two cases is fairly obvious; in the Kaliána stone the quartz grains interlock, and the matrix is partially removed; in the Chárli rock the interlocking takes place not between the quartz grains, but between the facets of the crystals of calcite forming the base. The two explanations have, however, an important feature in common, viz., the occurrence of free cavities which may ramify into the rock in all directions.

In this context it may be well to mention the occurrence of flexibility in a rock which is not sandstone. Mr. G. W. Card * in 1892, drew attention to a flexible limestone of Permian age developed at Marsden, in the County of Durham, and at a point south of Sunderland. The rock is very finely laminated, is very soft and friable, and in general appearance not unlike a fine-grained sandstone It appears (according to Sedgwick) to have resulted chemically from deposition in successive layers.

From sections prepared for the microscope it would appear that a low power reveals a large number of irregularly shaped empty spaces, in the main ranged linearly in directions parallel to the bedding, but also occurring promiscuously through the section. The material of the slide is mainly an aggregate of grains of dolomite, with a very few grains of quartz and specks of blue and brown material. Mica is very rarely present. The larger grains of dolomite appear to be intergrown in such a way that the convexity of one fits into the concavity of another. As a cause of flexibility, Mr. Card suggests: In the first place room for internal movement is provided for by the abundance of empty spaces, and in the second the structure revealed by high magnifying power suggests the possibility that many of the grains are interlocked in such a manner as to permit of a certain amount of movement upon one another. Owing, however, to the small size of the grains, Mr. Card was unable to demonstrate whether the grains actually possessed such power of movement or not.

Mr. Card's paper is of the greatest interest; the rock it describes differs much both in point of age, composition, and mode of origin, from Mr. Oldham's flexible rocks; again, the reality of the interlocking structure is far from certain, while the existence of cavities allowing free play of molecular movement seems well established.

* Geol. Mag. (3) IX., 1892, pp. 117, etc.

The instances I have cited may now be summed up. The Kaliána rock shows (?) interlocking structure of quartz with removal of matrix ; the Chárli rock shows cavities with possible interlocked structure of matrix. The rocks described by Mr. Card show cavities with possible interlocking of main material of rock (dolomite).

It would appear from these results that interlocking is often doubtful, and in the main subsidiary ; that flexibility depends on (1) the nature of the matrix ; (2) the removal of such matrix in suitable proportion, as set forth by Mr. Oldham, so as to allow of free movement of the other constituents of the rock.

SIR JAMES AGNEW, K.C.M.G., M.D., M.E.C.

Obituary.

Sir James Wilson Agnew, K.C.M.G., M.D., M.E.C., Senior Vice-President of the Royal Society of Tasmania. Died on 8th November, 1901, in the 87th year of his age.—Born at Ballyclare, Ireland, on the 2nd October, 1815, he studied for the medical profession in London and Paris, and at Glasgow, where he graduated M.D., as his father and grandfather had done before him, and came to Australia in 1839. After a short stay in New South Wales and Victoria (then known as Port Phillip), he accepted from Sir John Franklin the offer of appointment as medical officer to an important station at Tasman's Peninsula, where he devoted the greater part of his leisure time to the study of natural history. Prior to his removal to Hobart for the more extended practice of his profession, in which he subsequently attained a position of acknowledged eminence, he had assisted in founding the Tasmanian Society, and he became an active member of the Royal Society, into which the former Society merged in 1844. Shortly after the retirement of Dr. Milligan, its Secretary and Curator, in 1860, he undertook the duties of Secretary as a labour of love, in order that the whole of the limited amount available out of income might be appropriated as salary for the Curator of the Museum. From that time onwards, except during occasional periods of absence from Tasmania, he continued to act as chief executive officer of the Royal Society in the capacity of Honorary Secretary for many years, and latterly in that of Chairman of the Council; and to the admirable manner in which those self-imposed duties were discharged, the records of the Society will bear enduring testimony for those who were not personally cognisant of his work. As far back as 1843 he contributed to the original Society an exhaustive account of the structure, habits, and venomous properties of Tasmanian snakes. This was followed in 1864 by a paper "On the Poison of Venomous Snakes," which, after describing in detail some of his experimental researches, gives full directions for the necessary remedial treatment in cases of snake-bite, and is still a standard authority on the subject.

It is not by the number of papers appearing in the journals that the value of the services of such a man is to be gauged. A glance through the records of the Royal Society will show that he was ever on the look out for opportunities of promoting its work in the cause of Science, and in the public interest. He took an active part in the various projects for acclimatising the Salmonidæ in Tasmania, and defrayed the whole cost of the last importation of salmon ova from the mother-country, which was carried out with complete success, a cordial vote of thanks being accorded to him on the occasion by both Houses of Parliament. This, however, was only one of many instances of his liberal support of public enterprises which he deemed deserving of encouragement, and as to those with which he was more directly connected, the Library of the Royal Society, as well as the Tasmanian Museum and Art Gallery, will for all time bear witness to his generous benefactions to those institutions. He was not a politician in the ordinary sense of the term, but was a valued Member of the Legislative Council for many years, and held office without portfolio in various Ministries up to 1886, when, as Premier and Chief Secretary he took an active part in the re-organisation of the Department of Education and other business of great public importance. He was created K.C.M.G. in 1894.

But it is not only for such qualities as were evidenced in his public life, or in the practice of his profession, that the memory of Sir James Agnew will be held in affectionate remembrance. Of his private benevolence, and of his readiness to help any institution or enterprise that appealed to his sympathy, there can be no official record. Nor is it possible, even for those who knew him best, to give any adequate description of the versatility of his genius, which enabled him to take a keen and intelligent interest in everything that came in his way, from the translation of an Ode of Horace, or some literary criticism, to the discussion of *arcana* connected with his own profession, or the latest discoveries in mechanical and electrical engineering. This active interest in everything that concerned humanity continued throughout his life, and his faculties happily remained unclouded to the end.

> "He had reaped
> The harvest of his days, and fell asleep
> Amid their garnered sheaves."

RICHARD STONHEWER BRIGHT, M.R.C.S., E., L.M., L.S.A. Died 28th October, 1901.—Born at South Audley-street, London, in 1835, he was educated at Christ's Hospital and King's College, and, following in the steps of his father, took up the study of the medical profession, and qualified for membership of the Royal College of Surgeons in 1857. Commencing his professional career on his arrival in Tasmania in 1858, he continued in active practice until his death, having been for 41 years Honorary Surgeon at the

General Hospital, Hobart. At the Intercolonial Medical Congress, held at Brisbane in 1900, he was unanimously elected President of the Congress to be held at Hobart in 1902, an honour which he did not live to enjoy.

Dr. Bright was an old and valued member of the Royal Society of Tasmania, having been elected Fellow in 1865, and a member of the Council in 1897. He was also President of the Medical Section of the Royal Society.

HON. CHARLES HENRY GRANT, ASSOC. M. INST. C.E., M.E.C. Died 30th September, 1901, in the 70th year of his age.—Born at Great Marlow, Buckinghamshire, England, on the 9th November, 1831, he was educated at King's College, London, where he achieved distinction in mathematical studies, and he subsequently gained large experience in Telegraphy and Railway Engineering, both in England and in Canada. He came to Tasmania in 1872 to superintend the construction of the Main Line of Railway between Hobart and Launceston, of which he acted as General Manager until the line became the property of the State in 1890. He was elected a member of the Legislative Council in 1892, was a leading member of many public institutions, and was one of the representatives of Tasmania at the Federal Convention held in Adelaide, Sydney, and Melbourne in 1897-8. He was elected Fellow of the Royal Society of Tasmania in 1872, and a member of the Council in 1880, and was one of the original Trustees of the Tasmanian Museum and Botanical Gardens, taking an active and conspicuous share in all the duties which thus devolved upon him.

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