PAPERS & PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR THE YEAR

1902.

(ISSUED JUNE, 1903.)

Tasmania:

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SIR ARTHUR ELIBANK HAVELOCK,

G.C.S.I., G.C.M.G., G.C.I.E.,

President of the Royal Society of Tasmania.

Royal Society of Tasmania.

ABSTRACT OF PROCEEDINGS, APRIL 29th, 1902.

A meeting of the Royal Society of Tasmania was held on Tuesday evening, April 29, 1902, in the society's new room, Argyle-street. The President, His Excellency the Governor, Sir Arthur Havelock, G.C.S.I., G.C.M.G., presided. The Governor was accompanied by Lady Havelock and Captain Gaskell, A.D.C.

Welcome to the New President.

The Hon. Nicholas J. Brown, Speaker of the House of Assembly, and Vice-President of the Royal Society, said he was charged with a duty of a very pleasant character. He had, on behalf of the Fellows of the Royal Society, to welcome His Excellency on that, the first, occasion of his presiding at a meeting of the Fellows. According to the charter of the society, the representative of His Majesty the King was, ex officio, President of the Royal Society of Tasmania, a privilege which, he believed, was not included in the charter of any other Royal Society in Australia. They knew, from ample evidence, since His Excellency's arrival in Tasmania, that he took a very warm and sympathetic interest in the welfare of this State, and the Fellows of the society hoped that His Excellency would derive pleasure from his association with that society. They felt confident the society would derive great advantage, encouragement, and assistance from His Excellency's association with the society from time to time. He desired briefly to allude to a few instances in the past history of the society. In the early days of its existence, considerable difficulty arose regarding land for its use. One Government after another promised land, but a great deal of correspondence took place, and a few years ago they found that their title to a portion of the land supposed to be obtained was doubtful. The records of the society were searched, and a statement was prepared, showing beyond all doubt, that while it was the general intention to grant the society a large block of land, including Franklin-square, ultimately the land given was confined to the block between Macquarie - street and Davey-street, now occupied by the society. Their title to that large area of land was now assured, but he desired to refer particularly to a letter found in the correspondence written by the early secretary, in which he spoke of the necessity for ample space being reserved to the society. He said the society "must be cumulative and expansive beyond any limit they could assign to it." The Fellows had done very well so far. They had got natural history specimens, and a fairly good representation of art, and, on the whole, he thought the institution would compare favourably with any institution in the other States. But they could say now, as the secretary said in 1857, that the society must be cumulative and expansive beyond any limit they could assign to it. Its first expansion now should be in the direction of the securing and equipment of a Technological museum. That seemed to be necessary, in view of the anticipations that, in the near future, Tasmania would become an important manufacturing and distributing centre for the whole of Australia. Technical instruction was being imparted in our schools, and he hoped that technical knowledge would progress. But a Technological museum was a very important thing to have at our command. While welcoming His Excellency to the Royal Society, he ventured to express a hope that, while it was certain that the present moment was not an opportune one at which to discuss heavy expenditure, yet they believed the present difficulties would roll away, and that His Excellency's tenure of office, as Governor, and as President of the Society, might be signalised by the addition of a Technological museum to the National Museum of Tasmania. He extended to His Excellency a very cordial welcome on behalf of the Fellows of the Society. (Applause.)

His Excellency the Governor said he begged the Fellows to accept his very sincere thanks for the extremely kind terms which they had extended to him. He felt proud to occupy the chair which had been occupied by John Franklin, William Denison, and Robert Hamilton. (Applause.) He was unprepared for the suggestion that was thrown out by the Vice-President, but (for the short time he had had to reflect upon it) it seemed to be one that deserved consideration. He trusted that before his time was over, the idea might be carried into practice. He thanked them once more for their kind welcome, and they would now proceed to the business of the evening. (Applause.)

New Fellows.

Major R. C. Lewis, D.S.O., and Dr. R. R. Whishaw, and Mr. Horace Watson, were elected Fellows of the society.

Apologies.

Apologies for unavoidable absence were received from the Archbishop of Hobart, Mr. T. Stephens, M.A., F.G.S., and Mr. L. Rodway.

President's Address.

His Excellency the Governor, as President, delivered the following presidential address:—

Mr. Vice - President, members of the Council, and Fellows of the Royal Society, — Among the many honourable and agreeable positions held by the Governor of Tasmania, there is none more honourable, none more agreeable, than that of President of the Royal Society of Tasmania. Not only can the Royal Society claim to be one of the oldest scientific bodies of Australasia, but it may also justly pride itself on having contributed largely to the stores of science and research which have been laid up in this great Southern Dominion. The society had its beginning in an informal association, of Sir John Franklin and of men among his friends and acquaintances, who shared with him his love of knowledge and of inquiry. Under Sir John Franklin's care, this association grew, until in 1841, before he relinquished his office of Governor, it was formed into an organised society, called the Tasmanian Society. But, it was not until three years later, when Sir John Franklin had left the colony, that the institution which he had brought into being, and which he had so lovingly cherished, reached its fulness of strength and dignity. On the 12th September, 1844, Sir J. E. Eardley-Wilmot, Sir John Franklin's successor in the Government of Tasmania, was able to proclaim that the Royal Society, with an approved constitution, and with a grant of £400 a year from public funds, had been formally established. At the same time, the Governor was authorised to make the auspicious announcement that Her Majesty the Queen had signified her consent to be Patron of the society. For fifty-eight years—until by death the Empire lost the noblest and best Sovereign that has ever been—the Royal Society continued to hold and treasure this signal mark of honour. His Majesty the King has now been graciously pleased to become Patron. The leading objects of the Royal Society were defined to be the investigation of the physical character of Tasmania, and the illustration of its natural history and productions. The constitution and objects of the society remain, at the present day, substantially what they were at the time of its establishment in 1844. Among the names of men associated with its work, the Royal Society records with pride—Sir John Franklin, its distinguished founder; Captains Ross and Crozier, successful Antarctic investigators; Sir Joseph Hooker, the great botanist; Sir George Grey, the eminent colonial statesman and politician; the Reverend Mr. Colenso, the ardent naturalist; the Reverend Dr. Lillie, an eminent scholar and divine; Sir Thomas Mitchell, the Australian explorer. I could greatly prolong the list, but I fear to weary you. The names I have recalled to you are probably already growing faint in the memory of the present generation. But the roll of the society contains one name which is fresh in all our minds and hearts—that of Sir James Agnew, whose keen intellect, and whose warm power of sympathetic interest, pervade the whole history of the society, from its earliest days, sixty years ago, until November of last year, when he was called to his rest. All Tasmania owes Sir James Agnew a deep debt of gratitude for the good deeds, for the open-handed munificence, and for the noble example, by which, during a long life, he helped to raise the character of her people, to cheer their hearts, and to brighten their lives. Tasmania and her Royal Society need no visible monument to keep alive their remembrance of Sir James Agnew. But, if they did, it may be found in marble, in the beautiful work of the sculptor's art, which adorns the Art Gallery of our Museum, and which he has bequeathed to Tasmania. The Honourable C. H. Grant and Dr. Bright, who passed away only a few weeks before Sir James Agnew, have left also a record of earnest and successful work, in the service of the objects of the Royal Society, and of high aims for the improvement of the community among whom they lived and laboured. And now, before I close my testimony, which I feel to be inadequate and imperfect, to the zeal, the perseverance, and the ability which have been devoted to the furtherance of the objects of the society, I should not be doing justice to my subject, if I were to omit the name of our secretary, Mr. Alexander Morton. I have hardly yet ceased to be a stranger among you. But, already, the assiduity, the tact, the power of organisation, which Mr. Morton has brought to bear upon the promotion of the interests of the Royal Society in particular, and upon the advance of science, and upon the cultivation of art in Tasmania, in general, have been forced upon my attention. You, who have known Mr. Morton for many years, and who have had long experience of his work, of his constant and strenuous efforts, and I may say his successful efforts, to do good, are, I know, deeply imbued with the respect and gratitude which are due to him. Mr. Morton's labour among us is a labour of love. He has lately returned from much-needed rest and recreation in New Zealand; and I know you will join with me in trusting that he may be long spared to continue his career of usefulness among us. And, now I beg leave to be allowed to give a short summary of the history, for the past year, of the Royal Society, and of the Museum and Art Gallery, institutions which are closely allied with it. The council of the society and the Museum Board of Trustees have suffered great loss in the death of the three revered members whose names I have already mentioned. And, by the resignation and departure of Bishop Montgomery, the council has been deprived of the services of one of its most practical and active workers. The four vacancies thus created have been filled by the appointment of the Honourable Gamaliel Butler, M.R.C.S.E., M.L.C., Professor Neil Smith M.A., Mr. L. Rodway, and Mr. A. Mault. The high character and the scientific attainments of these men are well known to you, and need no comment from me. The scientific objects of the society have been furthered, and its records enlightened and enriched by the presentations of nineteen papers on Ornithology, Ichthyology, Conchology, Geology, Botany, Astronomy, and Geography. The subjects and authors of these papers are the following:—

Ornithology.—1. Note of the birds of Tasmania, by Col. W. V. Legge, R.A., C.M.Z.S.

Ichthyology. — 2. The Fishes of Tasmania, by R. M. Johnston, F.S.S.

Conchology.—3. The recent Mollusca of Tasmania, by Miss Mary Lodder. 4. Notes on some land shells from Maria Island, by W. F. Petterd, C.M.Z.S.

Geology.—5. The Minerals of Tasmania. 6. Description and analysis of a new species of Mineral, "Petterdite," a new Oxychloride of lead. 7. Description of a Meteorite from the Castra River. 8. Microscopic structure of some Tasmanian rocks, by W. F. Petterd, C.M.Z.S. 9. Outlines of the geology of Tasmania. 10. Progress of the mineral industry of Tasmania, by W. H. Twelvetrees, F.G.S. 11. Flexible sandstone, by Professor E. G. Hogg, M.A. 12. Notes on the discovery of coal at Wynyard, by R. M. Johnston, F.S.S.

Botany.—13. Tasmanian botany, by L. Rodway. 14. The present and future prospects of timber in Tasmania, by Wm. Heyn. 15. The value of the timber industry in Tasmania, by A. O. Greene. 16. Practical forestry in Tasmania, by A. Mault.

Astronomy.—17. Astronomical observations at the Cape, by H. C. Kingsmill, M.A.

Geographical.—18. Notes on a trip to Barn Bluff, by J. W. Beattie. 19. Account of a visit to British Columbia for the purpose of introducing the sockeye salmon (Onchorhynchus nerka) in Tasmanian waters, by Alex. Morton.

Antarctic Expedition.

The annals of science have been marked by the departure of the Antarctic ship Discovery, under the command of Captain Scott, Royal Navy, assisted by a staff of highly scientific men—among whom is Mr. L. Bernacchi, a young man, educated at the Hutchins School, in Hobart. Mr. Bernacchi was the meteorologist of the Southern Cross Expedition, which, under Sir George Newnes, explored the Antarctic in 1898-99. On the return of that expedition to London, Mr. Bernacchi was awarded by the Royal Geographical Society of England the society's diploma, the Cuthbert Grant Medal, and the society's gold watch, for his distinguished services.

A.A.A.S. Ninth Meeting.

The dignity of Hobart as a seat of science has been enhanced by a session of the Australasian Association for the Advancement of Science. I believe I may say that this was the most successful meeting of the association ever held in Australasia. Seven hundred members attended the session. A session of the Intercolonial Medical Congress has also been held in Hobart; and, although this congress is not directly connected with the Royal Society, I may claim that its session in Tasmania has added to the scientific lustre of the year.

New Additions to the Tasmanian Museum.

In the next place, I wish to draw your attention for a moment to the important extensions and improvements which have been made to the accommodation of the Royal Society, by the addition of the room in which we hold this evening's meeting, to the buildings of the Museum, and of the Art Gallery, and to the additions which have been made to the collections of the Art Gallery. I have already alluded to the splendid gift by Sir James Agnew of the statue of Medusa—probably the finest piece of sculpture to be seen in the Southern Hemisphere. In addition to this, the same generous benefactor has bequeathed to the Art Gallery several paintings of great beauty, and of high artistic merit. The Art Gallery has also been further enriched in the same way by munificent gifts, made by two ladies, the daughters of a Tasmanian statesman, whose name holds a distinguished place in the history of this country. A liberal grant of money by Parliament has enabled the Board of Trustees of the Museum, upon which the Council of the Royal Society are strongly represented, to complete the new wing of the Museum building, to provide a more suitable room for Tasmanian exhibits, and to add a large room specially appropriated to the exhibition of objects and trophies, which will show to advantage specimens of the products of the Tasmanian mines and of the timber and cabinet woods found in the State. Photographs, by the artistic hand of Mr. Beattie, in number about six hundred, representing the beautiful scenery of Tasmania, have been hung on the walls of this room. The Museum and the Art Gallery now form institutions of which Tasmania may be justly proud, and with which, as a means of illustrating and bringing into notice the resources, the attractions, and the progress of Tasmania, and as a means of cultivating our taste for what is beautiful and elevating, we may well be satisfied.

Mr. Vice-President and members of the council, ladies and gentlemen,—I think you will concur with me in the gratifying opinion which I venture to express, that the Royal Society has, in co-operation with the Board of Trustees of the Museum, worked well during the past year, towards their combined purpose, of promoting science, art, and the progress of the country. I trust the sessional year of the Royal Society, which begins to-day, will, at its close, show equally good results.

Late Sir J. Agnew.

Col. W. V. Legge, R.A., moved,—"That in the further recognition of the valuable services rendered by the late Sir James Agnew to the Royal Society of Tasmania and to the community generally as a liberal patron of art and science, a subcommittee of the council be appointed to draw up an obituary notice to be published in the Society's Transactions of 1901; such committee to consist of the Hon. N. J. Brown, Messrs. Thos. Stephens, M.A., R. M. Johnston, F.S.S., and the mover."

Mr. A. G. Webster seconded the resolution, which was agreed to.

Papers.

Graptolites in Tasmania.

Professor E. G. Hogg, M.A., read a paper by Mr. T. S. Hall, M.A., Melbourne, on "Discovery of Graptolites in Tasmania."

A brief discussion upon the paper followed, in which Mr. R. M. Johnston and Professor Hogg took part.

"Tasmania as a Manufacturing Centre."

By Mr. R. E. Naghten B.A.

The advent of federation, and the consequent abolition of intercolonial duties, are bringing about new conditions, which are well worth the attention of the British manufacturer or capitalist. Of no part of the Commonwealth is this truer than of Tasmania. In the first place, Tasmania possesses, in a superabundant degree, what is conspicuously wanting in all the other federated States, namely, water power. To this must be added the fact that, owing to the peculiar configuration of the island, this water power can be utilised at the mouth of the Derwent, on which Hobart, the capital, is situated; in other words, this water power is available in conjunction with one of the finest natural harbours in the world. To get some idea of the natural features of the island which bring about this resultant water power, Tasmania may be compared to an inverted and slightly elongated basin. From the very coast inwards the whole island is mountainous, and these mountain ranges culminate in a vast plateau in the midlands, where the large annual rainfall is stored in the natural reservoir of the lake district. These mountain ranges, covered in many places with vast indigenous forests, attract the atmospheric moisture which the neighbouring continent of Australia, owing to its flat and monotonous landscape, is unable to retain, and from this high plateau the water so accumulated descends by one or other of the natural courses to the coast line in a series of abrupt falls in a comparatively short space, in a manner that seems almost ideal for the best development of water power. For instance, the Dee river, which is the natural outlet of Lake Echo, starts at a barometrical altitude of 2,975 feet, and the total fall in the short distance of 27 miles is 2,675 feet. (N.B.—The height of the Great Lake, 3,350 feet, and that of Lake St. Clair 2,500 feet above the sea.) Report by K. L. Rahbek, Mem. Dan. Assoc. C.E. An interesting professional report on the possibilities of the water power that is available from three of the central lakes, namely, Lake St. Clair, Lake Echo, and the Great Lake, has lately been presented to the Tasmanian Houses of Parliament. From this report it appears that the horse-power probably available from these three lakes amounts to a total of 82,000 actual horse-power, represented by 46,000 from Lake St. Clair, 9,000 from Lake Echo, and 27,000 from the Great Lake. In this connection Mr. Rahbek says:—"It must be borne in mind that by obtaining the power as specified, I have not in any way prejudiced the irrigation question; in fact, it has helped to solve it, inasmuch as I have made provision for giving ample compensation water for all irrigable lands for the parts of the rivers where water will be drawn for power; and below the terminal power-stations all the water is available for any purpose, and will be forwarded in a steady stream all the year round . . . . . In case it should be possible to make Hobart the manufacturing centre of Australia, amongst other reasons, on account of her facilities in producing inexpensive and reliable power, the 82,000 horse-power at the different power-stations would be reduced by about 30 per cent, namely, by converting the mechanical energy into electric force, by friction and loss on line from power-stations to Hobart, and by reconverting the electric current into mechanical energy; and the power which could be distributed at Hobart would be, say, 57,000 actual horse-power. At present there is not one thousand horse-power consumed in Hobart for tram service and for lighting, but it is a true maxim that 'supply creates demand,' and if an inexpensive and plentiful supply of electric force was offered here the demand would increase; perhaps, under such conditions, Hobart itself might absorb from 5,000 to 7,000 horse-power, and 50,000 horse-power would be available for large manufacturing industries. . . . . Judging by the rapid strides which have been made during the last few years by electrical engineers and manufacturers, it is more than probable that within a few years it will be practicable and profitable to run all the Tasmanian railways, to supply light all over the island, to run all motors as well in the mines as anywhere else within this island by electric power, derived from water, but all this cannot be accomplished to-day." The water power mentioned in this report is that derivable from three only of the central lakes, and does not by any means exhaust the power available in other parts of the island; but enough has, perhaps, been said to give some idea of the vast quantity of water available, and of its value for commercial purposes. But water power is only one factor in the new situation. Even before federation, in spite of hostile tariffs, the manufacture of woollens in Hobart and Launceston was a growing industry. Partly owing to the climate, and partly owing to the excellence of the water supply, the local manufacturers were able to do an increasing export trade, even with the "protective" colony of Victoria, and notwithstanding her 25 per cent. duty. With the proper utilisation of water power (which has hitherto not been turned to account), and with the abolition of inter-colonial duties, there seem good reasons for anticipating that Tasmania will become a great manufacturing centre for woollens. Australia, the great wool-producing country of the world, lies at her very doors, and for fiscal purposes now forms part of the same community; and there seems little doubt that, as a purchaser of the raw article, the county of Yorkshire will in future find a formidable competitor in the colony of Tasmania. For at least fifty miles in a south-westerly and a south-easterly direction, each way from Hobart, the southern part of the island is pre-eminently suited for the establishment of "power" factories. From Hobart to Norfolk Bay on the one hand, and from Hobart to Franklin (situated in the Huon river) on the other, there is an uninterrupted stretch of deep yet completely sheltered water, which combines the advantage of a gigantic natural dock with the beauties of a lake. Along almost any part of these shores land can be obtained at practically "prairie value," which would be eminently suitable for the establishment of factories—that is to say, with deep water frontage, from which the manufactured article could be sent to the several Australian States by the cheapest of all means of transit, namely, water carriage. A greater contrast to the manufacturing centres of the Yorkshire woollen trade can hardly be imagined than these sheltered bays, with their forest-covered hills running almost down to the water's edge. At the present time the Channel (as the long and sheltered passage between the Island of Bruni and the mainland is termed) and the Huon river, whose waters flow into this channel's southern extremity, are chiefly known as a delightful roving-ground for tourists, and as a centre for the small fruit and apple trades. But it is at least within the bounds of reasonable probability that within the next twenty years these beautiful bays and quiet inlets, where the sea is calm, peaceful, and sheltered as a lake, may be resounding with the busy clang of machinery, though, fortunately, owing to the energy being derived from water power, there is no fear of the peculiar brightness of the atmosphere being marred by the volumes of smoke that cast a pall over the chief manufacturing centres of Yorkshire. There are at least three other industries which must make enormous strides with the advent of federation. It has already been incidentally mentioned that the valleys of the Channel and the Huon are the centres of the apple trade. In the past that industry has been seriously handicapped by the protective tariffs of the other colonies, with the single exception of New South Wales, and the duties thus imposed, added to such an appreciable extent to the price which had to be paid by the consumer, that only the wealthier classes were able to afford what, under these circumstances, became a luxury. But the moment that these hostile tariffs are removed the market expands automatically, and consists of four millions instead of about one million consumers; while the bulk of these four millions live in a climate which makes the consumption of large quantities of fruit almost imperative. Almost precisely the same remarks apply to the timber and the beer trades. The Tasmanian blue gum (Eucalyptus globulus) and the stringy bark (Eucalyptus obliqua) are amongst the most valuable hardwood timbers of the world, and, even in the teeth of an almost prohibitive tariff, a certain quantity was always exported to the mainland, chiefly owing to the fact that the timber country is in close proximity to water carriage, and the handling and transport were, in consequence, comparatively economical. Now, with the abolition of the tariff, the demand must enormously increase, and when once a proper system of re-afforestation is introduced, Tasmania must gain enormously and permanently from her wealth of forest lands. Lastly, it has been found that, owing to the temperate character of the climate and the excellence of the water supply, the beer which is brewed in Tasmania is very superior to the article produced on the mainland. Even before federation there was a considerable export; and now that the whole of Australia is open to the Tasmanian brewer, there seems every reason to believe that the brewing industry of Australasia will inevitably gravitate to the place where the climatic and general conditions are favourable to the production of the most superior article. In a brief sketch of this description it is impossible to do more than outline the new commercial tendencies which are at work in this part of Australasia, but enough has, perhaps been said to show that, under federation, the island State of Tasmania is well worth the attention of the British manufacturer and the British capitalist.

Discussion on the paper was deferred till the 12th May.

Notes on a New Tasmanian Fish.

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

Mr. Rodway, who takes a keen interest in all branches of the natural history of Tasmania, besides that of his loved science of botany, of which he is now our chief local authority, has recently submitted for my examination a small fish, preserved in spirits. Unfortunately, there was only one specimen obtained, and it is so shrivelled up that some of the ray characters cannot be very exactly determined. This specially applies to the anterior portion of the dorsal rays, which for nearly half the length of this fin are rudimentary or undeveloped, and closely enveloped in a somewhat thick and (now) opaque skin. However, the principal dental, scale, and other characters leave no doubt in my mind as to its true generic position, viz., the genus Pseudochromis of the family Trachinidae. The following contains a fuller description:—Family Trachinidae. Genus Pseudochromis. Rupp. Head and body rather compressed, more or less elongate; cleft of the mouth slightly oblique, with the lower jaw longest; eye lateral. Scales of moderate size, ciliated; lateral line interrupted. One dorsal with a few spines anteriorly; ventrals thoracic; the lower pectoral rays branched; jaws with cardiform teeth, anterior with canines; vomer and palatine bones toothed. Praeoperculum entire. Six branchiostegals; the gill-membranes joined inferiorly; pseudobranchiae and air bladder present; pyloric appendages none. Indian Seas. Port Darwin, Macquarie Harbour. Tasmania. Pseudochromis rodwayi R. M. Johnston. D.3/26—27. A. 3/17. P. 17. L. lat. 50? L. tr. 11. The height of the body is nearly five times in the total length; the length of the head four and a half. In front of both jaws there are markedly curved canine teeth, the three in the lower jaw the stronger; there are, besides narrow bands of small canine teeth on jaws, vomer and palatine bones; no spines on the operculum. Dorsal and anal produced posteriorly; half of the anterior portion of the former undeveloped or rudimentary, and enveloped for the most part in a somewhat thick (now) opaque, skinny integument. The number of spines on dorsal probably three, but not determined satisfactorily. Diameter of the eye nearly equal to width of interorbital space, and greater than the length of the snout. Colour in spirits a uniform darkish brown. This interesting little fish is only about 3 6-8in. in length, and is somewhat of the general appearance of one of our common shore blennies. Mr. Rodway informs me that the fish was captured by Mr. Hinsby, an enthusiastic collector, in or near Macquarie Harbour. It is to be hoped that he may soon obtain a few more specimens, in order to settle a few doubtful points in some of the characters. It is remarkable that, with the exception of a single member of the genus (P muelleri), described by Klunzinger from Port Darwin), this is the first member of the genus caught in Australian waters. The specific name is given by me in honour of our own distinguished botanist, Mr. L. Rodway.

Votes of Thanks.

The Hon. Adye Douglas (President of the Legislative Council) moved, and the Hon. N. E. Lewis (Premier) seconded, a vote of thanks to the president, which was cordially passed.

The President moved a vote of thanks to the readers of the three papers, which was also agreed to.

Members and the ladies present then adjourned to the large room, where refreshments were partaken of.

NEW ADDITIONS TO THE TASMANIAN MUSEUM AND ART GALLERY.

During the Parliamentary session of 1900 a vote of £4,000 was passed for additions to the Tasmanian Museum and Art Gallery, and it was decided to entrust the preparation of plans and specifications to the Public Works Department.

The original design, prepared by the late Mr. Hy. Hunter, in 1860, has been adhered to externally, as far as practicable, but the interior has been altered considerably to bring it more up to date; when the original design was made iron girders, steel joists, etc., were not available, and columns were necessary to support the upper floor. Now they have been dispensed with, and the whole floor space is clear in the new building.

Tenders for the work were invited in December, 1900, and Mr. W. H. Cheverton's, at £4,197 was the lowest, and was accepted. The work was commenced in January 1901, and the corner stone laid by His Excellency the Administrator (Sir J. S. Dodds), on the 20th March, 1901.

The front portion, facing Macquarie-street, is built of white and brown stone from Brighton and the Hobart Waterworks quarries. In the upper part of this front are three niches, which are proposed to be filled with statuary, etc., at some future date. The side and back walls are built of brick. The Museum and Art Gallery floors are each 93ft. in length, and 26ft. in width. A very ornamental embossed steel and zinc ceiling has been fixed in the Museum. The roof over the Art Gallery is open to the collar beam, and lined with pine boarding, painted in light tints, suitable for picture gallery. The roof is covered with Welsh slate. It is lighted with eleven large skylights, all the glass being fixed in specially prepared lead grooves, and no putty whatever is used in the glazing, as is usually done, consequently there will be no fear of shrinkage and leakage. Ventilation has been amply provided, there being three large air pump ventilators fixed in the roof, which connect to large galvanised iron shafts, with ornamental zinc ventilating centres fixed in the ceiling. Fresh air is admitted through 13 large air shafts about 7ft. above the floor. Tasmanian blackwood guard rails upon turned blackwood newels are fixed round the gallery to protect the pictures from injury. An ornamental staircase of special design, made out of Tasmanian blackwood and Huon pine, gives the visitor easy access from the trophy room to the Art Gallery.

The open court between the old portion of Museum and new additions has been utilised and enclosed by brick walls, and the whole space (64ft. by 56ft.) covered with a very neat and light-looking iron roof, abundance of light being provided through a large lantern light in the centre and skylights round the sides over the windows of the old building. The roof is covered with galvanised corrugated iron, laid upon roofing felt, and the underside lined with colonial stringy bark boarding; the portion under the lantern, being varnished, has very much the appearance of English oak.

The whole of the work has been satisfactorily carried out by the contractors, Messrs. W. H. Cheverton and Son, and sub-contractors, under the personal supervision of Mr. J. Shield, Inspector of Public Buildings, and his assistant, Mr. J. Maddison, Clerk of Works, and the architect, Mr. Orlando Baker.

MAY, 1902.

A meeting of the Royal Society of Tasmania was held on Monday evening, 12th May. His Excellency the President, Sir Arthur Havelock, G.C.S.I., G.C.M.G., who was to have presided, was prevented attending through indisposition. His Excellency sent a sympathetic letter, expressing his regret and interest in the business of the meeting. In his absence Mr. Thos. Stephens, M.A., senior vice-president, occupied the chair.

The Late Sir James Agnew.

Mr. Stephens said that his unavoidable absence from Hobart at the time of the last meeting of the Society had prevented him from reporting his receipt in February last of a letter from the Royal Colonial Institute in reference to the death of the late Sir James Agnew. The secretary states that the Council "had received with great regret the announcement of the death of Sir James Agnew, for many years a valued and highly respected member of the Institute, and expressed their deep sense of the loss sustained by the Institute, as well as by the community amidst which he had lived so long, and by whom he was so universally and deservedly esteemed."

Tasmania as a Manufacturing Centre.

Mr. G. E. Moore, C.E., opened the discussion on the paper read at the April meeting by Mr. R. E. Macnaghten on Tasmania as a manufacturing centre, especially in relation to water power. He said:—Mr. Macnaghten has drawn a very pleasing picture of Tasmania as a manufacturing centre, based upon its many natural advantages, especially with regard to its superior local conditions for obtaining cheap motive power derived from its lakes and rivers. What I propose to discuss is the reasonableness or otherwise of this foundation, on which he builds his hopes. His authority apparently is a report presented to Parliament by Mr. Rahbek, showing what power could be obtained from the water of the central lakes. Mr. Rahbek estimates that 57,000 h.p. could be delivered at Hobart from this source. A general statement of this kind is of no value to an engineer, and is distinctly misleading to the general public. With just as much accuracy I could state that there is daily 57,000 h.p. of wind power blowing to waste, or 57,000 h.p. steam power in undeveloped coal in Tasmania. To utilise to advantage this water power, two problems must be solved, engineering and commercial. The engineering problem resolves itself into the question whether the local circumstances are such as to enable the necessary works to be carried out to give a certain h.p. at a sufficiently low cost per h.p. to compete with steam. As regards the commercial problem, there is the necessity for constant remunerative employment of the power produced. Taking the engineering problem first, one of the chief necessary factors is a waterfall in proximity to civilisation. Unfortunately Tasmania does not possess a waterfall of any size, and to get a fall of even 10 or 15 feet per mile you must go 40 or 50 miles up the Derwent, and power derived from the central lakes would be double that distance away, so the elements for cheap construction are wanting. No doubt the power obtained would be turned into electric power, capable of being transmitted many miles, but although we hear of electric power being in special cases transmitted 100 miles and more, I think I am correct in saying that for practical purposes the economical limit is not over 20 miles at the present day. Then looking at the commercial side, Mr. Macnaghten mentions four indigenous industries: Woollen goods, beer, timber, and fruit as likely to benefit and increase owing to federation—as no doubt they will, but, unfortunately, they are not trades that require much power, so that if water power is to be largely used, it must be by introducing some new manufactures into the island. The position then is this. There is a large amount of water power undeveloped, but it is doubtful whether it would pay to utilise it at the present time. A practical solution of this question would be the erection of works to create and supply electric power. But Government would hardly be justified in engaging in such a speculation, and there does not appear to be sufficient inducement for any private company to enter the field. The question is entirely one of relative cost, and that you may more easily understand it, I will endeavour to show the approximate capital cost per h.p. of steam and water power. Steam plant may be put down for, say, £30 per h.p., while to put down a water power plant to utilise the power of the Gentle Annie Falls the estimate is not less than £100 per h.p. yet here we have a waterfall 400ft. high. To obtain a fall of 400ft. on any river, falling 40ft. per mile, would require a pipe or race 10 miles long, entailing a very large initial expenditure. For this reason water can only compete with steam when the local conditions are exceptionally favourable, such as the proximity of a waterfall, or when capable of being produced on a large scale. This is the real reason why the water power in this country is still what is popularly called running to waste, and it will continue to do so, until there is sufficient inducement for a company to sink from £50,000 to £100,000 in a large power producing plant. The only suggestion that I can make is that Government should assist private enterprise as far as possible by collecting and publishing useful information with regard to rainfall and river gauging, etc. They might also advertise the fact that they are desirous of developing the latent water power in the State, and with this intent are willing to deal liberally with any person or company formed for this purpose. They will have to give up the idea, which I believe they hold that this water power can be made a direct source of income, and be content with the indirect profit to the State derived from the establishment of new manufactures and new industries.

Mr. A. O. Greene said they were all much indebted to Mr. Macnaghten for again drawing attention to the subject. At Launceston, with the aid of the stream running through the town a very great deal was being done by water power, electric power for lighting, and numerous other purposes was generated, proving a great boon to the city in very many directions. He was much impressed with the water power available in this State to aid in the development of many industries. It was not at all necessary in his opinion that there should first be one great and expensive scheme for developing the power. He agreed that it would do much good to have directed attention to this latent power that was available in several districts.

Mr. R. M. Johnston, F.S.S., thought they must all agree that there was much water power available, but the question was whether it could be utilised with commercial advantage. It appeared that at present in transmitting electrical energy, generated by water power, over a considerable distance, there was a great deal of "leakage." There were engineers now in Tasmania alive to the existence of this water power in various parts of the island, and to some extent it was already being utilised.

Mr. Geo. Kerr looked forward to many manufactures arising in this State with the aid of water power. It would no doubt become a very valuable asset. The new Waverley woollen mills in the city were being worked by water power. He predicted that ere long paper mills would be established in Hobart.

Mr. Target, C.E., referred to the generation of electrical power on a large scale at Niagara Falls,

Mr. Macnaghten replied to the discussion. Mr. Rahbek's reports did not confirm Alderman Moore's view.

Mr. G. E. Moore could not find that Mr. Rahbek had gone into the financial aspect to prove that this water power would be remunerative, commercially.

Mr. Macnaghten: Last session of Parliament, two companies made application for rights to develop the water power. It was to be hoped that such a valuable asset of the State would not be given away. There was too much of the power of throwing cold water on projects existing in Tasmania. Tasmania would become a great manufacturing and industrial country if the people had more faith in their country, and more perseverance. (Applause.) He quoted Mr. Rahbek's report, which showed that 57,000 horse power (electrical) could be generated for use in Hobart, by utilising the available water power, and the place might become a great commercial centre.

Mr. Moore said it all depended on the cost of developing the power.

Mr. Macnaghten was accorded a vote of thanks.

School of Forestry and Agriculture.

Mr. L. Rodway read a further paper by Mr. W. Heyn, who is connected with the Dover (England) harbour works, on the question of establishing a School of Forestry and Agriculture in Tasmania. The writer offered numerous detailed suggestions with respect to marketing numerous products, from apples to timber. The State could easily grow enormous quantities of those timbers which she was now importing, equal to one-third of her exports of timber, and paid two-thirds more for it.

Discussion on the paper was postponed till the next meeting.

A New Fish.

Mr. R. M. Johnston tabled a description of a new species of Goby, which he named in honour of Mr. Geo. Hinsby, who has presented many specimens to the Museum, "Gobius hinsbyi." Mr. Johnston said: There is no doubt that many more of the smaller types of our marine and fresh water fishes have as yet escaped the notice of ichthyologists, and our amateur sportsmen might do good service in preserving and forwarding to the Tasmanian Museum all forms of fishes which may seem to them to be new or in any way strange in appearance.

The meeting then terminated.

List of books and magazines presented to the Royal Society of Tasmania during the month of May, 1902:—

Transactions of the Royal Dublin Society, Parts VIII. to XIII.

Proceedings of the Royal Dublin Society, Parts II. to IV.

Economic proceedings of the Royal Dublin Society, Vol. I., Part II.

Memoirs and proceedings of the Manchester Philosophical Society. Vol. 46. Parts III. and IV. 1901-2.

Atti della Reale Academia dei Lincei, Roma.

A list of the best books relating to Dutch East India, made up in commemoration of the third centenary of the foundation of the East India Co., March 20, 1602. By Martinius Nijhoff.

From Shanghai to Bhamo. By R. L. Jack, LL.D.

Proceedings of the Royal Society of England. Vol. LXIX. No. 457.

Boletim da Sociedade de Geographia de Lisbon.

Journal of the Society of Arts.

Journal of Agriculture of Victoria.

Proceedings of the Washington Academy of Sciences. (a) Papers from the Hopkins Standford Galapagos Expedition, 1898-9. (b) VII. Entomological results. Arachnida. By N. Banks. (c) Papers from the Harriman, Alaska Expedition. XXVII. Apterygota, by J. W. Folson. (d) Organisation and Membership of the Washington Academy of Science.

The Scottish Geographical Magazines, current numbers.

The Queensland Flora. Vols. I. to V. By F. M. Bailey, F.L.S., Government Botanist of Queensland.

The Periodical. by n. Froude.

Litzu v der Mathematischen Naturwissenschattichen.

The Victorian Naturalist. Vol. XIX. No. 1. May, 1902.

Annual report of the Colonial Laboratory of New Zealand.

Transactions of the Royal Irish Academy. (a) Vol. XXXI. Part XII. Further developments of the Geometrical Theory of Six Screws; by Sir Robert Ball, F.R.S., LL.D. (b) Notes on the High Crosses of Moone Drumcliff, Termonfechhin, and Killamery; by the late Miss Margaret Stokes. (c) The Ancient Forts of Ireland, being a contribution towards our knowledge of their types, affinities, and structural features; by T. J. Westropp, M.A. (d) Vol. XXXII. The interpretation of a Quaternion, as a point of symbol. Part II. Quaternion Arrays; by C. J. Joly, M.A., Royal Astronomer of Ireland.

Journal of the Royal Microscopical Society of London. Parc II. April, 1902.

Annals of the South African Museum. Vols. II. and III.

Bulletin of the Natural History Society of New Brunswick.

The Royal Geographical Journal, London, April 1902.

Journal of the Scottish Meteorological Society (third series).

Statistics of the Colony of New Zealand for the year 1901. Part III.—Trade and Interchange.

North Queensland Ethnography. Bulletin 4. March, 1902. "Games, Sports, and Amusements," by Dr. W. E. Roth.

The Record of the Mines of South Australia, Tarcoola, and the North-Western district, with plans by H. Y. L. Brown, F.G.S., Government Geologist.

Report of the British Association for the Advancement of Science held at Glasgow, September, 1901. (Bound.)

Proceedings of the Linnæan Society of New South Wales. Part IV. Vol. XXVI. No. 104.

Monthly Notices of the Royal Astronomical Society. Vol. LXII. No. 5, March, 1902.

Boletim Mensal do Observatorio, Rio ty of New Brunswick.

Boletin del Institutio de Geologico. Mexico.

JUNE, 1902.

A meeting of the Royal Society of Tasmania was held on the 10th June at the Museum, Argyle-street. His Excellency the Governor, Sir A. E. Havelock, G.C.S.I., G.C.M.G., President of the Society, presided.

New Members.

Mr. J. H. Maiden, Director of the Botanic Gardens, Sydney, was elected a corresponding member, and Messrs. W. A. Finlay and F. Grove were elected members.

The Observatory.

Mr. A. Morton, the secretary, read the following communication from Mr. H. C. Kingsmill, M.A., Government Meteorologist, Tasmania:—

Observatory, Hobart, June 7, 1902. To the Secretary of the Royal Society. Dear Sir,—I shall feel obliged if you will submit for the consideration of the Council the following remarks on the meteorological service of Tasmania, having reference to its present condition, and its prospects under federation. I am led to request their attention for two reasons:—One, their readiness in the past to give their help, on all occasions when it was needed for this work; and the other is that there is a crisis at present, due to the advent of federation. Recognising that changes must be made the Acting Federal Premier has asked all the States for detailed information as to the cost and personnel of their Meteorological Departments. The publication of this news in "The Mercury" would seem to indicate that the Government of this State is leaving the way open to receive suggestions. The Royal Society is in a position to make suggestions that would, I believe, have great weight with the Government. It will be remembered that a deputation from the Royal Society, in 1895, prevailed on the Government to invite Mr. Wragge to make a report on the meteorological service of Tasmania, and that he accepted the invitation. The report, coming from one whose training and experience as a meteorologist are so widely known, had two objects in view. One, to give the colony of Tasmania the benefit of his observations on the local meteorological arrangements, and suggestions for increasing the efficiency of the same. The other, to at the same time benefit the meteorology of the mainland by obtaining more thorough details from Tasmania, which occupies a position of much importance to those engaged in forecasting. I therefore think that what has been so ably done, with the double object of ensuring local efficiency, and also federal benefit, in the matter of meteorological work, will be found the best guide on the present occasion in estimating the cost of the service now required. For Mr. Wragge's estimate, see General Remarks, page 15, paragraph 18, of his report. To those who know what the actual expenditure has been, it will be apparent that a mere answer to the Federal Premier of the question asked would not be a fair indication of the cost of an efficient meteorological service, as it would have to be worked under federal control. Moreover, it should be pointed out that Mr. Wragge's estimate is for meteorological work alone, and does not include the astronomical work of the department.

The character of this work, and the conditions under which it had to be done, are explained in a report furnished to Lord Gormanston in 1894 by Admiral Bowden Smith. This report was prepared by Captain Cust, of H.M.S. Dart, who had been specially trained in astronomical work at the Royal Observatory, Greenwich. His suggestions are most valuable. They are a complete summary of the conditions necessary for the maintenance of an accurate time-service in an important shipping port; but he makes no estimate of the cost. These two reports, by Mr. Wragge and Captain Cust, are herewith enclosed. They cover all the present work of the Meteorological Department of this State, and they furnish data on the highest authority obtainable for estimating the cost of enabling it to work in line with the other States. I hope that the Council of the Royal Society will see their way to make some representation to the Government, and I shall be in readiness to give them further information if it is required.—Yours, etc., H. C. Kingsmill.

"Meteorological observations in Tasmania were begun by Sir John Franklin in 1840. Being Governor of the island, then called Van Diemen's Land, he sent home for instruments, and when Captain Ross arrived at Hobart in August, 1840, in command of the Erebus, an observatory was built near Government House, and three magnetometers, a transit, clocks, and other instruments set up. Lieut. Kay, R.N., was put in charge of the Royal Observatory, which was called Rossbank, lat 42.52, 27.4 S.; long. 147, 27.30 E. Mean magnetic dip, 70deg. 40.5; variation, 10deg. 24.24 E. Here Lieut. Kay took hourly observations for eight years, Sir John himself helping in the magnetic observations. Mr. Francis Abbott, who had a private observatory in Murray-street, carried on observations tri-daily from 1841 to 1880. Being a member of the Royal Society, he supplied them with monthly meteorological reports, which are published in their yearly report. Observations were taken of barometer, temperature, humidity, clouds, and rain. In 1858, ozone was added. Observations were also started of rainfall, etc., by the Marine Board at the lighthouses under their care, and by gentlemen in different parts of the island, observations being taken in 1864 by Mr. J. Boyd at Port Arthur, Dr, Storey at Swansea, Mr. R. Henry at Tamar Heads. In 1865, by Mr. M. Duncanson at Ross, Mr. F. Belstead at Westbury, and Mr. W. E. Shoobridge at New Norfolk. Mr. Francis Abbott was obliged to relinquish his work in March, 1880, and in 1881 observations were taken only at New Norfolk by Mr. W. E. Shoobridge. In 1882, Captain Shortt was asked by the Royal Society to undertake the work. In March, 1883, a deputation from the Royal Society waited on the Premier, and asked him to establish a Government Observatory. This was done, and the present observatory in the Barracks started under Captain Shortt in 1883, lat 42, 53, 28.3, long. 147, 19.45 E. Captain Shortt remained in charge till his death in 1892."

Professor McAulay said he desired to impress upon the right quarter the very unsatisfactory state of the keeping of time in Tasmania, and the pressing practical importance of an improvement being made. Those who had to do with the keeping of time knew that it was a matter of life and death to some to know the correct time to the half second at least. Accurate time was of the highest importance to navigators, who, if they were a single second wrong in their time, might be out a quarter of a mile. It was a small thing to provide for the simple commercial matter of accurate time, but he did not think that the residents of Hobart at the present realised its importance. The observatory at Hobart had not a clock worthy of the name. The observatory depended upon a private citizen of Hobart, Mr. David Barclay, for reasonable time. There was an antiquated transit, and accuracy to the 100th part of a second could not be secured. The accepted way of announcing the exact time to the public was by the dropping of a ball, but it might be done at 9 o'clock at night by a single electric flash. Two or three instruments, two good clocks, a good transit, and a proper connection between the observatory and the ball would not cost more than £500, and an extra salary would, perhaps, be £50 or £100 more. It was unreasonable for the Federal Government to have taken over lighthouses if they did not provide for the keeping of accurate time in an isolated place like this as well as in other ports of call.

Mr. H. C. Kingsmill, Government Meteorologist, read some questions asked by the Acting Federal Premier in a circular addressed to the State Premiers on the subject of astronomical and meteorological establishments in the various States, and said that a bare answer to those questions would be exceedingly misleading to the Federal Government. Mr. Kingsmill then went on to say that the transit was certainly antiquated; and that when he took charge of the observatory he found the meridian mark out. He recommended that it should be changed, but the cost would be £3, and the money could not be got. (Laughter.) Yet, in spite of difficulties, the Admiral of the Australian station had acknowledged the accuracy of the time signals here. At Tamar Heads, the Melbourne Observatory had been connected with, and it was found that Victorian and Tasmanian time agreed "to the very tick" of the telegraph. This success had been obtained with an expenditure of labour, which would be altogether unnecessary if he had proper apparatus. Practically, the observatory standard time was Mr. David Barclay's clock, with which they had electric connection. As regarded meteorological work, they had ten stations, which sent in daily telegrams, and these were sent on to the mainland to enable the forecasts to be made. There was nothing mysterious about forecasts. They were simply the result of the combination of the barometer, the telegraph, and an army of observers, and were of great value to farmers and passengers by sea. There were 80 rainfall stations over the island, and these sent in monthly reports, and each year a map based upon them was made. Magnetic observations would be of great importance. An instrument in the Isle of Wight communicated knowledge of earth-tremors in any part of the world. That was one of the additional pieces of work that the observatory staff would be glad to undertake, if placed in a position to do so.

Hon. N. J. Brown spoke of the efforts of the late Sir Joseph Abbott and himself at the Federal Conventions at Adelaide, Sydney, and Melbourne to have astronomical and meteorological observations included in the subjects to be dealt with by the Federal Parliament, and of the great benefit these observations were to persons engaged in pastoral and agricultural pusuits. Accuracy and continuity throughout the Commonwealth were important. It was now probable that the whole of the Barrack "Reserve" at Hobart would be placed at the disposal of the inhabitants, and the observatory would have to be removed. But this need not be regretted, as the accuracy of the instruments was interfered with by the ironstone rock of the place. He moved,—"That the Council be requested to arrange for a deputation of its members to wait upon the Hon. the Premier for the purpose of urging that the reply to be sent to the Acting Premier of the Commonwealth to the queries as to the present staff, cost, and equipment of the meteorological establishment of Tasmania should be accompanied with a statement that the present arrangements for astronomical and meteorological observations are altogether inadequate, and that in the general interests of the Commonwealth it will be necessary in the future to provide for a fuller equipment, and a better paid staff, as suggested by Mr. Clement Wragge in his report to the Tasmanian Government, dated August, 1895, and by Commander Purey-Cust, dated April 5, 1894, and laid upon the table of the House of Assembly on July 10, 1894."

Hon. A. Douglas seconded the resolution, which was adopted.

Tasmanian Conchology.

A paper by Mr. C. Hedley, F.L.S., entitled "Notes on Tasmanian Conchology" The author said : — "The study of Tasmanian conchology has been facilitated by an excellent catalogue published last year by the late Professor Tate and Mr. W. L. May in the proceedings of the Linnean Society of New South Wales. Therein certain species ascribed to Tasmania by the Rev. J. E. Tenison Woods were rejected from the fauna chiefly because no later observer had taken them. Though apparently of foreign origin, their exclusion could not be wholly justified until that origin was ascertained. At the invitation of Messrs. A. Morton and W. L. May I undertook their examination. From the result it appears that five West Indian species were supplied to Tenison Woods, which he erroneously described as Tasmanian, and as new to science."

On the "Advantages of Forest Conservation," by Mr. C. B. Target:—

Mr. C. B. Target read the following paper, "On the advantages of Forest Conservation": —

First, as to the term forest. In England a forest is a place reserved for wild beasts of the chase, and is not necessarily covered with timber. In Scotland many of the deer forests have few trees. On the contrary, on the Continent of Europe, a forest is an agglomeration of timber trees divided into two main classes—pure and mixed. The former is when the forest consists of only one species of timber; the latter when there are several kinds growing together.

It is in the Continental sense that the term is used in this paper; also, it relates more to sylviculture, which refers to woods and forests, rather than to arboriculture, which deals only with woods and plantations. In the one the tree is the unit, and the wood is considered a collection of trees; in the other the wood is the unit, and the trees are considered only as its constituent parts.

In Britain shelter is the primary object of the woods; on the Continent of Europe the material, or pecuniary, product is of primary importance.

In an address by Dr. Tholard, he says:—When the mountains arose in the geological revolutions which gave them birth, they must have presented themselves in the condition of bare rocks or banks of solidified matter, without trace of vegetation. They first crumbled by the action of water; this was followed by a chemical action, due to carbonic acid, which, combining with the alkaline elements of the rocks, decomposed and dissolved them; thus was produced a layer of soil capable of sustaining vegetation; then the first forms of vegetable life, of which the seeds were air-borne, the roots working downwards and assisting to crumble the rock, and by their decomposition, when they died, improving the soil, till at last large trees could be supported, the seeds of which do not germinate, except on soil which has been previously occupied and prepared for them by other vegetables.

Amongst other things, it has been noticed by Marsh that whenever a tract of country, once inhabited and cultivated by man, is abandoned by him and domestic animals, and surrendered to the undisturbed influences of spontaneous nature, its soil, sooner or later, clothes itself with herbaceous and arborescent plants, and, at no long interval with forest growth for this three negative qualities, exemption from defect or excess of moisture, from perpetual frost, and from the depredations of men and browsing quadrupeds.

We thus see how the forest grew, and by continually shedding its leaves increased the depth of vegetable soil, till man made the forest give place to the garden and to the fruitful field, produced by man's device. We might thus assume that the sole use of the forest is to produce the soil for agriculture. But all is not gain. Evil as well as good has followed in the wake of the artificial change. Marsh says as follows:—With the extirpation of the forest all is changed. At one season the earth parts with its warmth, by radiation to an open sky; receives, at another, immoderate heat from the unobstructed rays of the sun. Hence the climate becomes excessive, and the soil is alternately parched by the fervours of summer, and scarred by the rigors of winter. Bleak winds sweep unresisted over its surface, drift away the snow that sheltered it from the frost, and dry up its scanty moisture. The precipitation becomes as irregular as the temperature; the melted snows and varied rains, no longer absorbed by a loose and bibular vegetable mould, rush over the frozen surface, and pour down the valley seawards, instead of filling a retentive bed of absorbed earth, and storing up a supply of moisture to feed perennial springs. From the soil being no longer protected, the action of the sun and wind dries up the surface, and forms dust which is washed into the streams, and tends to silt up the rivers forming bars at their mouths, and spoiling harbours made by nature. This state of affairs has been going on since long before the advent of Christianity, and numerous cures have been suggested, till scientific forestry has stepped in to remedy the evil, although vast tracts of forest have been destroyed by natural causes, such as frosts, drought, epiphetic and parasitic vegetable growths, and insects, birds, and beasts.

But to a far greater extent have forests been destroyed by reckless fellings in wasteful exploitations; to some extent have injuries been done by flocks and herds depastured in the woods; and to a great extent have forests been destroyed by fire applied to the clearing away of trees, in order that the ground may be obtained for agriculture, and by fires attributed to accident, but to accident attributable to the carelessness of man.

There must be conservation against destruction occurring irrespective of man's agency, against destruction through man's carelessness, against destruction through man's dishonesty, and with this an improved, more economic, and less wasteful forest exploitation; with which, again, may be conjoined forest restoration, reboisement as a preventive of the formation of destructive torrents and inundations, or to assist rainfall, or arrest and utilise drifting sand.

The climate of countries covered by forests is more equable than that of deforested countries. This benefit derived from forests has been proved in France, Germany, the Cape, and India by simultaneous records inside and outside forests. Where the land is densely wooded the rains may be diffused more or less equably over several months in the year, and may frequently be of a drizzling character, while in a land similarly situated, devoid of trees, rain falls irregularly in what seems like thunder plumps, and in extreme cases whole years may pass without rain, as is the case in the Karoo, South Africa, and Aden, South Arabia; and the rain in the forest land may fall pretty equably over the whole district, while in the land devoid of forests it falls now here, now there; falls, it may be, in torrents, deluging the land, while extensive districts are left dry—both occasioning great inequality in the distribution, even where the quantity of rain falling may be proximately equal; and the inequality in benefit from what falls is made still greater by the torrential occasional rains draining off rapidly to the river beds, and by them to the sea, while the woodlands absorb and retain a much larger portion of what falls on them. And thus is fulfilled what is written: "The earth which drinketh in the rain that cometh oft upon it bringeth forth herbs, meat for those by whom it is dressed, and receiveth the blessing of God; but that which beareth thorns and briars is rejected, and is nigh unto cursing."

The following, by Jules Maistre, would refer to the vine industry in Australia: —"The phylloxera has its propagation facilitated, or has the way prepared for it by the most powerful and most general enemy of this entire region. It is manifest that this is the enemy, which equally with that, or still more, should command our attention and our vigilant watchfulness, and that against which we ought to contend with our greatest energy."

With us it is the enemy not only of the vine, but of all culture: this enemy which successively and progressively has made the peasant to give up the culture of flax, of hemp, of maize, and of grain; this enemy which has constrained us to substitute for the culture of cereals, which had become almost unproductive, that of the vine, an arborescent culture with deeper roots. This enemy which is increasing every day with greater damage than that caused by the phylloxera is drought.

In Coorg and the Wynaad, and also the Shimoger district of Mysore, India, it was found that the borer was worse where the bamboo had been cut ,so the planters have largely replanted the bamboo, with the result of keeping down the borer, which has helped destroy the coffee industry of Ceylon.

May not the entomologist find that the Californian scale on fruit trees is owing to its natural habitat being destroyed; for surely this pest was in the world before it began to damage apple trees?

Truly man cannot interfere with Nature without suffering sooner or later for his presumption. He may damage, but he has not learnt to improve. Nature will yield a portion of the surface for cereals, but when that area is encroached on too much, drought and floods destroy what man has done, but does not always, or rather seldom, restore the damage done by man.

Now, amongst the advantages derived from forests are the following industries: —Sawmill, buildings, shipbuilding, engineering, farming, carving, paper pulp manufacture, match making, manufacture of cases, boxes for fruit, etc., frames of sieves and drains and cask hoops, wooden wire for table covers, and blinds, pencils, wooden nails, instruments, shovels, spoons, shoes, lasts, saddle trees, staves for barrels, brushes, harrows, gunstocks, furniture ,toys, timber for mines, railway sleepers, etc. In Germany these industries support 3,000,000 people, but owing to the greater frugality of the Germans, the longer hours of labour, and lower wages, no competition could be started against the import of the manufactured article. In wood pulp there is an exception. In a letter from Mr. Henri Ami, of the Dominion Geological Department, he states:—"There is no doubt a big future for Canada in the direction you mention; in fact, the world is looking towards Canada's coniferous forests for its supply of paper for the coming generation, and if Canada will only extensively and vigorously carry out a prudent, provident policy in connection with this industry, as well as lumbering, there is no doubt that we can control the output in years to come. British Columbia has, as you know, fine coniferous forests. May they be everlasting, and they can be so by careful attention, and judiciously enforced legislation." With reference to inquiries as to forestry in the United States, it shows that there was little systematic work carried on except in New York State, and the main conclusion arrived at was, "There were but poor depauperated forests left in the United States just south of us."

Again, from the "Journal of Commerce of New York."—"But the main ground of objection to the privilege Congress has given to the paper manufacturers—the letters of marque and reprisal which Congress has given to the paper trust to prey upon the book and newspaper trade of the country—being frankly stated, a second reason of a very substantial character, is that, although pulp woods are free of duty, for the profit of the paper trust, the duties on pulp and paper stimulate the ruinous consumption of American forests. When forests are cut for timber, the smaller trees are spared, but the pulp men cut everything down to six inches at the stump, so that the spruce forests, ravaged by the paper makers, are not perpetuating themselves."

The National Irrigation Congress, a year and a half ago, and the National Forestry Association, have urged that all public lands, more valuable for timber than for cultivation, should be absolutely withdrawn from sale by the general government.

The efforts now making on a wide scale to preserve the forests do not spring from altruistic regards for the well being of the next generation. So far as the future supply of timber is concerned, the destruction of our forests will only make timber more expensive, and lead to a freer use of metal for the purposes of construction. It is the farmers' need of rain, and the cities' need of drinking water that is inspiring the efforts, legal and scientific, State and National, to retard the destruction of our forests. In England, New York, and the older part of the West, the denudation of the soil has already proceeded, so far as to seriously diminish the volume of the rivers. This has unfavourably affected the water supply of some of our cities, and it is diminishing the evaporation upon which agriculture must depend for its rainfall. It is for the sake of the crops, and for the sake of the water supply of towns that efforts are now making to check the reckless destruction of the forests. The enormous profit the pulp paper men are making, evinced by the capitalisation of the Trust at £11,000,000 sterling, and absorption of mills at a valuation of £5,500 per ton of daily output, which mills, with entirely new machinery, can be erected at 30—40 per cent. of that, offer an immense premium upon the rapid destruction of the forests.

Forests and Reservoirs.—From American "Gardening," October, 1901.—F. H. Newell, Hydrographer, United States Geological Survey, makes a few remarks which should appeal to all who cultivate the soil. He points out that the full development of the United States, especially of the arid West, rests upon a complete utilisation of the water for irrigation, power, and municipal, as well as domestic supply. Furthermore, as the evaporation of the water, and protection from pollution, both natural and artificial, rests largely upon the proper treatment of the forests at the headwaters of the streams, there can be no question as to the beneficial influence of these forests, although the extent of the influence may be, and still is, open to investigation and discussion. The forests, with the accumulation of vegetation upon the ground, serve to break the force of the rain, and regulate the runoff, excessive soil erosion is to a large extent prevented, and the waters drained from a forest are, as a rule, free from suspended mineral matter.

The Government has set about the protection of forests upon the head-water streams of the West, and Congress has under consideration legislation tending to promote the construction of large reservoirs within or adjunct to the forest reserves. Here are to be found at the head-waters of the streams many valleys whose outlets can be closed by a dam of moderate height, holding back the water from melting snow, or from occasional storms. These natural reservoir sites are being surveyed, and their capacity and cost ascertained. The amount of water available for storage is also being measured, and the facts recorded so as to make it possible to know definitely the benefits to be derived from the construction of these hydraulic works.

One of the sources of anxiety and uncertainty in regard to these reservoirs is the matter of silt and sediment.

The flood waters roll along sand, gravel, and even boulders, depositing them wherever the current is checked. These floods, entering the artificial reservoirs, are brought to a halt, and quickly lay down their load, forming a coating or layer of mud in the reservoir, tending to greatly diminish the storage capacity. If the waters come from forested slopes, where the soil is protected and held by roots, the amount of settlement may be negligible; but if, on the other hand, these forests are cut away, the underwood humus burned, the driving storms soon attack and move the loose earth and disintegrated rock, starting it on its journey down the slopes, to be finally caught in the reservoir below. Thus it happens that it is of the first importance for the prolonged life of the reservoir that every care should be taken to perpetuate the forest cover upon the catchment area, wherever this can assist in holding the soil.

It may be here mentioned, when reafforestation is out of the question, that when the volume of water in the stream entering the reservoir is so great in proportion to the size of the reservoir that the inertia of the water in the reservoirs is insufficient to arrest the velocity of the stream entering, the remedy is either to make the reservoir larger, or to make a greater number of reservoirs further up the valley before the minor streams have formed one large stream beyond control as to power.

Monsieur Valle, in a work entitled "Etudes sur les inondations," gives a table of floods in the Seine from 1615, showing that the height of the floods has decreased from 8.39 metres to 6.47 metres, and makes this deduction, viz., that the felling of forests gives us—

More rain annually.

Less flood water.

More cultivated land.

But he omits to mention that the Forest Edict of Colbert, made in 1669, was owing to the denudation of forests in France, and that the since then forests have increased, especially the Communal Forests, in the beginning of last century, and the end of the 18th under Napoleon, when, for twenty years, all private felling, without permission was strictly prohibited.

Schlich states that—

The climate of forested countries is more equable than that of deforested countries.

The mean temperature is lessened.

The reduction of temperature may be hurtful where crops do not ripen in time, but very beneficial elsewhere.

As forests moderate extremes of temperature, plants grown under their shelter do not suffer so much from the effects of early frosts or drought as plants growing in the open.

There is an excess of from 3 to 10 per cent. of moisture in a forest.

After allowing for the water intercepted by branches, etc., running down the trunk, 12 per cent. may be allowed as stopped by the forest. Against this, the evaporation in a forest, where there is leaf mould, is only 22 per cent. of that in the open, and this more than compensates for the loss of rain reaching the ground.

As to the effect of forests on slopes, I will give the case of Hoshiapur, in the Punjab, where formerly the hills were covered with forests, but by the act of man, and the grazing of cattle, these forests have disappeared. The treading of sheep and goats has loosened the soil. The soil being no longer bound together by roots, ravines have been formed, the debris actually destroying a part of the town. This is what may possibly happen to any irrigation works started here.

The advantages of sylviculture are:—

1. To yield the timber necessary for certain purposes.

2. To produce the greatest quantity per acre per year.

3. To produce the highest possible money return per acre per year.

4. To produce the highest possible interest on the invested capital.

5. To influence the climate, to regulate the draining of the country, and prevent landslips and avalanches.

The following table gives the results of forest culture in several different countries as far as possible. Only the Crown forests are given, as the results of private forestry are not obtainable, so the areas given are very much less than those of the total areas under forest:—

Return of Crown Forests in Foreign Countries.

Country.	Area in acres.	Expenditure. £	Revenue. £	Profits. £
Baden	1,120,000	510,000	1,270,000	760,000
Bavaria...	2,500,000	1,230,000	1,800,000	570,000
Prussia	6,000,000	1,050,000	2,100,000	1,050,000
Austria	2,330,000	3,103,000	3,193,000	90,000
France	2,110,000	533,029	1,540,000	1,006,971
The expenditure in France includes roads and plantations.				
Sweden	4,000,000	35,789	56,807	21,018
Forest maintenance in Sweden is only recently started.				

India.

Year.	Area in acres.	£	£	£
95-96	9,657,000	911,161	1,660,504	749,343
96-97	—	933,955	1,733,869	799,914
97-98	—	667,617	1,159,676	492,059
98-99	—	669,478	1,239,912	569,434
99-00	—	730,175	1,235,425	505,250

The £ in the case of India has been taken, as in the official returns, as Rs. 10 for purposes of comparison. The profit from the forests in 1869 was only £139,971. Since then, although a large portion of the revenue has been spent on reafforestation, yet the revenue has largely increased.

In European countries, which have been chosen as their climate more nearly approaches that of Tasmania, the total acreage of Crown forests is 18,060,000 acres, with a net profit of £3,376,971, or 3s. 10½d. per acre. This net profit, capitalised at 5 per cent. would give £3 17s. 6d. as the average value of each acre, and this is including large areas, of which some are inaccessible, and some valueless for tree planting.

During the last 10 years the country lots of Crown lands sold in Tasmania amounted to 248,924 acres, at an average price of £1 7s. 4¾d.; this, at 5 per cent., would give 1s. 4½d. per acre, so that, even after allowing for the hours of labour being less, and wages being higher than in Europe, twice the amount of the revenue yielded by the investment of the money obtained by the sale would be obtained by a judicious system of forestry on the same land. All the best land is first selected for agricultural purposes, so the price of sale and the small return given for perpetuity is presumably for the best land, whilst the returns for European forests are for all the land, including bad, and in many areas thoroughly denuded of trees, this is especially the case with the Crown forests of Sweden.

According to information kindly given me by Mr. Counsel, the area of the button grass land, which is absolutely worthless for agricultural purposes, is not less than 1,150,000 acres, and as it has been shown that forests are necessary for the climate, which is said to have become colder during the last half century, whether due to the denudation of forests or not, may be questioned by some, but the excess of evidence shows that forests cause milder winters, whilst the intense heat of summer is moderated; for agriculture, grazing, etc., it is necessary to strip a large area of land of its covering of trees, but at the same time they may be replaced elsewhere.

On the basis of a net return of 2s. an acre, and a gross return the same as in Europe, a rise of 26 per cent. may be given for the wages, but as the age at which trees mature in Tasmania is said to be half that required in Europe (see "A Practical Treatise on Tree Culture in South Australia," by J. E. Brown, L.L.S.), the profit may safely be taken as double. The exact profit caused by quicker growth must be more or less left for experience, although the age of timber may be judged by the rings.

Taking the time required for the pine tree to mature in Europe to be 112 years, every £100 of initial cost of planting at

2½ per cent. per annum compound interest would amount to £1,600, whilst if the trees matured in 84 years the compound interest would be £800; but if Mr. Brown's figures be adopted, only £400 would have to be deducted from the sale of the timber planted at a first cost of £100. No allowance has been made for maintenance, as this is met from the sale of the thinnings. In England, where the cost of labour more nearly approaches the rates prevailing in Tasmania, Dr. Schlich, a forest authority, states that allowing 100 years for the growth of the pine and 2½ per cent. compound interest for the money laid out, the result is £185, equivalent to 7s. 6d. per acre per annum after all expenses are paid, so surely with the quicker growth in Tasmania the estimate of 2s. per acre is a very safe one, presuming the trees are allowed to come to maturity. But I would not suggest this, but rather that the button grass land be planted with spruce, Scotch fir, and, as suggested by Mr. Rodway, stringy bark, and that a twenty year rotation be adopted for the stringy bark, as the tree after this would not be suitable for pulp. Allowing only stringy bark to be grown, and assuming that the growth is only that of the spruce, it would take 71,400 acres to supply the American consumption of wood for the pulp industry, estimated at 90,000 tons yearly. Allowing the spruce to weigh when green 40lb. per cube foot, this would give 5,000,000, and the German yield of spruce, 20 years old, is given as 1,400ft. per acre.

For spruce and Scotch fir a rotation of 60 years might be adopted. This would give the yield per acre as 5,400ft., 57,300 acres to supply this requirement annually, and would enable a most profitable industry to be established; an industry that pays so well that the American Paper Trust can afford to give 30—40 per cent. more for an old mill than it would cost to erect a new one with up-to-date appliances.

It is very probable that the button grass land might require some open drains before it be planted, but the advantage would be that we should be exporters instead of importers of deal and pine woods, and also that the oak could be grown as well as the pine by having the tap roots cut when planted, it having been shown by Duhamel that this does not interfere with the growth of the tree, but on the contrary, when the subsoil is sour, the growth is hastened. This has been largely adopted with great success on the Landes in France.

On the sandy wastes on the North-West Coast of Tasmania the Pinus pinaster might be planted with advantage. This would arrest the sand, and large areas of ground recovered for cultivation, leaving belts of pine to prevent the sand again moving, and after the pinaster has run its course, the Scotch fir might be planted, as the soil would then be in a fit state to grow it.

One of the principal products of the Pinus pinaster is resin and turpentine, after which the wood is used for charcoal or firewood. It might, very possibly, having lost its resin, be also good for pulp.

The oak, as well as the pine, would serve to increase the exports, and in compartively few years stop the imports, and cause a large export trade. For, owing to the ruthless manner in which the forests in America are being denuded of timber, the price is almost certain to rise, thus increasing the profit on all timber trees that are now planted.

The oak will find a ready sale for staves for barrels, which are now imported into Australia for the wine industry, and it is to be hoped that the cider industry will soon increase under federation in Tasmania.

One of the principal difficulties in extending the timber trade of Tasmania is decidedly the uncertain quality of the timber. This would, in a great measure, be overcome by the introduction of a Forest Department, for then, instead of the present license system, the trees that would have to be cut would be marked, and sold by auction. The approximate quantity required being estimated by the department, by this means, the trees would be ringed at the proper time. I am informed that the period for the rise and fall of the sap varies with the ages of the tree. Facilities would be given for carting the timber, or else it would be felled by the department, and the tress taken to a depot, and then sold. This latter system is in force in many parts of India.

For maintenance the usual average is 5 days work per acre, or from 40—60 acres per man. This, on an estimate of 600,000 acres, being carefully looked after, would require 10,000 men; thus an extra population of 30,000 people would be supported, exclusive of saw-mills; whilst making, preparation of turpentine, etc., would support some thousands more.

The total yield of an acre of spruce, 60 years old, after adding the amount given by the thinnings, may be taken at 8,250ft., so that after allowing 25s. a year for labour, any price over 2½d. per cubic foot would be profit (5d. per foot is allowed in England). No allowance has been made for the rapid growth of spruce in these colonies, as it has been left for a margin of safety, as these are only approximate figures taken from the yield given in German forests.

There is one matter to which I must draw attention, that is the scale of charges levied to give animals a free right to destroy young trees, which varies from 1s. 6d. for a horse, to 3d. for a goat, one of the most destructive, if not the most destructive animal that can be turned into a forest, except, perhaps, a camel.

The great necessity for a Forest Department is to see that the young trees which make the forest of the future are cared for. Without this a forest is either destroyed by being cut down, or, in due course, it perishes naturally, and disappears of itself. In either case the result is deeply to be deplored, for when once a forest disappears it can only be replaced at a great expense of time and money.

As a proof of what has already been effected in India by forest officers educated in European schools, I may mention that in 1884 there were in that country 9,820,000 acres of reserved forests, the whole of which are managed on the principles taught in the European Schools of Forestry, and 2,493,000 which are protected from fire, as well as cattle and sheep grazing, and goats, and consequently are now in a condition to reproduce themselves, under the natural system, and as perhaps the most convincing proof, from a financial point of view of the value of the system, the forest revenue, which in 1870 was £357,-000, of which £52,000 was profit, in 1880 reached £545,000 with a net profit of £215 000; and in 1900 the gross revenue was £1,235,425, with a net profit of £505,250. These figures speak so very eloquently that no comment is needed.

A Forest Act was passed in South Australia in 1878, and in 1883 a quarter of a million trees were planted out, and the forest revenue amounted to £6,517, against an expenditure of £6,200. Last year the revenue was £14,421; the expenditure, as far as can be seen from the Blue book, £12,675.

Why cannot we also secure the preservation of our forests, and plant, when forests are destroyed for the purpose of of agriculture, to restore, or rather maintain, what Nature has done to render the Tasmanian climate one of the most perfect in the world.

Adjourned Discussion.

A proposed discussion on Mr. Heyn's paper was postponed till next meeting.

Vote of Thanks.

On the motion of His Excellency, a vote of thanks was passed to those who had read papers.

The proceedings then terminated.

List of works presented to the Royal Society's Library during the month of June:—

Atti della Reale Academia dei Science, Roma, current numbers, from the Society.

Records of the Australian Museum, vol. VI., No. 6. From the Trustees.

Journal of the Linnean Society, London, vol. XXVIII., Zoology, No. 184, XXXV., Botany, No. 244. From the Society.

Proceedings of the Geographical Society of Australasia, 1st session, 1885-6, vol. I.

From the Society. Notes sur les Fourmis et les Guepes Extracts des Comptes rendus des Seances de l'Academie des Sciences. Rapports des Animaux. Myrmecophiles avec les Fourmis, 1897. Liste des Travaux Scientifiques. Les habitations a Bon Marche dans Villes les de Moyenne Importance. Sur l'Emploi de Desinences. Caracteristiques dans les Denominations. des groupes etablis pour les Classifications. Recherches sur L'Anatomie de la Fourmi et essai sur la Constitution. Morphologique L'Esthetaque dans les Sciences. De la Nature. From the Academie, Paris.

Contribution to Canadian Palæontology, vol. II., part 2. "Canadian Fossil Insects," by S. H. Scudder. Additions to the Coleopterous fauna of the Interglacial clays of the Toronto district. With an appendix, by A. D. Hopkins, on the Scolytid borings from the same deposit, vol. IV., part 2. A revision of the genera and species of Canadian Palæozoic Corals, the Madreporaria aporosa and M. rugosa, by L. M. Lambe, F.G.S. Catalogue of the Marine Invertebrata of Eastern Canada, by J. F. Whiteaves, LL.D., F.G.S. From the Geological Survey of Canada.

Journal of the Agricultural Department of Victoria, vol. I., part 6, 1902. From the department.

A Trencsen Varmegyei Termeszettud Qmanyi Egylet, 1900-1. From the Society.

The Quarterly Journal of the Geological Society, vol. LVIII., May 15, 1902, No. 230. From the Society.

The "Emu," vol. II., No. 1. From the Society, Melbourne.

The Indicator on Gold Mining, No. 3,

the Creswick Field and its Mining, by W. Bradford. From the editor, Ballarat.

Bulletin of the Museum of Comparative Zoology at Harvard College, vol. XXXIX., No. 2; "Chiriqui Mammalia," by Outram Bangs, vol. XL., No. 1; Changes accompanying the migration of the eye, and observations on the Tractus opticus and Sectum opticum in Pseudopleuronectes americanus, by S. R. Williams. From the Society, Mass.

The Gums, Resins, and other vegetable exudations of Australia; Useful Australian Plants; Notes on Eucalyptus trees, from the point of view of the Beekeeper; Some Australian Vegetable Fibres; The Cork Oak (Quercus suber), a useful tree for New South Wales; Records of the Sydney Botanic Gardens, by J. H. Maiden, Director of the Botanic Gardens, Sydney. From the author.

A list of plants collected in the vicinity of the Jenolan Caves, by W. F. Blakely and J. C. Wiburd. From the Director of the Sydney Gardens.

Memoirs and Proceedings of the Manchester Literary and Philosophical Society, vol. 46, part 5, 1901-2. From the Society.

The Geographical Journal, May, 1902, vol. XIX., No. 5. From the Society, London.

Catalogue of New and Recent Books, April list. From Henry Froude, London.

The Scottish Geographical Magazine, vol. XVIII., No. 5, May, 1902. From the Society, Edinburgh.

Journal of the Society of Arts, May, 1902. From the Society.

The Year Book of the Royal Society, London. From the Society.

The Ibis, April, 1902.

The Victorian Naturalist, vol. XIX., No. 2, June. From the Society.

Proceedings of the Royal Society of Queensland, vol. II., parts 1 and 2, vol. III., vol. V., parts 3 and 4, vol. VIII., parts 2, 3, and 4, vol. XI., vol. XVI. From the Society.

Proceedings of the Royal Society, London, vol. LXX., No. 459, May 12, 1902. From the Society.

Monthly Notices of the Royal Astronomical Society, vol. LXII., No. 6, April, 1902. From the Society.

HOBART OBSERVATORY AND ITS WORK.

DEPUTATION TO THE PREMIER.

A large deputation, representing the Royal Society of Tasmania and other public bodies at Hobart, waited upon the Premier, the Hon. N. E. Lewis, C.M.G., on Tuesday, June 17, 1902, with respect to the work of the Hobart Observatory.

The Hon. Nicholas Brown said it was known that the Federal Government had been in communication with the Premier of Tasmania on the subject of the Observatory at Hobart, and it was thought that, in reply, to furnish mere facts would be somewhat misleading. Neither the staff nor the equipment of the Observatory was satisfactory. There was in existence a report upon the subject from Mr. C. Wragge, of Queensland, who visited Tasmania some years ago, which stated what was wanting. Mr. Wragge stated that £600 would be sufficient to provide the necessary staff and properly equip the Observatory for its work. At a meeting of the Royal Society, held on the 10th, the following resolution was adopted:—"That the Council be requested to arrange for a deputation of its members to wait upon the Hon. the Premier for the purpose of urging that the reply to be sent to the Acting Premier of the Commonwealth to the queries as to the present staff, cost, and equipment of the meteorological establishment of Tasmania should be accompanied with a statement that the present arrangements for astronomical and meteorological observations are altogether inadequate, and that in the general interests of the Commonwealth, it will be necessary in the future to provide for a fuller equipment, and a better paid staff, as suggested by Mr. Clement Wragge in his report to the Tasmanian Government, dated August, 1895, and by Commander Purey-Cust, in his report, dated April 5, 1894, and laid upon the table of the House of Assembly on July 10,1894." He handed copies of these two reports to the Premier, and urged, on behalf of the Royal Society, that the Acting Premier of the Federal Government may be fully informed as to what would be required to be done both as to astronomical and meteorological equipment before the Tasmanian Observatory can do its work effectively as part of a general national organisation.

Mr. A. Morton read the following letters, which had been received on the subject of the deputation:—

"Bushy Park, June 14, 1902. Mr. A. Morton. Dear Sir,—As I am afraid I cannot be at the deputation on Tuesday, I am sending a record of Mr. Wragge's disturbances. I have had to rule the paper, and the readings of barometer are marked twice a day, and connected by pencil mark, showing curves of depressions. The names of disturbances are written down as soon as advertised, and, as I estimate their speed at 300 to 400 miles a day, they are often entered five to seven days in advance, and form a very reliable forecast of the weather. They always come as foretold, but sometimes go north or south of Tasmania. It depends on what part of the depression passes over here whether we get more wind or rain, and this can be known by the steepness of the waves. You will notice by the records that a wave is mostly followed by a smaller or half-wave, and it is during this small wave that most of the rain falls. By carefully watching the progress of the waves, in conjunction with the forecasts, a fairly reliable estimate of coming weather can be made for three or four and sometimes six or seven days, in advance. I need not say how important this is for all farming operations, and in scores of instances we have planned our work in reliance on these records, and have very seldom been disappointed. The most disturbing element is easterly or south-easterly weather. The rain from that quarter mostly coming with a high barometer. The black marks at bottom lines indicate the rainfall, each line being the tenth of an inch. If these sheets could be provided, anyone with a barometer and rain gauge could record the readings and rainfall, and, in conjunction with Mr. Wragge's forecasts, could form a fairly reliable estimate of coming weather. Much more might be done by giving more detailed information as to the course and velocity of the disturbances. I can only hope that, instead of lessening the information given, it will be increased, to the great benefit of agriculturists.—Yours, etc., W. E. Shoobridge.

"Launceston Hotel, June 16, 1902. Dear Morton,—I am sorry that I shall not be at the deputation to-morrow re the meteorological service. I am heartily in accord with the objects in view; not only as absolute necessity from a national point of view, but as a matter of great interest and use to the general public. A great nation should not exist without a great meteorological service.—Yours, etc., W. V. Legge."

Professor McAulay, M.A. (Tasmania University) spoke strongly of the necessity of keeping accurate time in Hobart, so that mariners would be able to regulate their chronometers. Hobart was at the present day an important shipping port, and promises soon to be still more important ; also it is a port of call for large ships two days out from a port (Sydney) where they have accurate time indicated. These ships subsequently have a voyage of many days before again reaching a port where time is accurately kept. Chronometer rates are different when at sea from what they are on board. Navigators require in Hobart to have Greenwich time to be given to them just as accurately as it can be obtained. Thus a tenth of second error in Hobart may mean several seconds error at a time when a large ship is reaching a dangerous coast, and this may mean all the difference between safety and danger. The matter is, therefore, clearly one of Federal interest. The equipment in Tasmania for keeping time is altogether inadequate to fulfil the requirements above indicated. There is not even (1) a modern transit instrument, nor (2) a reliable clock. Two citizens are practically supplying (the one by electric connection with the Observatory, and the other by the loan of a ship's chronometer) the deficiency in the matter of clocks. Also for utilising the proper equipment for obtaining time accurately it is essential that, at least, one observer should be paid, whose first duty should be to thus make time observations. The State Government ought to provide for two matters recommended by Commander Purey-Cust, R.N., in the paper referred to by the Hon. N. J. Brown. The one is to make permanent, by a suitable inscription, the standard of longitude, left us by the American astronomers, who observed the transit of Venus. The second is to provide for the Observatory a permanent meridian mark.

Mr. H. C. Kingsmill, M.A., Meteorological Observer, said that the Royal Society of Tasmania had brought into notice two forgotten reports, one of which dealt with the meteorological work of the Observatory by Mr. Wragge, the other by Captain Purey-Cust on the astronomical work. The authors of these reports were admittedly experts of the highest class, they were specially invited by the Tasmanian Government to supply the information which they gave, and they spared no pains in making themselves acquainted with local conditions. Mr. Wragge spent two months in Tasmania, visiting every observing station, and suggesting and making improvements at each. Captain Cust spent a month at the Hobart Observatory, testing all the astronomical instruments, taking observations, and checking the calculations of the Government Meteorologist. It would be interesting, said Mr. Kingsmill, to know what has been recommended by these experts, and how far their recommendations have been carried out. Such information is especially necessary at the present time, when the question of a transfer of observatory work to the Commonwealth Government is under consideration. It appears from what transpired at the meeting of the Royal Society on the 10th inst. that the conditions which Captain Cust and Mr. Wragge reported as necessary for the efficient conduct of the astronomical and meteorological work of the Observatory have never been provided by the Government, either as to staff or equipment. Consequently, as the Hon. N. J. Brown has pointed out, it must be made clear to the Commonwealth Government that if a transfer is made, additions to both will be required. The difficulty of the situation is enhanced by the pressing necessity for retrenchment at the present time. All are agreed as to the desirability of placing the Meteorological Department on a better footing. It seems to have been considered in the past that the department, having to deal with atmospheric phenomena, should live on air. This idea led to its being nearly starved out of existence. Yet if the work is required, it should be paid for, and the payment should bear some proportion to the skill and experience necessary to the attainment of scientific accuracy. Few who have not been trained in science, Mr. Kingsmill pointed out, can realise the quantity of labour necessary to ensure accurate results, or the worse than useless character of work in a scientific department that is nearly right, but not quite. For example, a small mistake in the time-service is more puzzling, and more likely to be misleading, than a large error, which would be obvious. What then is to be done? The most practical appears to be, that arrangements should be made for a conference of the Directors of Observatory work in the different States, and that they should be assigned the task of preparing a scheme which will satisfy both general and local requirements. There is no insuperable difficulty in the preparation of such a scheme; the problem is identical with one which has been already solved in the Dominion of Canada. There was a time, said Mr. Kingsmill, when each Province in the Dominion had its own seperate time service, and meteorological service, such as it was. Now, there is one central office in Toronto, which receives weather telegrams from over three hundred observing stations throughout the Dominion. Forecasts are issued daily from the central office to all the Provinces. A similar system prevailed in the United States, only on a greater scale. No meteorological service in the world was better organised than that of the United States, and on none was there so large an expenditure. Yet it is a productive expenditure, and it has often happened that a saving has been effected by the timely warning of a single storm, which would more than cover the cost of maintaining the service for a year. What has been done both in Canada and the United States, with signal success, can be done, and ought to be done, in this State. He would, in conclusion, most strongly submit for the Hon. the Premier's consideration the advisability of urging that a conference of meteorologists be appointed at an early date.

Mr. A. Risby, Warden of the Hobart Marine Board, supported the object of the deputation.

Mr. John Macfarlane (President of the Hobart Chamber of Commerce) urged that the work of the Observatory, if properly carried out, was of great importance to the shipping. The forecasts of weather, as given to the fishermen in the old country, were largely the means of saving life.

The Rev. J. B. Woollnough, M.A., M.H.A., asked had the Premier received any communication from the Federal Government as to giving Mr. Wragge facilities for his work, as we had been doing?

The Premier said he had received a telegram from Mr. Philp, Premier of Queensland, saying that if free telegrams and postage were conceded, Mr. Wragge's work could be carried on for £2,000 a year, and asking would the various States contribute that amount. He had replied, asking for information, and saying that if Tasmania's contribution was to be on a population basis, he would submit to Parliament a favourable proposal. South Australia had refused, and New South Wales had agreed to contribute. He understood that the Federal Government were willing to concede free postage and telegrams. He also understood that the Federal Government would consider in the recess—if there was one—(laughter)—the question of taking over the meteorological service. In writing to Mr. Deakin, he would bear in mind all that had been said by the deputation. He was afraid the time was not opportune for asking this Government to provide new instruments for our Observatory. He would suggest to Mr. Deakin the conference spoken of by Mr. Kingsmill.

JULY, 1902.

The monthly meeting of the Royal Society of Tasmania was held on the 8th of July at the rooms, Argyle-street. His Excellency the Governor (Sir A. E. Havelock, G.C.S.I., G.C.M.G.), (president of the Society) presided.

The King's Illness.

His Excellency the Governor said:—As members of the Royal Society of Tasmania, of which Her Majesty the late Queen was, and His present Majesty King Edward VII. is, patron, it was fitting they should join in expressing the feelings of public satisfaction and happiness at the news received during the last few days of the successful recovery of His Majesty the King from an illness, the result of which was watched with so much anxiety a fortnight ago. (Applause.) There was one other matter of congratulation he should like to mention concerning one of the oldest members of the Royal Society—the honour which His Majesty had been pleased to confer upon their friend Sir Adye Douglas. (Applause.) He was so well known to all in Tasmania and Australia that any words of his as to Sir Adye Douglas's place in the community or his past history would be superfluous. The honour conferred upon him in his 87th year had given pleasure and satisfaction to them, and to all Tasmania. (Applause.)

Sir Adye Douglas briefly replied.

New Member.

Mr. Edmund Leolin Piesse, B.Sc., of New Town was elected a Fellow of the Society.

Proposed Retirement of the Queensland Colonial Botanist.

Mr. Rodway, member of the Council of the Royal Society of Tasmania, moved the following resolution,—"That this Society hears with sincere regret the intention of the Queensland Government to retire Mr. F. M. Bailey from the position of State Botanist. It would respectfully urge that if this cannot be avoided, it may at least be delayed until the completion of Mr. Bailey's valuable work, "The Queensland Flora."

The motion was seconded by Col. W. V. Legge, R.A., and carried unanimously.

Mr. E. A. Counsel, F.R.G.S., Surveyor-General of Tasmania, who was to have taken part in a discussion on "Forest Conservation," forwarded the following telegram from Launceston : —"Please apologise for my unavoidable absence from meeting of Royal Society. Hoped to have returned on Saturday night."

Papers.

"Notes on Unrecorded and other Minerals Occurring in Tasmania," by W. F. Petterd, C.M.Z.S., Lond. The writer, in the opening remarks of his paper, said: — The following notes, in conjunction with a paper upon the subject published in the proceedings of the Royal Society of Tasmania, 1897, embraces the work done to elucidate the mineralogy of the State since the publication of the "Minerals of Tasmania," 1896. They comprise many interesting substances of more recent discovery, including one, or perhaps two, which are quite new to mineralogical science. It will be found that above 40 species hitherto unknown as occurring in this island have been added to the already voluminous catalogue, and additional localities and associations are recorded for several previously known. An important feature is the record of several complete analyses of complex substances for which I am indebted to Mr. S. Pascoe, of the Magnet Silver Mining Co., and Mr. O. E. White, of Hobart, to whom I return my sincere thanks for their ready and valuable assistance. Such work is invariably a welcome addition to mineralogical investigation, and I am sure it will be duly appreciated by those interested in this field of inquiry. In many cases it is only by such means, coupled with a crystallographic character, that the specific identity can be obtained with reasonable certainty. It is almost needless to say that in this department much yet remains to be done before we can possess a comprehensive knowledge of the mineral known to occur in this State The list, with descriptions and localities, number 77 species, and will prove to be a most valuable addition to our knowledge of Tasmanian minerals.

Note on Eucalyptus linearis, Dehnhardt (a supposed Tasmanian species), by J. H. Maiden, F.L.S., Director, Botanic Gardens, Sydney. (Corresponding member):—

The author said he had recently received from the Imperial Natural History Museum of Vienna, a type specimen of Eucalyptus linearis, Dehnhardt, which has not been seen either by Bentham or Mueller. Usually a Mount Wellington, Tasmania, smooth-barked tree, closely related to E. amygdalina, Labill, is referred to Dehnhardt's species, which was described from a European seedling in 1829. The author describes the type, and expresses the opinion that the precise position of the plant described by Dehnhardt requires yet to be determined by Tasmanian botanists.

Mr. A. M. Lea, F.E.S., Government Entomologist, contributed a paper, entitled, "Notes on some remarkable Tasmanian Invertebrates." The writer said, under the above heading, he proposed from time to time to give notes on some remarkable Tasmanian insects, and probably other invertebrate forms of life. The notes, whenever possible, would be illustrated with sketches. The present description deals with one of the "Walking Stick" insects, being the first official record of the occurrence of the remarkable family of Phasmidæ in Tasmania. The specimen was found at Burnie, and presented to the Tasmanian Museum by Miss Dora Shoobridge, and will be known as Acrophylla tasmaniensis.

The Great Lake.

Colonel Legge furnished the maximum and minimum temperature at the north end of the Great Lake for the month of June, 1902, compiled by Mr. F. H. Archer, Police Station, North Great Lake. The maximum was 43 degrees on the 3rd, 5th and 24th, and the minimum 15 degrees, on the 26th. The mean temperature for the month was 35 degrees.

Forest Conservation.

A discussion took place on Mr. W. Heyn's and Mr. C. B. Target's paper on Forest Conservation.

Mr. L. Rodway spoke upon the papers at considerable length. Speaking of the apple trade, he advocated the registration of brands by the Government, and the publication in pamphlet form of results of sales. Otherwise he thought the industry would be able to take care of itself. The timber trade possessed greater difficulties, and to do much for it, the Government would have to take the whole management of it. But the Government might inquire if there was a sufficient quantity of timber to warrant the going in for a large export trade, and if there was, it would be within their province to find markets. It was hardly possible to establish an agricultural college in Tasmania at present, but there were such establishments already in Victoria, South Australia, and New South Wales, and scholarships in one of those colleges might be founded here. If, then, the scholars were numerous enough, we might find it worth while to establish a college of our own. Referring to Mr. Target's paper, he said that the oak in Tasmania had not been a success. There was a great deal to be done in planting stringy bark, which grew very rapidly. Button-grass plains were poverty-stricken—you got a foot of soil, and then came gravel.

Mr. A. O. Green said that he always compared this country with Norway: Norway, like Tasmania, is a poor country. It is mountainous, it has a broken coast line, it is largely covered with forests, but there the similarity ends. The forests of Norway produce small trees, not more than a foot to eighteen inches in diameter, and from which a plank cannot be obtained wider than nine inches, or longer than ten or twelve feet; and yet the Norwegians so prepare and classify their timber for market that it has a staple value throughout the civilised world, and is sent everywhere, including Tasmania—and the country reaps a profit of about a million pounds annually. Tasmania on the other hand, with her magnificent forests from want of the system and care that make the Norwegian industry so successful, reaps a merely nominal benefit from her much more valuable forests. Mr. Heyn's remedy for this state of affairs, summed up in one word, was education, and with this in general terms he fully agreed. Tasmanians who should know better may be found, who will run down Tasmanian timbers as worthless, whereas, if properly prepared for market, they are second to none in the world for the purposes for which they are suited. Again, people may be found in Tasmania who will stigmatise the science of forestry as a fad, and even in the present day may be found Tasmanians who will deride education, as applied to timber. Mr. Target had shown, very forcibly, the good that forests do to a country from simply existing. He went on to show that they profit several countries to the extent of upwards of a million per annum, when treated on sound commercial principles, and further pointed out how, by systematic planting, barren and profitless stretches of country might be profitably improved. There is no what is termed "theory" about this. Round our coasts there are plenty of places where our good land is being overwhelmed by the sand blown in from the sea; exactly the same thing has been overcome on the shores of the Bay of Biscay by planting pine trees. In the Bay of Biscay, not only has the sand been stopped, and a profitable industry in turpentine established, but, owing to the fact that pine trees make vegetable soil more quickly than any other trees, the sandy wastes have been transformed into fertile land. In the same way in Denmark, by the planting of pines and other trees, heathy morasses, somewhat like our button-grass plains, have become a source of revenue from the timber, and, eventually, dairy farms adding greatly to the wealth of the country. If rightly managed, we have inexhaustible supplies of timber, superior to oak and ash, for which, were it properly placed upon the market, there would be an inexhaustible demand, at remunerative prices.

Mr. G. E. Moore, C.E., also offered some observations, and was followed by Mr. A. Mault

The discussion was adjourned till next meeting, and a vote of thanks to the readers of papers was passed.

The proceedings then terminated.

Colonel W. V. Legge said he had received a very important communication from Mr. F. H. Archer, residing at the Great Lake, dealing with the temperature of that part of Tasmania for the month of June of the present year, which he would read.

Police Station.
North Great Lake,
2nd July, 1902.

Colonel Legge,
Military Barracks,
Hobart.

Dear Sir.

I enclose herewith a record of the max. and min. temperatures for June. Comparatively, June was very mild. The frosts were not nearly so severe as they were last year. The Great Lake is covered with about 2in. of ice, and the Little Lake 3in. But a thaw set in this morning, with a strong N.W. wind, and the ice is breaking up. We had about 18in. of snow during the disturbance "Braddon," which is rapidly disappearing. We had 6in. last year at the same date, and it lay about till the end of August. Rainfall for June, 1902, 7.985in.

There are still a number of little gulls about, but the ducks have wholly disappeared.

I am, dear sir,
Yours, truly,
F. H. ARCHER.

Max. and Min. Temperatures at North End, Great Lake, for the month of June, 1902:—

Date. 1902.		Temperature. Max.	Min.
June	1	44	30
,,	2	39	28
,,	3	48	32
,,	4	45	40
,,	5	48	29
,,	6	44	30
,,	7	44	39
,,	8	44	33
,,	9	45	34
,,	10	42	29
,,	11	44	26
,,	12	46	24
,,	13	43	21
,,	14	39	32
,,	15	41	32.5
,,	16	42	35
,,	17	39	33
,,	18	34	24
,,	19	37	30
,,	20	38	23
,,	21	38	22.5
,,	22	36	21.75
,,	23	44	18
,,	24	48	23
,,	25	39	13.5
,,	26	37	15
,,	27	44	23
,,	28	45	25
,,	29	45	21
,,	30	43	23

Mean for month, 35deg.

List of Works Presented to the Royal Society of Tasmania during the Month of July, 1902.

Journal of the Department of Agriculture of Victoria. From the Department.

Journal of the Straits Branch Royal Asiatic Society, No. 37, January, 1902. From the Society.

Journal of the Society of Arts (current Nos.) From the Society.

Journal of the Royal Anthropological Society of Australasia. From the editor.

Transactions of the Royal Society of South Australia, Vol. XXVI. From the Society.

Insect Enemies of the Pine in the Black Hills Forest Reserve. An account of results of special investigations, with recommendations for preventing loss, by A. D. Hopkins, Ph.D. From the U.S. Department of Agriculture.

Catalogue of Casts, Models, Photographs, and Restorations of fossil vertebrates. From the Department of Vertebrate Palæontology. American Museum of Natural History.

Hand-list of the Genera and Species of Birds, Vol. III. By R. Bowlder Sharpe, LL.D.

Catalogue of the Collection of Birds' Eggs in the British Museum, Vol. I. Ratitæ, Carinatæ (Tinamiformes, Lariformes), by E. W. Oates. Catalogue of the Fossil Fishes in the British Museum, Part IV., containing the Actinopterigian, Teleostomi, of the Suborders Isospondyli (in part), Ostariophysi, Apodes, Percessoces, Hemibranchii, Acanthopterygii, and Anacanthini, by A. S. Woodward, LL.D. Catalogue of the Lepidoptera, Phalænæ, in the British Museum, Vol. III. From the trustees of the British Museum.

Reports of the Evolution Committee of the Royal Society, Report I. Experiments undertaken by W. Bateson, F.R.S., and Miss Saunders. From the Society.

Calendar of the University of Sydney for the year 1902. From the University.

Geological Magazine. No. 456 N.S. Decade IV. No. VI., June, 1902. From the Society.

Annals and Magazines of Natural History, Vol. 9. No. 54, June, 1902. From the Society.

Monthly Review, No. 21, June, 1902.

The Athenæum, May, 1902.

Classified catalogue of an extensive and valuable collection of books, pamphlets, views, maps, and transactions of societies relating to Africa and African countries. Part III., July, 1902. From the publisher.

Fourth annual report of the Northern Tasmanian Anglers' Association. From the hon. secretary.

Catalogue of Indonesian Art. From Karl W. Hersemann.

Sitzung der Mathematisch —Naturwisissenschaftlichen. From the Society, Wien.

Monthly notices of the Royal Astronomical Society, Vol. LXII., No. 7, May, 1902. From the Society.

Record of the Geological Survey of New South Wales, Vol. III., Part II., 1902. From the Mines Department.

Copy of an old Mercator of 1706. From Mr. Thos. S. Read, Adelaide.

Atti della Reale Academia dei Lincei. From the Academy.

Boletein da Sociedade de Geographia de Lisboa. From the Society.

Acta Horti Petropolitani, Vol. XIX., Fasciculus 1 and 2. Flora Manchuria, Flora Korea, Lichenes Flora Rosiœ et regionum confinium Orientalium. From the Department of St. Petersburg.

Proceedings of the Royal Society, London, Vol. LXX., No. 460, May 461, June, 1902. From the Society.

Catalogue of Henry Sotheran and Co.'s Illustrated Catalogue of valuable books, beautiful old prints, and original drawings, 1902. From the publishers.

Scottish Geographical Magazine. From the Society.

Proceedings of the Washington Academy of Sciences. Papers from the Harriman Alaska Expedition, XXVIII., Hymenoptera, by W. H. Ashmead. From the Academy.

Katalog einer Sammlung von 923, Modellen in Bernbaumholz zur Elanterung der Krystallformen der Mineralien Katalog, No. 50. Petrographisches Praktikeem. Beschreibung einer Sammlung, Von 386. From Dr. Krantz.

Geographical Journal of England, Vol. XIX., No. 6. From the Society.

Geological Map of Victoria. From the Mines Department.

Victorian Naturalist, Vol XIX., No. 3, July, 1902. From the Society.

Gazette of Literature. A monthly classified list of new publications, London. From the publishers.

AUGUST, 1902.

The monthly meeting of the Royal Society of Tasmania was held on the 12th of August at the Museum. His Excellency the Governor, Sir Arthur Havelock, presided. There was a large attendance of members.

New Members.

Mr. W. M. Hardy and Mr. W. A. Thorpe were elected members of the society.

Queensland Flora.

A letter was received from the Under-Secretary for Queensland, acknowledging receipt of a letter from this society, forwarding a resolution in which regret was expressed at the decision to dispense with the services of Mr. F. M. Bailey, Colonial Botanist of Queensland, and urging that he be retained till the completion of his work on Queensland flora, on which he was now engaged. In reply, the society was informed that the Queensland Government had already made arrangements for continuing Mr. Bailey's services for six months from the 1st inst., in order that he might be able to complete the work in question.

North Great Lake.

Colonel Legge read a letter from Police Trooper Archer, at North Great Lake, stating that they had experienced no very severe frosts during the month of July, and the lakes, with the exception of Pine Lake, which was covered with four or five inches, had been remarkably free from ice. The only birds to be seen on the Great Lake now were the gulls. They appeared to be quite as plentiful as they were in the summer. The grey thrush was there all the winter, but not plentiful; also a few white magpies and wattle-birds. Ground larks were plentiful, and yellow-throated honey-eaters were not scarce. There were also butcher-birds, robins, and emu wrens. He had not noticed the white hawk up there. He had noticed the brown hawk in the spring, flying along the edge of the lake and round the islands, apparently looking for eggs and water fowl. At present, most of the days were bleak and sunless, and the winds unpleasantly cold. During July the minimum temperature was 19deg. on the 30th, and the maximum 40deg. on the 24th; mean temperature for the month, 34deg.

Max. and Min. Temperature at Great Lake, North, during July, 1902:—

Date. 1902.	Temperature. Max.	Min.
July 1	43	26
2	41	30
3	43.5	36
4	38	33
5	40	31
6	36	25
7	34	22
8	35	23
9	37.5	29
10	39	30
11	39.5	30
12	38	24
13	34	23
14	37.5	23
15	38	23
16	37	28
17	38	29
18	42	32
19	44	28
20	43	31
21	44	32
22	39	26.5
23	40	28
24	48	28.5
25	38	22.5
26	44	33
27	40	34
28	42.5	35
29	41.5	31.5
30	39	19
31	40	31

Mean for month 34

Governor Denison.

The Secretary read the following letter from Mr. H. E. Smith:—"I have very great pleasure in presenting to the Royal Society of Tasmania a splendid engraving, a full length portrait of the late Sir Wm. Thos. Denison, who was Governor of this colony from January 28, 1847, to January, 8, 1855, as a token of esteem and affection in which he was held by me." Mr. Smith, the secretary said, gave a very interesting account of Sir Wm. Denison, and it was decided that the valuable notes furnished by Mr. Smith should be forwarded to the Historical section of the Royal Society of Tasmania.

Tasmanian Forestry.

The adjourned discussion on Tasmanian forestry took place.

Colonel Legge made some observations, in the course of which he expressed a desire to see a Forest Conservancy Department created in this State, and expressed his regret at the extent to which "ringing" was indiscriminately practised in Tasmania.

Hobart he was told that typhoid would not live in it, but on reaching Tasmania he found that two children of Bishop Montgomery's had been laid up with it, and that one of them died. He had been in a great many cities on the Continent of Europe, including Cologne, which was famed for its foul and beautiful smells, and he could say that the smells of Hobart were quite as bad as those of Cologne. On one occasion, while going to one of the Hobart churches to preach, he got a smell which remained with him during half the service. Hobart was a long way behind the age in the matter of sanitation. The cobble stones of the channels retained the sewage in their interstices, and if the smells were so bad in the cold weather, what must they be in the hot weather? At Bishopscourt, when he went there, he saw adjacent a lovely creek coming down from the mountain, but he was told that when the summer weather had set in, it would become a filthy sewer. As to the pan system, it was beneath the dignity of a community of 40,000 people like Hobart to have it. He indicted it on the ground of costliness alone. They had the same system at St. Helens, Lancashire, and it cost 2½d. per head per week, but he was told that in Hobart it cost 6d. per week. He cited statistics showing that zymotic disease decreased in cities as the water-carriage system was used. An epidemic of fever in 1900 in South Africa was directly traced to the operations of flies, and at Gorton, where he had come from, a table was kept showing when the flies and the typhoid came and went, and it was seen that the one exactly agreed with the other. No one was safe where the flies were. Hobart was a lovely place, but let them make it more lovely still. The open sewers of the city were a disgrace to it. It was not a matter of the death-rate but of the typhoid rate. He strongly appealed to the authorities to take action in this matter.

Mr. A. Thorpe, Alderman G. E. Moore, Dr. E. J. Crouch, Mr. Target, and Mr. A. R. Green also took part in the discussion.

Mr. E. H. Wilkinson, Engineer of the Metropolitan Drainage Board, showed a number of lantern views illustrating the sewage works at Sydney, and went on to say that the existing sanitary conditions at Hobart were most unsatisfactory. It was the old tale of impure air and water, owing to defective drainage. The positions of some of the dwelling houses were quite unsuited for human habitations. The configuration of the city told any engineer that the natural outfall for the drainage was Macquarie Point. The tides at Hobart were very regular, and the mean average difference between high and low water was 3ft. 9in. There was nothing sentimental about septic tanks; they were scientific facts. They purified sewage without bacterial beds. It was intended to take the Hobart sewage into very deep water, where it would get the full benefit of the tidal flush.

Some ladies, who were members of the old sanitary society of Hobart were present, and the president invited them to contribute to the discussion, but no response was made. He, however, asked them to continue the useful work which he was told they had done in times gone by.

A vote of thanks was passed to the speakers, and the proceedings then terminated.

EVIDENCE OF GRAPTOLITES IN TASMANIA.

By T. S. HALL, M.A. (Melbourne University, Corr. Memb.)

Read 29th April, 1902.

At the last Sydney meeting of the Australasian Association I discussed the Tasmanian graptolite record,* and arrived at two conclusions—Firstly, that Thureau had found a Diplograptus, and, secondly, that, on the supposed identification of an (Upper) Silurian graptolite, the Lisle slates had been referred to Ordovician.

After the publication of my paper Mr. Thureau wrote to me on the matter. He speaks of the Lisle so-called graptolite, that is, the one he had recorded under the useless name of Diplograptus nodosus, as follows:—"I now recollect seeing there (*i.e.*, at Lisle, T.S.H.) dark elongated imprints—probably carbonaceous—in those dark-blue slates, but they were too indistinct to be classified. . . ." Then follow some remarks which explain the confusion into which I fell in my previous paper through my ignorance of Tasmanian geography. "With regard to the *true* graptolite . . the locality is about 10 miles from Strahan, on the old Mount Lyell Road (Tas.), close to an old road-maker's camp and stable, near a spring of water." This is the specimen which, from Mr. Thureau's conversation, I felt convinced was a Diplograptus. Of the Lisle record I express no other opinion than my belief in its worthlessness.

During the session of the Australasian Association, at Hobart, last January, while looking over some samples of slate in the collection of Mr. Thomas Stephens, M.A., I found traces of a graptolite in a specimen from near the Ring River, on the North-East Dundas Railway. I understand that the rock samples had been given to Mr. Stephens by Mr. G. A. Waller, Assistant Government Geologist. The slate is a very hard, much-jointed rock, with a silky lustre, and the fossil is badly preserved. Some branched talcose and ferruginous markings first caught my eye, and on examination with a lens I found three or four thecae.

* 1 Rep. Aust. Ass. Adv. Sci., v. 7, 1898, p. 401.

Now, this will give you an idea of what a really infinitesimal tax on all who are likely to profit by the project under discussion would place annually at the disposal of the managing committee. Of course, the figures can be changed or modified to suit the requirements and circumstances of the case, but I do not think that any real objection can be made to such a reasonable solution of finding the funds required for the purpose.

I have not the honour of knowing personally your new Governor, but from all reports he is a thoroughly energetic and shrewd business man. If you can only convince him of the necessity and value of such an institution, and enlist his sympathy and co-operation in your efforts, I think success is certain. I am persuaded that the foundation and ultimate success of such a school, under his auspices, will add fresh laurels to his diplomatic career.

In conclusion, I have done my utmost to impress the importance of this subject upon you. I only wish I could be with you to aid by advice and assistance, but, as I have already told you, my services are always at your disposal to carry out a project which I feel sure will benefit Tasmania, to which I am so sincerely attached, and where I received such kindness and made so many new, and, I trust. lasting friendships.

it as a recognised axiom in practical life and political economy, that the persons likely to profit most by the adoption and subsequent successful result of any enterprise, are those who should find the necessary resources for its establishment and support. Now, those who are sure to benefit by this school of forestry and agriculture are numerous, and can, I think, be divided into the following categories:—1st. The Government, by a larger revenue derived from extension of trade and foreign relations and sale of timber growths; 2nd. Parents of boys who will be fitted in the school for a profitable career; 3rd. Timber merchants and saw-millers; 4th. Agriculturists, fruit-growers, and exporters who, by better management and more theoretical and practical methods, will procure more remunerative returns for their produce; 5th. Small farmers, whose dairy and general farm products will reap a similar benefit; 6th. Large steamship companies, for whom the increase of fruit, timber, and other agricultural produce means better freights and larger shipments; 7th. Bankers whose clients in those industries will be doing a more lucrative and safe business; 8th. The whole community, who must profit by the success of these industries.

Now, let us see what these different sections ought reasonably to contribute to securing the success of this scheme—

		£
1st.	The Government annual subsidy	250
2nd.	Parents, pupils' fees........................	660
3rd.	Timber merchants and saw-millers ½ per cent. on export value of wood, say £50,000 (or an equivalent per 100 s. ft.)................................	250
	(To be augmented as trade increases.)	
4th.	Agriculturists and fruit growers and exporters, ¼ per cent. on £733,000 export value (or equivalent per case, sack, or bale)	1830
5th.	100 small farmers, at £2	200
6th.	Five steamship companies, at, per annum, £20 each	100
7th.	Three banks, at, per annum, £20 each	60
8th.	Subscriptions from agricultural Societies and private individuals	200
	Making a total of	£3550

Tasmania and to himself. It will not be an easy task to find such a man, and when found, he must be properly paid.

As for the professors or teachers, I should think four or five would be sufficient to begin with. They must be practical men, representing forestry, agriculture, fruit-growing, botany, and farm and dairy produce generally. Of course they will have to expound the theoretical reasons for the practical work taught the pupils, and which, after all, ought to be the principle part of their instruction in this school. You have among you many fit and competent for this, and you have only to make a prudent choice to secure a good working staff, and I should imagine that, wishing to further the project, they would not demand too high a payment for their services, which, with a proper division of labour, should not exceed much more than 24 hours in the week.

You will also require a capable accountant, not alone to keep the receipts and expenditure of the school, but also to teach the pupils the book-keeping so absolutely necessary for their success in their future career.

The minor details of outdoor foremen and servants must, of course, be discussed and arranged by the committee of management and the manager.

I had hoped to be able to make up for you a sort of balance sheet of "ways and means," but, on consideration, I find it would be impossible for me to do so, ignorant of the expenses you will have to incur, and, therefore, without any real basis upon which to form any reliable calculations; but this your committee will easily be able to do. I can, however, inform you that the school on the Continent, which I have chosen as a model, with about 100 pupils, has a yearly gross revenue of—

	£
Pupils' fees	2120
Proceeds of farm (100 acres)	800
	£2920

and that the—

Total expenditure (but not including professors' fees) is	£1520

And now comes the vital part of the whole question—How is the money necessary for the establishment and maintenance of the school until it becomes a self-supporting and paying institution to be obtained? I think we may take its advantages recognised, you could count upon many strangers, but later on it is more than probable that you will get a number from the neighbouring States and New Zealand. There might also be a likelihood in these days of cheap passages, that English parents and guardians would prefer sending their boys to a lovely climate like Tasmania in preference to the Continent, provided they know they could be brought up in a suitable manner to fit them for forest and agricultural work in India, South Africa, and the Colonies, particularly as the training they would receive in Tasmania would be better adapted to prepare them for such a career.

One of the most important points to settle will be, whether the school is to be a Government one, or solely under the management of a committee chosen from the different persons most interested in the scheme. In my opinion, a combination of the two systems might prove beneficial, and give a certain status to the institution which neither, separately, would confer upon it. The Government, which will no doubt be asked, and will consent, to grant a reasonable annual subsidy at least during the first few years of its existence, will naturally and very properly claim the right of having a vote in the proceedings. The very fact of the legislative bodies having a certain control over the organisation and expenditure will have an advantageous influence as a safeguard against extravagance on the one hand, and parsimony on the other. The members of the committee will be able to bring forward a detailed scheme as practical men interested in the industries involved, knowing what is actually required and should be done.

One of the next most serious points you will have to consider will be the selection of a proper manager of the school. The importance to be attached to this can scarcely be exaggerated. Upon the choice of a competent person to occupy this position may depend, in all probability, the success or failure of the scheme. He must be a well-educated man, of a certain age and standing, to secure the respect and esteem of the parents and teachers, as well as the deference of the pupils. He must possess both energy and tact, and, indeed, he cannot have too much of each combined. He should have, if possible, a good knowledge of French and German, so as to enable him to study the very important works which appear periodically in these languages upon the management of similar schools elsewhere, and to correspond with their managers. With a practical knowledge of both forestry and agriculture, he should be imbued with a firm desire to make the school a credit to annum), 10 only availed themselves of it in the first five years, but then their good common sense and shrewdness prevailed, and their number increased proportionately in a still greater degree.

The lessons to be derived from these facts are, I think—1st. neither to be too sanguine of immediate success, nor despondent of ultimate attainment; 2nd. Once convinced of the necessity and vital importance of the scheme, no hesitation should be allowed to interfere with its immediate commencement; 3rd. Caution and prudence in beginning, and perseverance, activity, and energy until its achievement are nearly certain to be rewarded with final success.

The school which, after serious investigation, I think to be the best model for you to follow, was at first designed to 50 boarders, but it was not until after 25 years of existence that room for this number was required. In my opinion, a house which would accommodate 12 boarders and 12 day scholars, besides manager and inside staff, would be sufficient to start with; and I think that such a house, with good outbuildings and sufficient grounds, which are so essential for the practical teaching which is such a material feature in this scheme, could be leased at a reasonable figure, and thus save the expense, trouble, and delay of building. Indeed, during my stay in Hobart, I saw some places in the neighbourhood of New Town which I thought might, with some trifling changes, prove admirably adapted for the purpose. Of course you on the spot will, particularly after you have been able to estimate the probable number of pupils likely to join at once, or in a short period, be in a better position to form an opinion of the suitability of any place better than I can do. It would be advisable, in order to induce parents or guardians to send their boys, and thus form a nucleus with which to begin operations, that the scholastic terms for pupils should be kept as low as possible. In Germany and Belgium the charge for boarders is about £40, and for day scholars £15, per annum, and, from their reports, they appear to make about £4 per year profit on each pupil. Of course it will be for those who have the management to see if it can be done for these prices, but you must remember that this school will not be founded to make money out of it, but to benefit the community and to provide for a pressing requirement if two of your most important industries are to prosper as they should. There should be a difference made between terms for Tasmanians and strangers; on the Continental plan this would mean 30 per cent. additional for boarders and day scholars. I scarcely think that, until the school begins to be known and scholars from that date up to 1900 will be seen from the following statement:—

Number of Scholars attending.

Period.	Total.	Boarders.	Day Scholars.	Native.	Strangers.	Farmers, &c.
1861-1865. . . .	167	112	55	110	57	10
1866-1870. . . .	276	170	106	106	170	43
1871-1875. . . .	362	179	113	194	168	67
1876-1880. . . .	352	188	164	229	123	40
1881-1885. . . .	392	234	158	305	87	35
1886-1890. . . .	502	317	185	420	82	71
1891-1895. . . .	562	290	272	461	101	66
1896-1900. . . .	479	267	212	398	81	32
1901. . . .	113	47	56	83	30	10

Now this return of 40 years' progress, in cycles of five years each, is valuable and instructive as a forecast of what may happen, proportionately, to your School of Forestry and Agriculture, once it is established.

I would just call your attention to a few facts which I think may be gathered from it, and I feel certain that our good friend R. M. Johnston (who finds sermons in stones and figures in everything), can find many more if he examines the statement.

The first fact which strikes me is the small number of pupils belonging to the country in which this school is situated, who attended it during the first 10 years of its existence; viz.:—1860 to 1865, 110; and 1866 to 1870, 106; or an average of only 21 per annum. It is the confirmation of the old adage, "No man is a prophet in his own country," and which, in this case, might be freely translated "Anything got up at home is of no good." Similar remarks have, if I remember rightly, been made not 100 miles from Hobart.

The second fact is that, whereas in the first five years only 57 strangers attended, or, about 11 per annum, within the next 10 years their number was tripled. *They* were not so long in finding out the value of the school as those at home, for whom it was actually founded.

The third fact: after 10 years' hesitation, no sooner do the latter see that their own institution is certainly appreciated by strangers, if not by themselves, than they begin to think that there may after all be some good in it, with the result, that during the next five cycles their numbers are more than quadrupled.

Fourth fact: of the adult agriculturists who were permitted to attend the classes at a nominal fee (about £2 per might be distributed on a scale somewhat similar to the following:—

Subject.	*Written.*	*Vocal.*	*Total.*
English, Grammar, Reading, Writing, &c.	15	15	30
Arithmetic and *Algebra*.	10	10	45
Geometry and *Trigonometry*.	15	10	
History, Ancient and Modern.	5	5	25
Geography, World.	5	5	
Physical Science (1st elements).		5	
Total points			100

In order to gain admission, the candidate would require to have gained at least one-half of the points attributed to each section.

There might be two examinations annually for the admission of pupils, at dates specified beforehand, if found necessary and practicable. The examiners would be appointed by the school authorities, one of whom should be present to superintend the proceedings. The names of the successful candidates, with the points they have acquired, as well as the establishment where they have been educated, ought to be published in the papers within a fortnight after the examination. This publicity would benefit the schools from which the successful pupils had passed, and would doubtless encourage the masters in training boys for the future examinations. After three year's study at the outside, the scholar, if attentive to his work, should be able to pass such a satisfactory final examination as will entitle him to a diploma of efficiency either in forestry or agriculture, or both, and he is fitted for a career, either in his own interests or for the account of others, who will, I feel certain, be glad to make use of his services, knowing that he is competent to render them efficiently.

Of course you will understand that I merely throw out these suggestions as my own ideas on this subject, and they ought, of course, be discussed and modified after careful study to suit the requirements of your State. I may, however, remark that, on the whole, they have proved successful elsewhere.

At one of the most prosperous of existing similar schools (I do not name it, as the information so kindly afforded me by personal friends is more or less confidential), which was founded in 1860, the progress made in the number of

I cannot fancy a more suitable career for your Tasmanian boys, such as I know them (active, courageous, and full of life and vigour, fond of all sports), than the fields and forests, for which such a scheme as I propose would prepare and enable them to exploit to their own advantage and to that of their country. Not only would they benefit from a material point of view, but occupied away from towns, with all their seductions and temptations, they would, in your bush, fields, and orchards, most likely become both physically and morally, finer and better men. I wish I could impress upon parents, and particularly on the mothers and daughters of Tasmania, the importance I think they should attach to the completion of this project, and get them to use their utmost influence, so valuable and all-pervading, in a matter which concerns both their own family interests, and in which the welfare of their boys is so deeply involved, feeling certain that any successful exertions on their part to get such a school founded will eventually be amply rewarded by the results acquired.

You have also numerous agricultural, horticultural, pastoral, and other similar societies in Tasmania. I would propose that some of the most important of them should send one or more of the most promising scholars in their districts to the examinations, and, if returned successfully, pay all or part of their expenses during their education at the school. They could scarcely do anything more calculated to benefit the interests they wish to promote.

Now, supposing that such a school will, as I trust, be established, what I propose is this—Boys intended to benefit by the instruction it will afford them should, after having attained their thirteenth or fourteenth year, and completed their usual schooling term, be entered for it. An examination, one half written, one half verbal, to prove that the candidate is up to the standard in reading, writing, spelling, arithmetic, algebra, geometry, trigonometry, geography, and the first general principles of physical science, with a voluntary examination in French or German (to count as five points each, and to be added to any deficiency in English or Geometry), should be compulsory before admission. The two first examinations should, I think, be of such a nature as to allow ordinarily well educated boys from good schools to pass without much difficulty, and, as the number of pupils increase and the popularity of the school is established, the questions might be made more difficult. The maximum of points attributed to the different subjects prevent your wasting your money, time, and labour for no profitable result, to keep men honest against their will, and to hinder those most interested from destroying their own property, and ruining the State's prospects of success in the leading markets of the world.

All these proposals, or some of them, may perhaps be considered as a magnificent scheme of grandmotherly government and political philanthrophy, and will no doubt meet with the approbation of men who prefer others to do the work they should be doing themselves, but, to any practical and business man, such a system must appear as preposterous, as it would, on trial, prove to be useless and impracticable. What possible good can it do an agriculturist who has been properly taught, trained, and knows his business to be told by an expert that he has pests in his orchard? He ought to and would know that long before the expert, and have taken the necessary measures to abate or eradicate them, and this example applies to all the other functions to be performed by experts and bailiffs in carrying out the duties suggested in the foregoing so-called remedies. How many experts do you imagine would be required to inspect thoroughly all your orchards, fruit gardens, and agricultural establishments in Tasmania? How do you propose to inspect and examine the fruit, before shipment, on the wharves? I fear that there would not be the necessary room, and decidedly not the necessary time to do this efficiently, and better no inspection than an inefficient one. Then, where are you to get proper experts in sufficient numbers whose inspection and knowledge can be relied upon, if you have no training schools where they can study and be taught theoretically and practically their duties? In my opinion there is no real remedy for curing existing evils and preventing their continuance and recurrence in the future but one, and that is the establishment of a well-managed Tasmanian School of Forestry and Agriculture. In such an institution the rising generation, as well as adults occupied in these pursuits, would receive an education or information which would very soon render expert interference supererogatory and unnecessary. Not alone would it be of invaluable service to these two industries, but it would open a new field of enterprise and remunerative employment to the youth of Tasmania. As you are well aware, most of your professional and mercantile occupations are more than sufficiently filled up at present, and your young men are often obliged to go to other lands to seek their living, much to the detriment of your State and population, a loss which ought to be avoided, if possible.

produce, and the ultimate ruin of your fruit trade, now valued at the export worth of nearly £300,000.

Commercial history is full of examples, dating from the most ancient periods up to the present time, showing how some of the most flourishing trades and markets have been lost or destroyed by negligence, ignorance, or dishonest dealing, and the following extract from Mr. Neville Edwards' interesting "Story of China" shows with what disastrous results a similar policy in the once important tea trade of China has ended. "In Tea from China," he says—"The falling off in our purchases has been enormous. The Chinese have injured the reputation of their tea by re-colouring old-used tea leaves. It took a long time to knock this idea into our heads, but now having once got that idea, it will take an equally long time to regain our confidence." Substitute "Tasmania" for "China," "fruit" for "tea," and "inferior shipments" for "re-coloured tea leaves," and we have a timely warning of what may and will happen to your own fruit trade unless precautionary measures be immediately taken to prevent such a catastrophe.

In regard to your timber industry, the foregoing observations relative to the loss of a valuable market can only be applied in a limited degree, as you have not, unfortunately, as yet, got any market worthy of the name to lose. Why this should be so is a question which ought to occupy your most serious attention. It may be, and most likely is the case, that the small quantities you have exported have been of inferior quality, or not properly prepared, chosen, or suited for the work for which it was intended. Another reason, no doubt, is that no energetic means have ever been taken to bring the good qualities of your timber for construction works, paving, furniture, &c., to the knowledge of the foreign consumer, and no really business-like efforts made to establish a market for the disposal of your wood produce. Whatever the reason may be, it is more than time that a proper remedy be applied. So-called remedies have been proposed in abundance, such as—experts to examine the cases of fruit before shipment; experts to find out real, or invent imaginary, pests; experts to see that your fruit is properly packed; Agents-General to tell you that you are ruining your markets; bailiffs in your forests to prevent your destroying and burning your own property and your best timber; experts to see that the wood is of good quality, and properly seasoned and prepared before shipment, &c. Of course, as usual, it is expected that all these people are to be paid by Government, in order to

Pests of various kinds no doubt give sometimes much trouble, but, as a rule, their presence in numbers sufficient to menace the existence of the crop is a proof of bad or careless cultivation. During my stay in Tasmania several so-called "pest scares" arose, and it always struck me that if the same time, energy, and labour displayed in writing and disputing about their existence or non-existence, and the best means of eradicating them, in the long letters appearing every day in the newspapers, had been judiciously expended in the orchards and fruit gardens, the result would have been decidedly advantageous to the fruit crop. We must not forget that agriculture in all countries has been subject to pests of all descriptions, some of them more destructive than the average of those with which you have to deal, and Tasmania can scarcely expect to escape from the ills that plants are heir to. But scientific culture, increasing care and examination, combined with the well-directed application of the latest remedies, will be found as effective in either considerably diminishing or eradicating these pests in Tasmania, as they have been elsewhere. The suppression and extinction of pests, to be effective, must be thorough, and, consequently, entails a certain loss of fruit, as every apple affected by codlin moth, &c., or injured in any way, must be picked from the tree at once and destroyed. This waste of produce (more apparent than real, the tree profiting by the removal of unsound fruit), should be followed by careful selection, picking, and packing, if the fruit is expected to arrive at its destination in good condition. It would seem, however, that many producers are not alive to this fact, and will not take, or do not know how to take, the most necessary precautions to prevent any but the soundest and best fruit being sent to markets at a distance of some 13,000 miles. They appear to think that purchasers in England and on the Continent are such fools as to be willing to pay a good price for bad fruit, although they have the choice of importations from some of the finest fruit-exporting countries in the world. Worse still, the recurrence of inferior shipments from Tasmania will lower the reputation of its fruit, and purchasers on the other side of the world, who have neither the time nor the will to discriminate between good and bad shippers, will refuse to have anything to do with fruit exported from that country, unless at such low prices as they may think may cover any risk they run. This, in reality, means the destruction in a very brief space of time of some of the best markets in which to dispose of your

Before leaving these interesting statistics, the compilation of which reflects the greatest honour on their author, I would also call your attention to that most important part of agricultural industry, dairy produce. It appears that you are exporting annually butter and cheese to the value of about £2000, and importing the same produce at a cost of about £35,000. This fact seems strange, considering that other countries, not much larger than Tasmania, are able to supply their own wants besides making the exportation of these products one of the most prosperous and remunerative of their industries.

I wish to impress upon you that the foregoing statements are not mere "idle fancies of the heated brain," but *solid facts*, corroborated by statistical figures, which, if you doubt their correctness, you can easily examine and verify for yourselves. Taking for granted, then, that these statements and figures are correct, what conclusions can we reasonably draw from them? It appears to me that we can reasonably conclude that—1st. The agricultural industry of Tasmania, particularly as regards the production and exportation of fruit, is at present not realising the advantages and profits which the resources of the country, if judiciously and properly exploited, would legitimately warrant the producers and exporters to expect; 2nd. The timber industry, considering the large area of forest lands and the quality of the wood growing there, is in a still more unsatisfactory condition as regards conservation, replanting, and exportation, while one-half of the value of exported home products is absorbed in payment of imported timber, which could and ought to be grown in Tasmania at one-third the cost; 3rd. The minor products of the farm, such as dairy produce, butter, cheese, eggs, poultry, honey, &c., may, as far as exportation is concerned, be treated as quite negligable quantities; 4th. The most strenuous efforts should be made, without delay, to determine the cause of this state of affairs, and remedies found to ameliorate the present condition and ensure the future development and prosperity of the two great industries of forestry and agriculture in Tasmania.

The causes which are generally put forward as reasons why your fruit trade is not giving a remunerative return for the labour, time, and money expended on it, are numerous. Unpropitious seasons and weather will, of course, have an influence on this as well as on other agricultural crops in every country in the world, but in such a climate as that of Tasmania it is not likely that great material injury will be caused by them, or only in rare and exceptional instances.

item in the budget of any country, but of paramount importance to a small State like yours. If the export value of other agricultural products, which is returned as being about £454,054 (including wool) be added, we have an annual total export value of £734,042, or 28·12 per cent. of the whole total export value of every description from Tasmania, and next in importance to the mineral export, valued at £1,640,778. So much for agriculture. Now let us see how forestry figures in these statistics. In a State with such important forests, containing, as I have already informed you, some of the finest timber in quality, and unique in possessing trees of dimensions and specific gravity invaluable for certain important works of construction, it might have been confidently expected that the export value of such produce would form a large asset in your revenue statistics. On examination, however, it appears that this, unfortunately, is *not* the case. In these statistics, in 1900, timber of all descriptions, including bark, only figures for export value as £71,618, but against this there is an item of import value of £23,246 for timber imported, so that this product in reality would only represent a net value of £48,372 really to the credit of your timber account.

We see, therefore, that Tasmania is importing wood from other countries, principally Norway and Sweden, a distance of about 14,000 miles, amounting to one-third of her own export of timber, and paying at least two-thirds more for it than if it were grown on her own soil. As a matter of fact, it could be grown better on your own waste lands and islands, within a few miles of your principal ports, at a mere nominal expenditure relatively to what it costs you now to import. I think you must admit that it can scarcely be called good business to go to such a distance to procure an article which you could easily have grown in your own country at a saving of 60 per cent. to 70 per cent., with the triple advantage of having sufficient for your home consumption, a large quantity for exportation to the neighbouring States (on which you could make a good profit), and last, but not least, at the same time ameliorating the hygiene of your island by plantations which would collect the rain of which you have, in some districts, so much need.

Another most regrettable fact gleaned from these statistics is that there does not appear that one single log or plank of timber had been exported in 1900 to Great Britain, the largest timber-importing country in the world, and the most important market for all other timber-producing countries in which to dispose of their produce.

outdistanced in the fierce race of life, and learn, perhaps too late, that "the survival of the fittest" is the ultimate result of the struggle, and that their old-fashioned and unreasoning efforts have neither benefited themselves nor others

We cannot shut our eyes to the fact that in every branch of business and industry the most important improvements and developments are being introduced daily, requiring careful scientific, technical, and practical teaching, training, and study to enable us to understand them thoroughly, to adapt them to our own requirements, and to profit by these new facilities for the promotion of commerce in our own interest and for our country's benefit.

Quite lately most important changes have been introduced into your own export business. Quick steamers, fitted with refrigerating machinery and chambers, call weekly at Hobart, enabling you to deliver your splendid fruit in good condition in the markets of England and the Continent, at a period of the year when such produce, if of good quality, ought to realise a remunerative result. Have you profited by this grand opening for your fruit trade, and have satisfactory results been obtained by producers and exporters?

From market reports it appears that about 8*s*. per case was the average rate realised for your apples, a price which, after paying freight and other charges, will certainly not leave much, if any, profit to the producer or exporter. Considering that *good* Tasmanian apples were being retailed at the same date in England at 8*d*. per pound (about 30*s*. per case, and South Australian produce was realising 13*s*. to 15*s*. per case, there seems to be *primâ facie* evidence that some serious deficiency, arising either from bad cultivation or careless or dishonest shipment, in connection with Tasmanian exports, must have existed, which calls for examination and future immediate remedy if your fruit trade is to prosper as it should. I think you will find that the reports of your Agent-General and others interested in the matter point to the conclusion that these faults did exist, and that your producers and exporters had only reaped what they had sown, and had only themselves to blame for such a deplorable state of affairs, which must eventually lead to the loss of your English and other markets.

What such a lamentable occurrence would mean to Tasmania, the following statement, taken from figures compiled by your well-known Statistician, Mr. R. M. Johnston, will give you some idea:—

In his report the value of the fruit export for 1900 from Tasmania is estimated at about £279,988, a very considerable

SUGGESTIONS FOR THE ESTABLISHMENT OF A TASMANIAN SCHOOL OF FORESTRY AND AGRICULTURE.

BY WILLIAM HEYN,

(Timber Department, Admiralty Harbour Contract Works, Dover, England.)

Read 12th May, 1902.

In the paper on "The Present and Future Prospects of Timber in Tasmania," which I had the honour to read at a meeting of the Royal Society of Tasmania, on the 29th April, 1901, I ventured to express my firm conviction that a Tasmanian School of Forestry and Agriculture was absolutely necessary if the treasures of vegetable wealth which exist in your Island are to be properly exploited, so as to yield a remunerative return for the time, labour, and money expended on them.

It must, I think, be painfully evident to anyone who has seriously studied the subject which, in my opinion, is of such vital importance to Tasmania, that the unscientific and unreasoning manner in which forestry and agriculture has been conducted there for the last 15 or 20 years has materially hindered their proper development, has led to the destruction and waste of valuable produce, and prevented the attainment of results which, under scientific and technical treatment, would have been satisfactory, not only to those who are occupied in these pursuits, but to the community in general.

As the world advances in civilisation and population, and the "struggle for life" becomes more imperious and necessary, competition, of ever increasing intensity and ubiquity, manifests its presence with new inventions, new methods, and better appliances.

Those who continue to follow the now antiquated ideas and systems in vogue some years ago will find themselves

As the thecae can be seen only when the specimen is held in a particular position with regard to the light, they are not easily demonstrated. Their outer edge is straight, and the apertural margin is about normal to the branch. From the appearance of the indistinct markings present on the stone the specimen belongs to the Dendroidea, and I am inclined to think to the genus Callograptus, which is in itself of no great stratigraphical value.

A few weeks ago Mr. Waller sent me two slabs of slate from 12½ miles from Zeehan, on the same railway line. On one of these a fragment showing graptolite thecae can be distinguished, the specimen being monoprionidian. The specimen on the other slab is more obscure, and I can only say it is suggestive of a graptolite. In neither instance can even a guess at the family be hazarded.

We thus have undoubted evidence of the existence of graptolites in Tasmania, but, so far, no evidence is thrown on the exact age of the containing rocks, and it rests with those on the spot to fill up the hiatus in our knowledge.

Mr. Stephens' specimen has been sent to the Hobart Museum, and Mr. Waller's two specimens to Mr. Twelvetrees, for the Survey Collection.

NOTES ON UNRECORDED AND OTHER MINERALS OCCURRING IN TASMANIA.

By W. F. PETTERD.

THE following notes, in conjunction with a paper upon the subject published in the proceedings of the Royal Society of Tasmania, 1897, embrace the work done to elucidate the mineralogy of the State since the publication of the "Minerals of Tasmania, 1896."

They comprise many interesting substances of more recent discovery, including one, or perhaps two, which are quite new to mineralogical science. It will be found that 40 species hitherto unknown as occurring in this Island have been added to the already voluminous catalogue, and additional localities and associations are recorded for several previously known. An important feature is the record of several complete analyses of complex substances, for which I am indebted to Mr. S. Pascoe, of the Magnet Silver Mining Company, and Mr. O. E. White, of Hobart, to whom I return my sincere thanks for their ready and valuable assistance. Such work is invariably a welcome addition to mineralogical investigation, and I am sure it will be duly appreciated by those interested in this field of enquiry. In many cases it is only by such means, coupled with crystallographic characters, that the specific identity can be attained with reasonable certainty. It is almost needless to say that in this department much yet remains to be done before we can possess a comprehensive knowledge of the minerals known to occur in this State.

1 ANALCITE.—(*Hydrous silicate of sodium and aluminium.*)

Somewhat abundant in the haüyne phonolite of Port Cygnet.

2 ANORTHOCLASE.—(*Triclinic soda-potash-felspar.*)

In rhombic sections of a shining milky-white. Sölvsbergites of Port Cygnet.

3 ARSENOPYRITE.—(*Sulph-arsenide of iron.*)

In peculiar minute crystal trillings implanted in cavities in hard gossan. Magnet Mine.

As minute needles abundantly scattered throughout siderite gangue. Block 291, Ringville.

Analysis of this Mineral.

Fe	=	32·95,
As	=	43·20,
S	=	21·48,
		97·63,

with about 2 per cent. of antimony.

4 AUGITE.—(*Variety of pyroxene.*)

The embedded crystals of the nephelinite of the Shannon Tier are of a shining black colour, and often of remarkably large dimensions, sometimes one inch and a half in length.

5 BERESOWITE.—(*Chromate and carbonate of lead.*)

Occurs as small, in many cases almost microscopic, lamellæ implanted in gossan. The colour varies from pale yellow to orange-red. It is sometimes changed to crocoisite. Magnet Mine.

6 BERYL.—(*Metasilicate of beryllium and aluminium.*)

At the Shepherd and Murphy Mine, Bell Mount, specimens have occurred several inches in length, wholly changed to gilbertite, fluor, and chlorite. At the same locality small slender crystals have been met with of a pale green colour, intermixed with quartz, topaz, molybdenite, and cassiterite. The crystals are commonly embedded in a thin film of pyrite.

7 BOURNONITE.—(*Sulphantimonite of lead and copper.*)

In bright well-developed orthorhombic crystals, which gave the following result upon analysis:—

S	=	13·62	per cent.
Sb	=	28·68	,,
Pb	=	42·39	,,
Cu	=	11·93	,,
Fe	=	1·97	,,
		98·40	

8 Brucite.—(*Magnesium hydrate.*)
Radiating, massive, and white, near the workings, Mt. Bischoff.

9 Calcite.—(*Carbonate of calcium.*)
Some remarkably fine crystals have been obtained at the Mt. Lyell limestone flux quarry at Queenstown. (H. W. Judd.)

10 Campylite.—(*Lead arsenate.*)
In very characteristic barrel-shaped crystals aggregated together. The colour is very pale, almost white. Britannia Mine, Zeehan.

11 Carminite.—(*Arsenate of lead and iron.*)
In minute orthorhombic groups of crystals coating fractures and vughs in gossan. It is of a reddish colour, and adamantine lustre. The Magnet Silver Mine.

12 Cassiterite.—(*Dioxide of tin.*)
Pseudomorphous after orthoclase. Mt. Rex Mine, Ben Lomond.

13 Cerussite.—(*Carbonate of lead.*)
Analysis of the characteristic form of a yellowish-green colour from the Adelaide Proprietary Mine, Dundas, by Mr. J. C. H. Mingaye, F.C.S., of Sydney, N.S.W.:—

PbO	= 83·07	per cent.
CO_2	= 15·97	,,
Cr_2O_2	minute trace.	
Gangue	·62	per cent.
	99·66	

14 Chalcophanite.—(*Hydrated manganese and zinc protoxide.*)
As an amorphous black metallic brilliant substance, somewhat rare. Dundas.

15 Chalcocite.—(*Copper sulphide.*)
Occurs massive in several of the Mt. Lyell mines and at the King Jukes Mine, Mt. Jukes. Small crystals have been obtained disseminated in schist, with bornite, at the North Lyell Mine.

In slugs up to many pounds in weight, associated with native copper, at the King Lyell Mine. (H. W. Judd.)

16 CLINOCHLORE.—(*Basic magnesium and aluminium silicate.*)

In large masses and occasionally crystalline bunches of a pale metallic green colour. Near Mt. Heemskirk.

Abundant in fine groups of hexagonal crystals of a dark olive-green to black colour. The plates are often over one inch in diameter. Near the Hampshire Hills Silver Mine, Hampshire Hills.

At Anderson's Creek in minute, almost microscopic, radiating bunches of a dark colour. (W. H. Twelvetrees.)

17 CHLORITE.—(*Basic silicate of magnesium and aluminium.*)

In schist, and as beautiful bright green fan-shaped crystals in honey-combed quartz—Crown Lyell Mine—species undetermined. (H. W. Judd.)

Occurs pseudomorphous after felspar—Block 4891-93M, Ben Lomond. (Waller, "Report on the Ben Lomond District," 1901.)

18 COPIAPITE.—(*Hydrous basic ferric sulphate.*)

Results from the decomposition of pyrites, Colebrook Mine, Ringville, Khaki Mine, Whyte River, and at Barn Bluff. The rock from the last-named locality, when freshly broken out, soon becomes coated with this and other sulphates.

19 CROCOISITE.—(*Chromate of lead.*)

Rare as small crystals in gossan at the Silver Queen Mine and at the Colonel North Mine, Zeehan. (H. W. Judd.)

A full detailed description of the typical and well-known Dundas occurrence of this beautiful mineral, by C. Palache, may be found in the "American Journal of Science" for 1896, page 389.

20 DEWEYLITE.—(*Hydrous basic magnesium silicate.*)

In thin seams, sometimes reaching a foot in width, traversing serpentine. Harman's Rivulet, near the Parson's Hood Mountain.

21 DOLOMITE.—(*Carbonate of calcium and magnesium.*)

Analysis of the pure white form from the Magnet Mine. (F. O. Hill.)

Ca O	31·72	per cent.	= Ca Co_3	56·64	per cent.
Mg O	15·60	,,	= Mg Co_3	32·76	,,
Fe	3·92	,,	= Fe Co_3	8·26	,,
Mn	1·80	,,	= Mn Co_3	3·76	,,
				101·42	

22 DUNDASITE.—(*Hydrous carbonate of lead and aluminium.*)

"Minerals of Tasmania," 1896, page 33.

Dana, "First Appendix to the Sixth Edition of the System of Mineralogy," page 23.

The following is a complete analysis of this new species:—

Pb = 38·84	per cent	= Pb O	41·86
		Al_2 O_3	26·06
Fe = 3·85	,,	= Fe_2 O_3	5·50
		H_2O + Co_2	28·08
			101·50

Mr. Pascoe states that the Fe_3 and O_3, or a portion thereof, may be foreign to the substance, as it is next to impossible to perfectly separate it, since it almost invariably occurs as an incrustation on the mineral from the original locality at Dundas. A trace of P_3O_3 was also found; this was certainly obtained from an extremely thin coating or skin of pyromorphite, which is often present, and gives an external green colouration to the surface of the mineral. At the Hercules Mine, Mt. Read, a mass of snow-white cellular quartz has been obtained, throughout which are scattered crystals of cerussite, gibbsite, and numerous patches of dundasite, the whole forming one of the most attractive associations of minerals as yet obtained in this State.

23 DUFREYNOYSITE.—(*Sulpharsenite of lead.*)

Analysis:—

Pb	=	32·88
Cu	=	9·08
As	=	21·60
Sb	=	8·53
Fe	=	6·42
S	=	21·79
Ag	=	0·22 = 73 ozs. 3 dwts. 11 grs. per ton.
		100·52

Occurs in thick orthorhombic crystals, which are deeply grooved longitudinally, colour lead-grey, highly polished, and implanted on and in the cavities of crystalline siderite. Many of the beautifully developed crystals exceeded 1″ in length and ⅜″ in width. Locality, Block 291, North-East Dundas.

24 ELÆOLITE.—(*Orthosilicate of sodium, potassium, and aluminium.*)

Occurs as a constituent in the elæolite syenite of Port Cygnet.

25 EPIDOTE.—(*Basic silicate of calcium, aluminium, and iron.*)

Occurs very well crystallised and of good colour on the Melba Flat, North Dundas. (H. W. Judd.)

26 EVANSITE.—(*Basic phosphate of aluminium.*)

Analysis of this mineral from Zeehan, by Mr. H. G. Smith. (Proceedings Royal Soc., N.S.W., 1895.)

P_2O_5	=	18·11
Al_2O_3	=	40·19
H_2O	=	41·27
		99·57

27 GILBERTITE.—(*Variety of potassium mica.*)

Of a yellow to green colour and glimmering lustre with tin ore in granite. Mt. Rex Mine, Ben Lomond, Anchor, Liberator, and other mines, Lottah.

28 GIBBSITE.—(*Hydrate of aluminium.*)

Apparently abundant in botryoidal masses, associated with native copper and earthy lode-material. It varies in colour from clear pellucid glassy to pale green, and more rarely to golden yellow with a bronze lustre. It decomposes to a white powder. Rio Tinto Mine, Savage River.

29 GMELINITE.—(*Hydrous sodium, calcium, and aluminium silicate.*)

A fine lot of perfect crystals of this zeolite have been obtained loose and coating a vugh in Tertiary basalt at Bell Mount. Middlesex.

30 HAÜYNITE.—(*Sodium, calcium, and aluminium orthosilicate with sodium sulphate.*)

In micro-crystals sparingly in the fayalite-melilite basalt from One Tree Point, near Hobart.

31 HEMATITE.—(*Sesquioxide of iron.*)

At Zeehan this occurs pseudomorphous after cubical pyrites. (R. F. Waller.)

32 HISTRIXITE.—(*Sulphide of antimony and bismuth.*)

An apparently new substance occurring in radiating groups of prismatic crystals, which are occasionally in confused bunches, and commonly stained externally with a dark brown coating. The crystals are orthorhombic, with acute but indistinct terminations, and striated longitudinally. They sometimes reach over 2 in. in length by ⅜ in. in width. Slightly sectile, with a hardness of about 2. Lustre eminently metallic, shining on fresh crystalline surfaces. Colour and streak, steel-grey. When massive, it presents a foliated structure, and tarnishes to blue and purple iridescent colouration. The crystals occurred interpenetrating a vugh from a bedding of a mixture of iron and copper pyrites. It was found in a somewhat massive body of tetrahedrite, with which were associated bismuthinite and pyrites, and appeared to be of very exceptional occurrence.

Result of two analyses of the pure material:—

S = 24·05	S = 23·01
Bi = 55·93	Bi = 56·08
Sb = 10·08	Sb = 9·33
Cu = 6·86	Cu = 6·12
Fe = 5·18	Fe = 5·44
102·10	99·98

Answering to the formula—

$$7\ Bi_2\ S_3 + 2\ Sb_2\ S_3 + 5\ Cu\ Fe\ S_2$$

(Locality, No. 1 Curtin-Davis Mine, Ringville.)

33 HUASCOLITE.—(*Sulphide of lead and zinc.*)

A massive, fine-grained, dark-coloured and somewhat dull substance—Comstock Mine. Zeehan.

34 HYDROMAGNESITE.—(*Basic carbonate of magnesium.*)

Occurs in solid, almost white, radiating bunches—Comstock Mine. Zeehan.

35 HYPERSTHENE.—(*Magnesium and iron metasilicate.*)

In basalt, Circular Head; in granite, St. Mary's Pass.

36 JAMIESONITE.—(*Sulphantimonite of lead.*)

Analysis of a sample from the Magnet Mine:—

Ag = 0·12 per cent. = 39 ozs. 4 dwts. 10 grs. per ton.
Pb = 40·82
As = 2·44
Sb = 21·48
Fe = 4·91
S = 17·51
Insol = 11·51

98·85

Analysis of a sample from the Silver Spray Mine, Zeehan, by W. F. Ward, Government Analyst:—

Pb = 40
Sb = 29
S = 18

87

Analysis of a columnar and striated sample from Mt. Bischoff :—

Ag	= 0·12
Pb	= 32·08
As	= trace
Sb	= 26·74
Fe	= 5·56
S	= 17·82
$Si\ O_2$	= 14·28
Al	= trace
	96·60

37 JOHNSTONOTITE.—(*A new manganese garnet. Pro. Roy. Soc., Tas., 1898-99.*)

Occurs abundantly distributed in the mica-sölvsbergite of Port Cygnet. The cavities containing the garnet are often lined with a thin coating of purple fluor and arsenical pyrites.

38 KNOXVILLITE.—(*Hydrous basic sulphate of chromium, iron, and aluminium.*)

Occurs as a granular sugar-like substance of a pale green colour. From adit at the Victoria Gold Mine, Salisbury.

Analysis :—

$S\ O_3$	= 30·32	per cent.
$Cr_2\ O_3$	= 8·47	,,
$Al_2\ O_3$	= 2·48	,,
$Fe_2\ O_3$	= 15·86	,,
Loss on ignition	40·56	,,
	97·59	

The identification is somewhat doubtful. Associated with this sulphate is another of a fibrous habit. It has been found in large compact felted masses, which are extremely tough under the hammer, and comparatively heavy from contained hygroscopic water. The fibres are minute, short, and silky-white; the surface often nodular and rough from protruding fine spiculæ.

An analysis of this substance gave the following result:—

SO_3	= 27·20
Fe_2O_3	= 14· 0
Cr_2O_3	= 10·64
Loss on ignition over	39·19
Gangue	10·77
	101·80

Before the blow-pipe the substance swells and forms a brown-coloured mass, which is easily powdered. With soda, after trituration, it leaves a loose powdery residuum, which is readily attracted by the magnet. The fused mass with borax bead gives reactions of iron and chrome oxides. It is readily soluble in water, and if kept in dry situation it gives up much of its hygroscopic moisture. If a new mineral species, which is highly probable, I propose it should be called "Sclerospathite."

39 Leuchtenbergite.—(*A variety of chlorite poor in iron.*)
In the variolite rock at the Magnet Mine.

40 Lillianite.—(*Sulphobismutite of lead.*)
Found disseminated in association with bismuth, sulphide, and other minerals in a quartz matrix at the Osborn Blocks. Mt. Farrell.

41 Magnetite.—(*Sesquioxide and protoxide of iron.*)
In bunches of well-formed crystals—Tenth Legion Mine, Zeehan. (H. Waller.)

42 Margarite.—(*Basic aluminium and calcium silicate.*)
In irregular radiating bunches in schist. Locality, west slope of Hamilton Hill, near the Hercules Mine.

43 Melilite.—(*Complex silicate.*)
As microscopic rock-forming crystals in the melilite basalt of the Shannon Tier and One Tree Point, near Hobart.

44 Microcline.—(*Triclinic potash soda felspar.*)
Occurs abundantly in the hypersthene granite of St. Mary's Pass.

45 Millerite.—(*Sulphide of nickel.*)
In the characteristic capillary patches in quartz, with pentlandite—near the Colebrook Mine. Ringville.

46 Monazite.—(*Phosphate of cerium metals.*)
This mineral has been obtained in a fine granular form in alluvial at the following localities, in addition to those quoted in the "Minerals of Tasmania":—Stanley River, South Esk Tin Mine (Ben Lomond), Briseis Tin Mine (Derby), the Pioneer Tin Mine (Mt. Stronach), and at the Khaki Mine at the foot of the Meredith Range).

47 Natrolite.—(*Hydrous sodium and aluminium silicate.*)
Somewhat abundant in massive pure white masses and pockets, which often exhibit distinct rhombic crystals agglutinated together. Nephelinite, Shannon Tier.

48 Nephelite.—(*Orthosilicate of sodium, potassium, and aluminium.*)
In microscopic crystals, as an essential constituent in the nephelinite of the Shannon River.

49 Nontronite.—(*Hydrated iron silicate.*)
A green variety of chloropal. Occurs of a pale yellow-green colour. Middlesex.

50 Osmiridium.—(*Iridium and osmium in varying proportions.*)
A fine nugget of this substance was recently obtained in the Whyte River, near its junction with the Pieman. The specific gravity was 19·5, and weight 60 grains.

51 Pectolite.—(*Metasilicate of sodium and calcite.*)
Occurs in fibrous radiating bunches of a pure white silky subvitreous lustre—Upper Emu River. W. R. Bell.

52 Penninite.—(*Basic silicate of magnesium, aluminium, and iron.*)
In dark, almost olive-green, masses and crystals, the latter sometimes over $\frac{3}{4}''$ across. It is invariably associated with quartz—Tharsis Copper Mine. Mt. Lyell.

53 PEROFSKITE.—(*Titanite of calcium.*)
Microscopical crystals in the melilite basalt of the Shannon Tier.

54 PETTERDITE.—(*A new oxychloride of lead. Pro. Royal Soc., Tas., 1901.*)
Occurs implanted and in bunches of pseudo-hexagonal crystals—Britannia Mine. Zeehan.

55 PHARMACOSIDERITE.—(*Hydrous basic iron arsenate.*)
Found as coatings of microscopic cubic crystals of an intensely green colour and bright lustre—Magnet Mine. (R. F. Waller.)

56 PHOSGENITE.—(*Chlorocarbonate of lead.*)
Some fine adamantine crystals of this somewhat rare mineral have been obtained at the Comet Mine, Dundas, with anglesite and cerussite.

57 PICOTITE.—(*Aluminate of magnesium and chrome.*)
Chrome spinel is stated to occur in the vicinity of Zeehan. (Krausé, "Mineralogy," p. 245.) Abundant in the alluvial of the Heazlewood River.

58 PROSOPITE.—(*Hydrous fluoride of aluminium and calcium.*)
Occurs as a granular powder, and often kaolinised. It is associated with decomposed green tourmaline (zeuxite), which is so characteristic of Mt. Bischoff Tin Mine.

59 RHODONITE.—(*Metasilicate of manganese.*)
Massive, in a somewhat impure form as a boulder in a large asbestos seam in serpentine on the ground leased to the Australasian Asbestos Company at Anderson's Creek, west of Beaconsfield. Called "red quartz" by the miners. (W. H. Twelvetrees.)

60 SAPONITE.—(*Hydrous magnesium and aluminium silicate.*)
Occurs in patches of a yellow to brown colour and glimmering lustre, with chrome ochre and quartz on the hanging-wall of a reef at the Duchess of York Mine, Salisbury.
White and amorphous at Trial Harbour. West Coast.

61 SCAPOLITE.—(*Hydrous silicate of aluminium and calcium.*)

This mineral was found as loosened rounded boulders in a seam of asbestos occurring in the serpentine at Anderson's Creek, near Beaconsfield. It was mistaken by the miners for quartz, which it somewhat resembles. It has, however, a slightly greenish tinge, and its hardness is only between 5 and 6. It is soluble with difficulty in HCl.

Microscopical characters.—Confusedly crystalline, with the larger crystal faces obscurely divergent. The crystals often form rosettes. Double refraction, strong; interference colours higher than quartz; extinction straight in longitudinal sections; no sensible absorption.

Scapolite is mostly found in schists and gneiss. It also occurs in amphibolites and ophites. When it is found in gabbro, it has been derived from felspar, and this may have been the case here, though there is some reason to believe that the serpentine was originally pyroxenite. Scapolite is undeniably a secondary mineral, and was here formed during the hydro-metamorphic process of serpentinisation. (W. H. Twelvetrees.)

62 SCHEELITE.—(*Tungstate of calcium.*)

Analysis of a sample of this mineral from Mt. Ramsay:—

$W O_2$	= 79·77
$M O_3$	= trace
Ca O	= 19·65
	99·42

(Dana, "System of Mineralogy," page 987.)

63 SCHRÖTTERITE.—(*Hydrous aluminium silicate.*)

A soft brittle white to honey-yellow coloured gum-like substance, occurring as an incrustation and in patches in a fissure in Silurian slate. It decomposes to a white powder. Occasionally it is stalactitic or mamillated, and easily falls to pieces. Obtained near the Pieman River.

64 Siegenite.—(*Sulphide of cobalt and nickel.*)
Occurs massive, of a steel-grey colour, intermixed with magnetite, pyrite, and niccolite. Rocky River Mine.

65 Sodalite.—(*Chloro-silicate of sodium and aluminium.*)
In the elæolite syenite of Port Cygnet, changed to natrolite.

66 Spodumene.—(*Aluminium and lithium metasilicate.*) Variety, *triphane.*
Several thin flakes of this substance have been obtained in alluvial tin workings near Mt. Cameron, with quartz, topaz, and sapphire. It is of the very characteristic yellow-green colour, and quite indistinguishable from the clear samples found in Brazil. It might easily be mistaken for a variety of corundum—Oriental topaz—or even quartz; in fact, it is highly probable that it is more abundant than supposed, but has been overlooked from its resemblance to the minerals mentioned. Some minute bright green specks in granite from Ringarooma are probably the same mineral.

67 Stilbite.—(*Hydrous sodium, calcium, and aluminium silicate.*)
In large radiating masses of a yellow-brown colour imbedded in basalt vitrophyre. Bell Mount, Middlesex.

68 Strigovite.—(*A basic silicate of iron and aluminium.*)
A chlorite-like mineral consisting of a black shining aggregate of minute plates, in the fractures decomposed to brown. Occurs as a narrow band a few inches wide in granite—near the Great Republic Tin Mine. Ben Lomond.

69 Stromeyerite.—(*Sulphide of copper and silver.*)
Analysis of an amorphous slug from the Mt. Lyell Mine:—

Ag	= 13·80	= 4507 ozs. 19 dwts. 23 grs. per ton
Pb	= 1·60	
Cu	= 32·46	
As	= 3·17	
Sb	= trace	
Fe	= 19·26	
S	= 38·27	
	98·66	

70 Sulphur.—(*Native.*)
Found in minute blebs on crystallised and other galenite. Magnet Mine.

71 Symplesite.—(*Hydrous iron arsenate.*)
Occurs thickly coating gossan in small radiating blue-green tufts, of great attractiveness under the lens. Magnet Mine.

72 Tennantite.—(*Sulpharsenite of copper.*)
Analysis of a sample from No. 4 adit, Mt. Lyell Mine:—

Ag = 0·54
Cu = 16·17
As = 13·82
Sb = 17·10
Fe = 16·39
S = 30·77

94·79

73 Tephroite.—(*Orthosilicate of manganese.*)
Occurs in crystallised masses of a dark reddish-brown colour and greasy lustre. Blyth River.

74 Tetrahedrite.—(*Sulphantimonite of copper.*)
Variety, *Freibergite.*
Analysis of a pure sample from the Hercules Mine, Mt. Read:—

Ag = 9·82 per cent. = 3201·32 ozs. per ton.
Au = ·0019 „ = 13 dwts „
Cu = 29·76
As = 2·69
Fe = 4·56
S = 27·21

94·7319

Balance, insoluble matter.
Occurs in well developed crystals at the 650-ft. level, Western Mine, Zeehan.

75 Thomsonite.—(*Hydrous sodium-calcium-aluminium silicate.*)
In bunches of white capillary fibres coating vughs in the nephelinite of the Shannon Tier.

76 VARISCITE.—(*Hydrous phosphate of aluminium.*)

As incrustations, often with a uniform surface. General character somewhat dull, but of a bright emerald-green colour, and thus sometimes mistaken for an ore of copper.

Associated with wavellite. Back Creek.

Implanted in the cleavages of quartz. Lefroy.

77 VOLTZITE.—(*Oxysulphide of zinc.*)

Formed as an incrustation of a thin lamellar structure and globular; colour, clove-brown. Very Rare. Silver Crown Mine, Zeehan.

78 WAVELLITE.—(*Hydrous basic phosphate of aluminium.*)

Occurs in small white discs, with the characteristic radiating structure implanted in the cleavages of sandstone. Ballast Quarry, Zeehan—Comstock Line.

79 WOLFRAM.—(*Tungstate of iron and manganese.*)

An unusual occurrence of this mineral is in small patches, associated with stannite and pyrite, at the Oonah Mine. Zeehan.

Occurs in the form of small brown crystals in quartz. Mt. Bischoff Mine.

80 ZEUXITE.—(*A ferriferous tourmaline.*)

A peculiar variety of tourmaline of a dark green colour, of remarkable habit. It is confined to and characteristic of the tin-deposits of Mt. Bischoff, where it occurs in great abundance, often forming rock masses of considerable size. Its common habit is in short acicular crystals, which are interlaced together into irregular bunches. Both colour and habit are very constant.

SAWMILL TRAMWAY.

THE TIMBER INDUSTRY.

By A. O. GREEN.

Read 12th August, 1902.

FOREST PRODUCTS.

AMONG many other natural resources, Tasmania possesses large forests of valuable timbers. It is a land of forests, extending in many places to the water's edge, and producing more than 50 varieties of timber trees, from which woods suitable for almost any purpose may be obtained. There is no lighter Pine than the Tasmanian King William, and none more durable than the Huon Pine. Tasmanian Horizontal is almost the toughest wood in the world; while the Native Ironwood resembles *Lignum Vitæ* in weight and hardness, and is used for pulley-wheels and plummer-blocks. The Tasmanian Beech (locally known as Myrtle) is as strong as English Ash, and in character resembles the hardest and heaviest English Beech. The Native Box and Whitewood are suitable for engraving blocks and fine turnery, and there are more than a dozen species of Tasmanian trees adapted for ornamental and decorative purposes. One of the most beautiful ornamental timbers, the Blackwood (*Acacia melanoxylon*)—often used in the outlying districts for making post and rail fences—has for many years past been extensively used in Melbourne for the manufacture of billiard-tables, and within the last few years by well-known London firms for pianos. Some of it is called locally "fiddle-back," from the resemblance of its grain to that of the back of a fiddle. It is of a rich reddish brown to an almost black colour, banded with golden-brown. The Huon Pine, from which large panels up to three feet in width can be cut, the grain of which is curiously curled and spotted, like the "bird's-eye" Maple, is of a light yellow colour, turning browner with age. Some Red Myrtle trees also produce good figured-timber. The Myrtle is also subject to a growth which produces large bosses on the trunk two or three feet across and a foot thick, which are prized for veneers and ornamental work. The boles of the Musk, the wood of which is of a yellowish brown colour, and takes a very high finish, have a great reputation for furniture-wood. There are also a number of the smaller trees, from which pretty wood can be obtained for inlaying and the smaller kinds of ornamental work. These are all used locally, and are highly esteemed, but are not to be found in such quantities as to form the basis of a trade by themselves. Tasmania has a great wealth of ornamental wood besides these, which is at present almost entirely neglected. The various Gum trees grow with a straight, clean barrel to an immense height, and above six to ten feet from the ground the trunks have a very small amount of taper, but from two feet below the ground to this height there are curving buttresses springing from the roots which all unite to form the trunk of the tree. This part of the wood is so hard to chop that trees are never felled less than three feet from the ground, and often scaffolds are erected to enable the woodman to cut the tree through at a point from six to twelve feet above the ground. These stumps are left as they stand, and often contain the most beautiful wood, from a yellow to a bistre brown colour, crinkled and waved and barred, the grain of which, when polished, has a singularly bright appearance. Very occasionally such stumps of trees are got up, and are reduced to panels for wardrobes and drawer-fronts, but as a rule they are entirely neglected, and left to decay where they grew. This ornamental wood, if systematically put upon the market, would be valuable, as it can be supplied in quantity, and natural curves very suitable for furniture-making can be got.

In Tasmania the forest lands may be classed as "bush" and "forest." In the Tasmanian "bush" the timber trees are comparatively small, and the undergrowth appears either in patches or, if continuous, is so stunted that little difficulty is experienced in walking through it. In the forests the reverse is the case. The soil may be of the richest or poorest description, but, thanks to the humid atmosphere, due to the proximity of the sea in every direction, and the fact that the mountain peaks of Tasmania draw down the rain-clouds sweeping up from the Southern Ocean, the prodigality of growth is equalled only in tropical regions. In many cases not a foot of soil can be seen, so dense is this wealth of foliage. The ground is covered with cat-head fern (*Aspidium aculeatum*) from one to two feet in height, or with "lady" fern (*Pteris incisa*) rising to three or four feet. Above these rise the "tree" ferns (*Dicksonia antarctica* and *Alsophila australis*), growing from four to eighteen feet in height. Above these rise the smaller trees locally termed "scrub," though their height ranges from ten to forty feet or more, their diameter being from three to twelve inches—the Musk (*Olearia argophylla*), Dogwood (*Pomaderris apetala*), Wooden Pear (*Hakea acicularis*), Sassafras (*Atherosperma moschata*), and several minor species, some of them flowering shrubs. Above all this wealth of foliage rise the timber trees, straight in grain, because they have to struggle upwards to the sunlight (which rarely falls on the lower growth of ferns), and branchless until they have far overtopped the scrub below them. These forest giants are confined to the *Eucalypti*, or "Hardwoods," of Tasmania, the Myrtle, though it attains a large girth, not being so lofty.

The principal agricultural districts in this State have been "carved" out of the primeval forest. To the agricultural settler the timber, so valuable elsewhere, is (except such as he requires for buildings, fences, &c.), the bane of his existence, and his whole energy is devoted to destroying it with axe and fire. Fortunately for the timber, the inhabitants have so far been too few to appreciably diminish the immense extent of forest with which the Island is covered. Tasmania has until of recent years been far from a market, but the knitting together of the countries of the world by improved steam communication, and the increased scarcity of timber in the older countries, make it apparent that there is an opening for the profitable employment of capital and energy in rendering marketable the various vegetable products of this State. There is a steady trade with the other Australian States and New Zealand, and timber is also sent to South Africa, to England, and the Continent of Europe. Tasmanian Eucalyptus oil is sent all over the world, but as yet the trade is very small compared with what it might be, and several industries are quite untouched. Pyroligneous acid and potash might be made, also wood-pulp, besides which the distillation of essential oils could be largely increased. One common tree, the Native Box (*Bursaria spinosa*), of the order *Pittosporiæ,* is impregnated with a very fragrant resin, while the Oyster Bay Pine (*Frenela rhomboidea*) exhudes gum sandarach, and the grass-tree (*Xanthorrœa*), a red resin which is used as dragon's-blood for staining and for making varnish. The Tea-trees (*Melaleuca* and *Leptospermum*) and other trees have very fragrant leaves, and contain both essential oils and tannin. Many of the smaller trees, producing excellent timber for a variety of purposes, are neglected and wasted because they are so dwarfed by the giant Eucalypti as to be considered not worth the cutting. Truly the Eucalypti are noble trees, growing in serried ranks, with a smooth, clean trunk, sixty, seventy, eighty feet and more (sometimes over two hundred), without a limb, and from four to twelve feet in diameter. The wood is hard, strong, and tough; some very free, making excellent shingles and palings; some with the grain interlocked. They contain a resin which is used medicinally, and is called "kino." The leaves give Eucalyptus oil, and the flowers are full of honey. The bark contains fibre suitable for paper, also tannin. The wood is rich in pyroligneous acid, and the twigs and leaves in potash and valuable essential oils. The seeds also are marketable abroad. At present trees are cut down for the seeds alone, or for oil or for timber; but it seems certain that, when the industries of sawing, pulping, and distilling are combined, as well as the utilisation of the small trees that abound among the larger ones, the expenses of each industry will be considerably reduced, the forests will become a large source of revenue, and the old ground be better re-afforested for coming generations than under the present system.

Tasmania, with its temperate climate, reliable rainfall, and land-locked harbours, affords special facilities for the growth and export of timber. Deep arms of the sea run inland, reducing land-carriage to a minimum; and from sheltered inlets the ground rises to a central plateau, where lakes conserve water to feed rapidly-falling streams, which provide ideal sources of motive-power. It is the policy of the Government to encourage legitimate enterprise, and the terms for leases of timbered lands and water-rights are almost nominal, as may be seen by the following extracts:—

SAWMILL AREAS.

A lease may be obtained on application to the Commissioner of Crown Lands, for a period not exceeding twenty-one years, of an area not exceeding five thousand acres, at an annual rental of one pound for every hundred acres per annum, in advance; and the payment of a royalty of—

6*d*. per 1000 superficial feet of Eucalyptus timber, cut in the log.
5*s*. ,, ,, ,, ,, of other than Eucalyptus timber, cut in the log.

If a survey is necessary to define the lease, fees have to be paid by the applicant for the lease, at varying rates from five pounds for a fifty-acre block to fifty pounds for a five-thousand acre block, and approved machinery and plant must be put up of a nominal power varying from eight horse-power for a two-hundred-acre block to twenty-five horse-power for a five-thousand-acre block. The lessee must also use due diligence and despatch in removing the timber from his lease, and employ an adequate number of men.

Detailed information may be obtained on application to the Agent-General in London, or to the Commissioner of Crown Lands, Hobart, Tasmania.

WATER.

The general rate for the use of water is one pound per annum for a flow of twenty-four cubic feet per minute, which is known as a "mining sluice-head."

SHIPPING TIMBER AT HOBART FOR DOVER (Eng.) BREAKWATER.
Average Length 100 feet.

TASMANIAN TIMBER.

MYRTACEAE.

GUM TREES *(Eucalypti).*

Eucalyptus means well-covered, because the flower-bud is covered with a lid, which is forced off when the flower expands.

Of all Tasmanian trees Gum trees are the most remarkable, from the immense size to which they attain, their very general distribution over the Island, and the wide range of uses to which their products may be put. The trunks of these trees are straight and cylindrical for a hundred feet and upwards, with only a small amount of taper; the whole tree will measure from two to over three hundred feet in height; the diameter of well-grown trees, varying from three to six feet commonly, and up to twelve and fifteen feet above the buttresses. Piles have been recently cut for the Admiralty Works, Dover, one hundred and twenty feet long and twenty inches square. Bridge beams and large wharf-timbers also are cut on "the quarter," not sided down out of the round timber, as is done with smaller European trees.

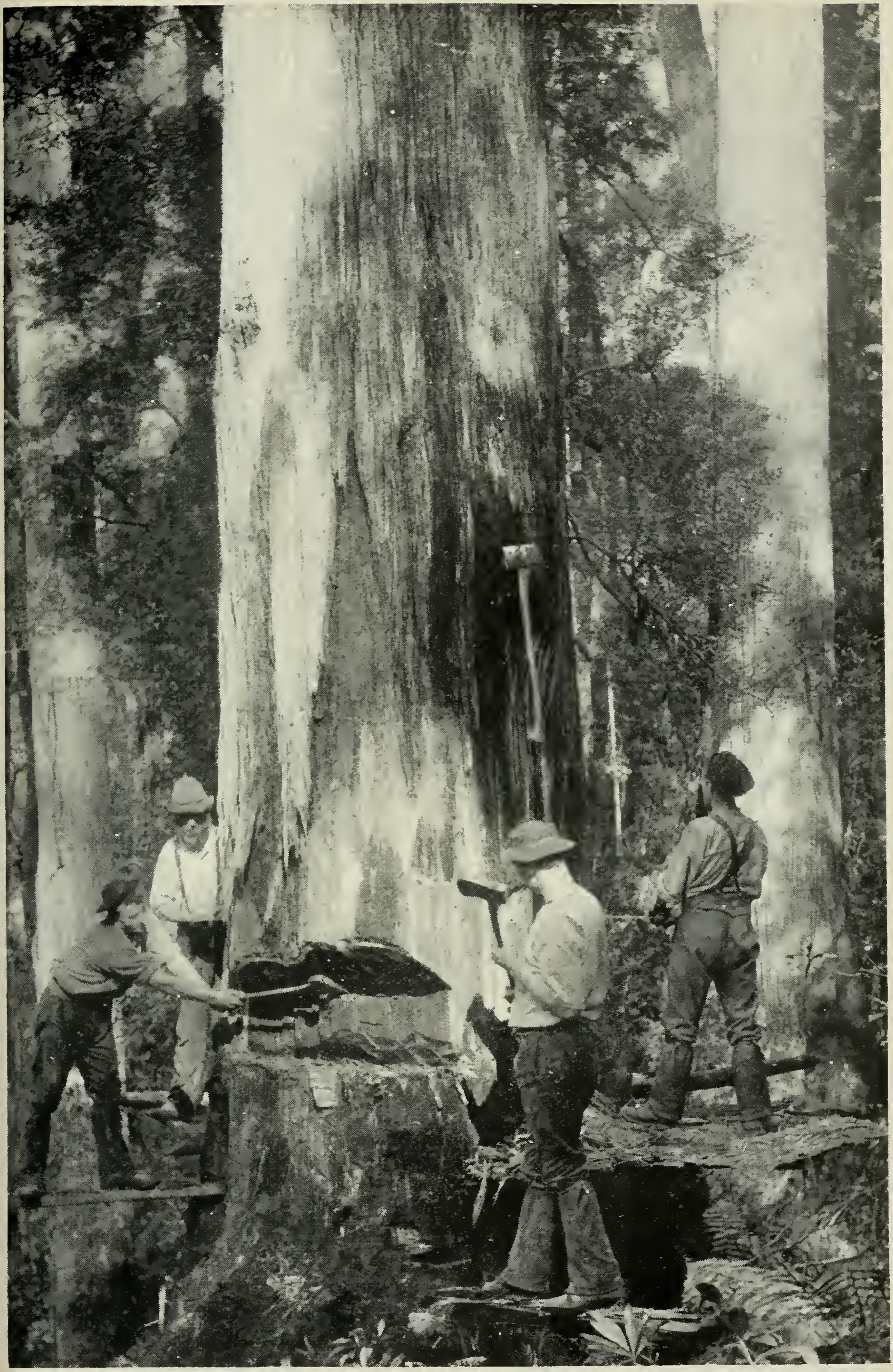
In Tasmania timber is got from the virgin forest, not from plantations or artificially-made forests, as sawmills have not been established for a sufficient length of time for secondary growths of the Gum or Eucalyptus timber to grow to their full size. In consequence of this, trees that are somewhat past their prime may be cut with others. In aged trees the first part to fail is the centre or heart-wood, the wood increasing in strength towards the outside of the tree, the best part being the ring inside the sapwood. This is always borne in mind in getting or inspecting timber; any showing signs of being near the heart is either rejected or very carefully tested. The growing tree and felled timber left in the bush is also subject to the attack of grubs (the larvæ of beetles), which riddle the wood with small holes the size of a pin-head. The holes are so small that the roughness left by the saw will hide them unless carefully looked for, and any timber showing them should be rejected. This is known as "specky timber."

The timbers of the various Eucalypti or Gum so closely resemble each other that it is a matter of great difficulty to say with any degree of certainty from which particular variety any specimen was cut. In the two best-known varieties—Blue Gum and Stringy Bark—the leaves, flowers, fruit, and bark are quite distinct. Blue Gum is, on the average, seven to eight per cent. heavier than Stringy Bark, though mature, slow-grown Stringy Bark will be much heavier than some specimens of Blue Gum, so that identification of the wood after the tree is cut up is difficult.

BLUE GUM (*Eucalyptus globulus*).

This tree takes its name of *globulus* from the large seed-vessels, which appear of a globular form on the tree. It is named Blue Gum because of the colour of the young growth, which is of a glaucous blue tint. It is found abundantly in the south-west, but is not generally distributed, like the Stringy Bark.

Blue Gum grows up to two hundred feet in height, and one hundred and twenty feet before the first branch springs, with a diameter of from four to ten feet at the butt. The colour of this timber when planed is of a golden yellow to purplish brown or buff. The grain, especially of the butt of the tree, is considerably crossed and interlocked; in the upper portions of the tree the grain is freer, and splits well when green. It is especially esteemed for piles, owing to the large size that it attains, and the comparative immunity it enjoys from the attacks of the Teredo. It is also used for ship and boat building, the superstructure of wharves and bridges; builders' scantlings of all kinds, joists, frames,



FELLING A STRINGY-BARK.

beams, floor-boards; wheelwrights' work, for naves, shafts, swingletrees, felloes, spokes, and body work. It is very durable, both in the water—especially sea-water—and in the air.

In the Exhibition held in Hobart, in 1894, amongst the Government exhibits was a sample of bridge-decking that had been about fifty years under foot-traffic, and which was still hard and sound. A timber also was shown which formed part of the original Bridgewater Ferry punt, built in 1818. The punt had been destroyed by blasting about fifty years before, and the wreck had been lying on the foreshore, between high and low water mark, and where there is Teredo, ever since. This timber, when cut out and planed in 1894, showed no sign of decay, and beyond being stained by the iron fastenings the wood was absolutely fresh. At the same Exhibition were shown bent shafts, turned naves, spokes, and hammer-handles, all cut from Blue Gum timber.

In Tasmania the rainfall of different districts varies from twenty to sixty inches per annum; the Government Railways are ballasted with gravel, and on these railways Blue Gum sleepers six feet six by nine inches by five inches have an average life of fourteen years.

The life of the wharf-piling in Hobart is reported to be twenty-five years. These piles are up to eighty feet in length, and are driven in forty feet of sea-water, where they are subject to the attacks of the Teredo. The oldest wharf now in use was erected in 1868, and has stood till now (1902) without renewal. The waggon ferry-steamer plying across Hobart Harbour, built of Blue gum, has been running about fifty years without any repair or caulking to the hull.

Throughout the country there are several small factories, where the essential oil is extracted from the leaves. This oil is exported for medicinal use and for varnish to various parts of the world, and is probably the only example in which what may be termed the "by-product" of a tree is utilised in Tasmania. The Blue Gum has been largely planted in Southern Europe, South Africa, America, and India, both for its timber—which it produces more rapidly than almost any other tree—and for the beneficial effect it has upon the climate of marshy and malarial districts. The exhalation of its essential oil and its vigorous circulation together purify the air, and make the soil more healthy.

RED GUM (*Eucalyptus stuartiana*).

This variety produces timber very similar to the Blue Gum, but of a red-brown colour. It is not a large tree, and is rather branching.

MUELLER'S GUM (*Eucalyptus Müelleri*).

This is a fine, tall, straight tree, with a very heavy reddish timber, hard and strong, but does not grow in quantity near a shipping port. It is a valuable tree, and appears to stand a considerable amount of frost.

STRINGY BARK (*Eucalyptus obliqua*).

The distinguishing name *obliqua* is from the leaf, the two lobes of which are unequally divided by the midrib, and the foot-stalk springs from one side obliquely, not from the middle of the end of the leaf. It is termed Stringy Bark from its bark, which is of great thickness and of a fibrous nature.

Stringy Bark trees are very much more widely distributed through the Island than the Blue Gum; growing over large tracts of poor, hilly country, they attain to an immense size, up to three hundred feet in height and from two to ten feet in diameter. The wood is on the whole of a lighter colour than Blue Gum, and varies from a pale straw to a reddish brown. In appearance brown Stringy Bark is somewhat like Oak, and it would be a difficult matter for most people to distinguish a picture-frame made of Stringy Bark from one made of Oak.

BLUE GUMS AND SASSAFRAS.

The timber varies very considerably, according to the situation and soil in which the tree grows. In appearance it is freer than Blue Gum, but lacks the purplish tint, and is more subject to gum-veins. It is the most general timber for all sorts of constructive works in this State. It makes excellent piles, especially for fresh water, but is not considered quite so good as Blue Gum for salt water, being more subject to the attacks of the Teredo.

It is also used for shipbuilding, the construction of wharves and bridges, and for railway sleepers; for the dado, flooring, and fitting of houses, and for furniture; it is also an excellent wheelwright's wood. When polished it very much resembles Oak, but has a more sparkling grain; it has a very pretty effect when used for a ballroom floor, or for wainscotting.

Besides being sawn for almost every purpose, Stringy Bark is split into fence-rails, palings, and shingles. It is certain that if this wood and the Blue Gum, properly prepared, were exported to London, a ready sale would be found for it for the construction of carts and vans. It would very well take the place of English Oak and Ash used for this purpose, which are every year becoming scarcer.

In the Tasmanian International Exhibition before-mentioned a Stringy Bark sleeper was shown by the Government that had been twenty-five years under traffic. The usual life of this timber in bridges is from twenty to twenty-five years; sleepers average about fourteen years, and none of the Government Railway buildings—some of which were built twenty-seven years ago, chiefly of this timber—have yet been renewed.

Wood Pavement.

The Stringy Bark of Tasmania is especially suited for wood-paving. It is preferable to Jarrah, being quite as durable, gives a better surface, and is also lighter in weight. If properly laid on a good foundation Stringy Bark blocks will wear out two sets of the Deal or Beech blocks which are largely used in European cities.

Stringy Bark is evenly hard all through, the annual rings of growth not being so well defined as in Fir timber, and there are no alternate layers of soft spongy wood to absorb moisture. Stringy Bark blocks do not polish under traffic, but give a good foothold for horses. The mode of laying found most successful in Australia is, first, to form a solid concrete foundation, accurately rendered, to the camber and incline of the roadway; second, to dip the blocks in boiling gas-tar, drain them, and again dip and drain; third, to bed the blocks, end grain up, close together, in hot pitch and tar, grouting as the work proceeds with hot tar, pitch, and sand; fourth, to pay the surface with a good coat of hot tar and pitch, with plenty of hot, coarse sand, sprinkled as the work is payed. An expansive joint is usually left between the blocking and the kerb. Stringy Bark blocks laid as above will last under heavy traffic from fourteen to twenty years. The Stringy Bark paving of the roadways of the Hobart Market building, laid in 1853, are still doing duty.

PEPPERMINT (*Eucalyptus amygdalina*).

This variety is called *amygdalina* from its almond-like leaves, and *peppermint* from the scent of the leaves, which contain a larger percentage of essential oil than those of any other Tasmanian Gum. This division of the Eucalyptus family produces several very different classes of timber; one variety, growing upon dry ridges and reaching a height of one hundred feet, with two to three feet of diameter, supplies the most durable wood of any of the Gums in the State. It is especially used for sinking in the ground, or for shingles; and fence posts, in districts where it can be obtained, are always specified to be of Peppermint. The wood is more of a brown red than the Blue Gum and Stringy Bark.

This quality of timber is not to be found in large quantities at any point of the Island within easy reach of a shipping port.

GUM-TOPPED STRINGY BARK

(*Eucalyptus haemastoma.*)

A second variety of the *amygdalina* division is known as Gum-topped Stringy Bark from the base being clothed with rough hairy bark, like the Stringy Bark, while the upper trunk and limbs have smooth grey bark, like the Blue Gum. This tree is very plentiful throughout large districts of the Island, and produces fine straight timber; it grows up to two hundred feet in height and four feet in diameter.

The wood is easily split, and when sawn makes excellent house-framing, floor-boards, skirting-boards, &c., but it has not the strength of the Blue Gum or the Stringy Bark; neither is it so good for resisting the weather. It would be an extremely valuable hardwood for any purpose not requiring the utmost strength, and makes good staves for casks.

SWAMP GUM (*Eucalyptus regnans*).

Swamp Gum, another variety of the *amygdalina* subdivision, grows to a large size, has a wood of a light brown colour, which, when kept dry, is of great strength, and when planed up and polished makes an excellent furniture-wood for wardrobes, &c., and inside fittings of houses. It has a bright sparkling grain, and takes a very good finish. This wood is discredited chiefly because it is sometimes sold for Stringy Bark or Blue Gum, and used for purposes for which it is entirely unfit. It is not lasting in the ground or if exposed to the weather.

WHITE OR MANNA GUM (*Eucalyptus viminalis*).

A sort of willow; is called *viminalis* from its growing upon the Viminal Hill of Rome, and White Gum is called *viminalis* from the leaves resembling those of the Willow Viminalis. Called White Gum from its very white, silvery bark, and Manna Gum from a peculiar exudation from the leaves and bark somewhat resembling the icing of a wedding-cake, and caused by the punctures of insects. This tree grows to a very large diameter, eight to twelve feet; the timber is reddish when green, and from a pale straw to ivory colour when seasoned. When dry it is brittle, and does not last in the weather, and so has the name of being useless; it is, however, a very useful hardwood for internal fittings. It can be got in wide planks, and when properly cut and seasoned will stand very well. When used for wardrobes, and polished, it has much the appearance of Ash.

IRON BARK (*Eucalyptus sieberiana*).

This is a tree that is locally distributed in the higher land of the north-east, and produces a very fair timber. The trees grow from a hundred to a hundred and thirty feet high and from two to four feet in diameter, but are not within reach of a shipping port. The timber is used for general construction works, piles, post and rail fences, builders' scantlings, &c.

CIDER GUM (*Eucalyptus gunnii*).

Named from its sweet sap; is rather a branching tree, from which long planks cannot be obtained. It will stand a considerably colder climate than the other Gums, and the seeds are sometimes inquired for from abroad for sowing in districts subject to frosts.

WEEPING GUM (*Eucalyptus coriacea*).

This is a mountain species, and does not grow to a great size. The timber is somewhat similar to the *viminalis* or White Gum.

The last three varieties have been mentioned more with a view of completing the list of trees that will produce timber than for any use they may be commercially. There are some three or four other species that do not grow beyond the size of a bush; but, besides producing essential oils, these are only of interest botanically.

IDENTIFICATION OF TIMBER.

As before mentioned, the identification and differentiation of the above-mentioned timbers, if not absolutely impossible, requires a lifelong acquaintance with the subject. The present botanical classification is not exact; each name may be said to cover several closely-allied varieties, rather than one specific kind. The bushman and the man who lives amongst timber would scout the idea of Gum-topped Stringy Bark being called a Peppermint; but Peppermint is a division to which this tree comes nearest botanically. Then trees, acknowledged to be of exactly the same kind, will produce very different timber, according to where they grow. For instance, upon a rocky eminence or in a sheltered river-bottom, the timber will differ in texture, in colour, in durability, and in weight, according to soil and situation.

Then, as to durability. Timber cut when the sap is in full flow will shrink and warp to a very much greater extent than that which is cut when the tree, either through cold weather or from drought, is in a dormant stage; it will also decay more readily.

Of course, when a mill has to be kept cutting logs, it is difficult to arrange all the felling at the most suitable time of the year; but if the tree is ring-barked six months before it is felled, the timber got out of it will be of a better quality than that taken from a tree in full growth. Young and free-grown trees will give a very different class of timber to that got from a slow-growing tree of the same class. To these difficulties must be added the fact that timber from all the varieties of trees before-named is put upon the market as "Tasmanian Hardwood," and from the descriptions of the various sorts given, and from the specific gravities and strengths shown in the accompanying tables, it will be seen that the terms "Hardwood," "Gum," or "Eucalyptus Timber" are not terms under which timber for any special purpose should be bought.

CORYLACEAE.

MYRTLE or BEECH (*Fagus cunninghami*).

This is a true Beech, but the local name is Myrtle, probably so-called from its small dark leaves. It is a tree that grows in great abundance over the western half of the Island. It attains a height of one hundred and fifty feet, with a diameter of from two to four feet.

The wood varies from a greyish-brown to a brown pink; when planed, it takes a beautiful surface, and, like the European Beech, always wears smooth. It is a strong, close-grained timber, and except for the colour, resembles European Beech, but is of considerably greater average strength. If cut from a level of eight hundred feet or upwards above the sea, and felled in the winter, it is a very fairly durable wood for outside work, but it is apt to "go" between wind and water. It makes splendid felloes, staves for tight casks, saddle-trees, gun-stocks, and all sorts of turnery, floors, skirtings, and dados. The pinker tints make handsome furniture. The seasoning and treatment of this timber should be exactly that of European Beech, and it must be felled in the winter to get the best results. Although there are such large quantities of *Cunninghami* to be obtained in the Island, very little of it has been exported hitherto; probably because the chief beds of this timber are not near a shipping port. It is very generally distributed, and produces an excellent timber for a variety of purposes. The difference between the grey and the pink is hard to account for, as they are botanically identical, and there is no apparent reason for the difference.

The railway from Emu Bay to Zeehan now passes through many miles of Beech country, so that there is a better prospect of this timber being utilised.

ACACIAS.

BLACKWOOD (*Acacia melanoxylon*).

Melanoxylon means blackwood. This tree is very generally distributed, but only grows in single trees or in clumps. It attains a height of sixty to eighty feet, and a diameter of from two to four feet. It is of a dark-brown colour, with reddish rings, but sometimes of a light-brown. It has much the appearance of Walnut, and makes an excellent furniture wood. Some trees are beautifully figured. It is used for all kinds of furniture, including pianos and billiard tables. The timber varies in quality, and the sort where the reddish grain predominates is called, locally, "Pencil Cedar." Again, a third variety, which is of a lighter colour, lighter weight, and freer grain, is called "Lightwood." These three names for varieties of the same timber sometimes cause confusion.

There is a small but steady output of this timber, and it is exported to the other States of the Commonwealth for furniture, carriage-building, and as staves for casks; but there it not sufficient quantity of it, in accessible places, for a large trade.

SILVER WATTLE (*Acacia dealbatá*).

So called from its blue-green silvery foliage. It is a tree that grows up to fifty or sixty feet in height, with a diameter of from twelve to thirty inches, and produces a somewhat porous timber of a dark-brown to a yellow-brown colour, easily split, fairly tough, and used and exported chiefly for cask staves. It is occasionally used for furniture, and when polished has a very handsome grain.

This timber is not to be had in large quantities. The bark is used for tanning.

BLACK WATTLE (*Acacia decurrens*).

Called "black" from its dark bark and dark green leaves, and *decurrens* from two lines "running down" from the base of the leaf-stalk. It produces a wood similar to the Silver Wattle, but darker in colour, heavier, and stronger The bark is so valuable, and largely used for tanning, that very few large trees are to be found. It will grow to a height of forty feet, and a diameter of two feet. It comes up readily from seed in light soils, and may be made a profitable source of income, if systematically cultivated, for the bark.

CONIFERAE.

HUON PINE (*Dacrydium franklinii*).

The Huon Pine, so-called from the Huon River, where first found, and also named after Sir John Franklin, is a pine which grows to a great size in the river-bottoms of the West Coast, with a diameter of eight or ten feet, but the ordinary size of the tree will give a plank of from fourteen to thirty inches in width and up to twenty feet in length. The wood is straight-grained, and heavy for a pine, of a bright yellow straw-colour, and very full of an essential oil, which causes it to be almost rot-proof. When made into furniture, the essential oil slowly oxidises, and the wood turns to a smoky-brown colour with age. It is a splendid joiner's wood, and is especially useful for boat-planking, as the teredo objects to the essential oil.

The supply is little more than sufficient for the local demand, but it is a timber that is well worth systematic cultivation. Most of the finest timber grows below flood-level, and it is an exception to the rule that durable timber does not grow in swampy ground, Huon Pine being one of the most durable timbers known. It is not a tough wood, having rather a short fracture, but it steams and bends well. Some trees will cut very handsome figured panels. It has a strong and, to some people, rather a sickly odour. The logs are cut in almost inaccessible gullies, and floated down the streams to the seaport, where they are shipped, generally, to Hobart.

KING WILLIAM PINE (*Athrotaxis selaginoides* and *Athrotaxis cupressoides—Cypress-like*).

This pine is so named from the leaf resembling the selaginela, an ornamental tree-moss well known in hot-houses. It grows on the high lands in the north and west from two to four feet in diameter, and forty or fifty in height. It is not very plentiful. The wood varies in colour from a pinkish-yellow to pink. It is extremely light, and has a scent like cedar, from which it is called "Pencil Cedar" locally. After it is planed up, there is a slight exudation of the resin. It is used for cabinet and joiners' purposes, and for making sculls for racing-boats. Notwithstanding its extreme lightness, it has considerable toughness and strength, and is very durable in the weather, being second only to Huon pine in this respect.

CELERY TOP PINE (*Phyllocladus Rhomboidalis*).

So called from the leaves in the young plant resembling those of the celery. A heavy, strong pine, of a clear yellow colour, useful for boards, internal fittings, or implements. It is very tough, and the shrinkage so small that the general belief is that it will not shrink at all. The smaller trees furnish masts for small vessels. Though not very plentiful, it is well distributed. This tree might also be very usefully cultivated.

OYSTER BAY PINE (*Frenela rhomboidea*).

A tree on the East Coast, deriving its name from the locality in which it is chiefly found. It grows from ten to fifteen inches in diameter. The supply of timber from this tree is nominal, as the trees have been nearly all cut out, or burnt, but it is a tree well worth preserving and cultivating, as its timber is of extreme durability. It makes good posts; is also used for hop-poles, gates, and carpenters' work, and is a strong useful timber. It produces a fragrant resin (like gum sanderach) suitable for varnish.

SASSAFRAS (*Atherosperma moschata*).

This tree grows in creek bottoms to a height of forty to a hundred feet, and from twelve to eighteen inches in diameter. It is a light timber, suitable for wooden pails, brushware, casks, wooden screws, &c., and is a good wood for carving; but it is essential that it should be cut when the sap is down, or it very quickly decays if exposed to weather. The bark and leaves have a pleasant bitter flavour, and the extract is used as a tonic.

SMALLER TREES OF TASMANIA.

PRODUCING USEFUL TIMBER, WHICH IS NOT EXPORTED.

LEATHER WOOD (*Eucryphia billardieri*).

A small tree twenty to forty feet in height, with a trunk of from twelve to thirty inches in diameter, producing an excellent pinkish-brown mottled wood, which is very useful in the manufacture of implements, being somewhat akin in nature to the English ash, but stronger.

TEA TREES.

MELALEUCA ERICAEFOLIA

(*Leptospermum lanigerum*) and (*Kunzea corifolia*).

Called "Tea" trees because Captain Cook's sailors are said to have used the leaves for tea.

These trees have a brownish timber, which is very lasting, either in the ground or in the water. The swamp tea-tree grows in salt-water and morasses, and is useful for shelter and the reclamation of land. The leaves, like others of the myrtle tribe, contain essential oils, amongst them, cajeput, which is used medicinally. The timber is used for pick-handles, shafts, wheelwrights' work, paddles, and small piles.

HE-OAK (*Casuarina suberosa*).

SHE-OAK (*Casuarina quadrivalvis*).

These are short, bushy trees, growing usually through the open country, having a trunk of six to ten feet and a diameter of eight to ten inches. When green, the colouring of the wood is very rich; but this fades to a brown colour with age. The grain, especially the medullary ray, is very marked, giving the wood a bold figure. At present it is used almost solely for firewood; but it is fairly tough, and useful for implements, and would cut small veneers.

LANCEWOOD (*Eriostemon squameus*).

A tree of small growth, with wood of a yellow colour, which is fairly tough, and of a very fine grain; useful for shafts, swingle-trees, and implements.

IRONWOOD (*Notelaea ligustrina*).

This is a handsome tree, giving a trunk of ten or twelve feet, with a diameter of from one to two feet. The outer, or sap-wood, is yellow, and the heart-wood of a dark brown, getting darker with age. It is extremely hard, and is used in place of lignum vitæ, also for tools of various kinds.

HORIZONTAL (*Anodopetalum biglandulosum*).

A small-growing tree, which branches over the surface of the ground and forms impenetrable thickets on the West Coast. Before it is thoroughly dry it is of extreme toughness, almost impossible to break. It is used for tool-handles and implements. When dry it has not the toughness of English Ash, or American Hickory.

DOGWOOD (*Pomaderris apetala*).

A small tree growing thirty to fifty feet in height, but only up to ten inches in diameter. The wood is similar to that of the English pear tree, and is useful for carving, fine turners' work, and drawing instruments.

MUSK (*Olearia argophylla*).

A small tree producing a hard brownish wood useful for furniture. Some of the boles would cut veneers of good figure.

HONEYSUCKLE (*Banksia marginata*).

This is widely dispersed over the open country, and produces a very curious yellow to pinkish-brown wood of a reticulated or netted appearance. Larvæ of certain moths and beetles are so fond of this tree, that it is extremely difficult to get a sound plank of any size.

TALLOWWOOD (*Pittosporum bicolor*).

A small tree producing a yellow smooth-grained wood useful for implements and furniture.

BOX (*Bursaria spinosa*).

A handsome bushy tree, with white, sweet-scented flowers; the wood is ivory in colour, and of an even grain, suitable for carving or engraving-blocks. This wood is also very much eaten by larvæ, and it is difficult to find a tree over ten inches in diameter that is not perforated.

NATIVE CURRANT (*Leptomeria billardieri*).

This tree grows little larger than a bush, but produces a very nice yellowish-brown timber useful for small tools, also for ornamental works and boat-knees.

PINKWOOD OR ROSEWOOD (*Beyera viscosa*).

A small tree with a reddish wood, something like the Rosewood of commerce, but of very small size. It is used for ornamental work and tools.

WARATAH (*Telopea truncata*).

This tree may be got up to six inches in diameter. It is famed for its flowers; but the wood is also used for ornamental joiners' work, and has a very pretty grain.

LABURNUM (*Goodia lotifolia*).

NATIVE LAUREL (*Anopterus glandulosus*).

MINT TREE (*Prosthanthera lasianthes*).

All the above are small trees, occasionally used for inlaying and turnery.

NATIVE BIRCH (*Dodonea viscosa*).

Has a pink sap and a dark heart-wood of extreme hardness, but this tree rarely grows to any size in Tasmania; it is useful for rulers, turnery, &c.

NATIVE CHERRY (*Exocarpus cupressiformis*).

This tree will grow a trunk of six or eight feet long by ten inches in diameter; the wood is a warm red brown. It is used in cabinet work, but is not of commercial value. Its claim to notice is that the fruit is spoken of as the "Australian Cherry," which grows the stone outside instead of in the centre of the fruit; though, as a matter of fact, the fruit is more like that of the Yew-tree than the Cherry.

COMPARATIVE TABLE OF WEIGHTS AND TRANSVERSE STRENGTHS OF EUROPEAN AND TASMANIAN TIMBERS.—(A. O. Green.)

Name of Timber.	lbs. weight per cubic foot.			Transverse strength $\frac{LW}{4bd^2}$			Experimenters
	Min.	Max.	Mean.	Min	Max.	Mean.	
Ash, English	43	53	47	1471	2445	2130	Barlow, P. W. Barlow, Beaufoy, Denison, Ebbels, Peake and Barrallier, Tredgold, and Rankin.
Beech ,,	37	50	43	1557	2031	1794	
Yellow Deal (Sylvestris)	30	44	36	1183	2058	1600	
Oak, English	43	62	54	1092	2892	1788	
Blue Gum, Tasmanian, Fresh Cut	60	80	73	1957	2100	2019	Mitchell, Green, Mann
,, ,, Dry	52	67	60	1867	3361	2706	Mitchell, Laslett, Green
Stringy Bark ... Fresh Cut	55	75	69	1377	2046	1874	Kernot, Green
,, ... Dry	48½	66	57	2514	3661	3273	Mitchell, Ransome, Green
Gum Top Stringy Bark ... ,,	48½	51	50	1524	2391	1958	Kernot, Victorian Timber Board, Green
Swamp Gum ... ,,	..	..	54	1400	3334	2367	Green
Peppermint ... ,,	50	65	59	1599	1646	1623	R. M. Johnson Green
White Gum ... ,,	44	48	46	1646	1788	1717	R. M. Johnson, Green
Myrtle or Beech ... ,,	39	54	47	2712	2946	2804	Ransome, Green
,, ,, ... Fresh Cut	..	..	67	..	..	2257	Kernot
Leatherwood ... Dry	42	49	45	..	..	3258	Green
Celery Top Pine ... Fresh Cut	..	..	64	..	..	1378	Kernot
,, ,, ,, ... Dry	40	44	42	2124	2326	2225	Kernot, Green

TASMANIAN-AUSTRALIAN TIMBERS.

(A. O. Green.)

Approximate Breaking Weights for Stresses, of Crushing, Shearing, and Tension, in pounds per square inch, from experiments of Professor Kernot, Melbourne University.

	Crushing along the grain.	Crushing across the grain.	Shearing across the grain.	Tension along the grain.	Tension across the grain.
Stringy Bark .. Fresh cut	4400	2000	2000	10,000	
,, .. Dry*	8000	4500	2000	22,000	
Blue Gum ... Fresh cut	—	—	—	—	
,, .. Dry*	9000	4500	2000	22,000	
Leatherwood .. Fresh cut	—	—	—	—	
,, .. Dry*	8000	6000	2000	—	
Myrtle ... .. Fresh cut	5000	—	—	10,000	
,, .. Dry*	7000	4500	3000	12,000	
Celery-top Pine ...... Fresh cut	4000	—	—	3000	
,, .. Dry*	7000	1000	1400	12,000	

EUROPEAN TIMBERS.

	Crushing along grain.			Tension along grain.			Tension across grain.		
	Min.	Max.	Mean.	Min.	Max.	Mean.	Min.	Max.	Mean.
Ash dry	8700	9500	9000	16,000	19,600	17,600	—	—	—
Bee .	7700	9500	8500	11,000	22,000	17,000	—	—	—
Oak ,,	6500	10,000	8300	9000	20,000	13,600	—	—	2316
Deal ,,	5500	6500	6000	12,000	18,000	15,400	540	840	626

* Note.—For Australian timbers, and given as an approximate guide, for the breaking weights of Tasmanian timbers, data for which are wanting. The weights given for European timbers are from results obtained by the experimenters enumerated at the head of the Table of Weights and Transverse Strengths on page 29.

For purposes of comparison, the "Shearing across the grain" shown for the Tasmanian woods may be taken as equivalent to the "Tension across the grain" shown for European.

TRANSVERSE STRENGTH, DEFLECTION, AND ELASTICITY.

(A. O. Green.)

Experiments made in Hobart in May, June, and July, 1902.

Size of specimens 30 x 1 x 1 inches, of Tasmanian timbers of the ordinary quality accepted by the Tasmanian Government Railway Department for maintenance purposes—the Deal and Oregon the best that could be got. The time of each experiment was about an hour. About three-fourths of the load was put on slowly, with thirty-pound lead-weights; then fourteen pounds, then lighter weights, until the breaking load was attained; all at about the rate of thirty pounds in five minutes.

The specimens were supported on fixed wooden supports of two feet clear span, and the weights were placed in a scale-pan hung on the centre of the specimen by a half-inch shackle. The specimens weighed from half to about a pound each, but this weight is neglected in the deductions.

In all the experiments but two the sap-side was down and the heart up. The deflection was taken by means of a scale divided to fiftieths of an inch, standing on the specimen and against a fixed board, with a vernier, bridging the span.

In the accompanying table the symbols used in the formulæ are as follows:—W = weight in pounds, L = length in inches, b = breadth in inches, d = lepth in inches, δ = deflection in inches, l = length in feet. S, E and A are constants for transverse breaking "Strength," modulus of "Elasticity," and for the stiffness of beams, the deflection of which does not exceed one four-hundred-and-eightieth of the span. The last, A, is Tredgold's formula for the stiffness of beams, which is often quoted in tables for European timbers where depth in inches, $d = \sqrt[3]{\frac{l^2 \, W \, A}{b}}$ and $\delta = \frac{l}{480}$. $S^{\times}$= the breaking-weight of a beam 1 foot x 1 inch x 1 inch, supported at the ends and loaded in the centre.

EXPERIMENTS MADE IN HOBART, 1902, BY A. O. GREEN.

Date cut.	Name of Timber.	Weight per cubic foot.	δ $\frac{WL^3}{4bd^3E}$ Deflection Load 100 lbs.	W $\frac{4bd^2S}{L}$ Breaking Weight.	S $\frac{LW}{4bd^2}$ Specific Transverse Strength.	E $\frac{WL^3}{4bd^3\delta}$ Mean Modulus of Elasticity.	A $\frac{40bd^3\delta}{Wl^3}$ Constant for Stiffness.	$S^{\times}$ Breaking Weight of beam 1ft. × 1in. × 1in. supported at ends and loaded in middle.
		lbs.	inches.	lbs.	lbs.	lbs.		
	TASMANIAN TIMBERS.							
1892	*Eucalyptus obliqua.* Stringy Bark, dry	60·1	·115	610¼	3661	2,988,939	·0058	1220
1900	*Eu. globulus.* Blue Gum, dry	59·2	·170	560¼	3361	2,048,047	·0085	1120
1894	*Eu. Regnans.* Swamp Gum, dry	53·6	·100	555¾	3334	3,423,086	·005	1111
1894	*Eucryphia billardieri.* Leatherwood, dry	48·6	·150	543	3258	2,283,927	·0076	1086
1894	*Fagus Cunninghamii.* Myrtle or Beech, dry ...	54·0	·210	491	2946	1,626,287	·0106	982
1894	*Phyllocladus Rhomboidalis.* Celery-top Pine. dry...	40·3	·238	387¾	2326	1,447,775	·0121	775

1902	Unseasoned Stringy Bark	58·8	·155	341	2046	2,263,680	·0076	682
1902	Unseasoned Blue Gum..................	69·7	·195	326¼	1957	1,759,963	·0098	652
1894	*Athrotaxis Selaginoides.* King William Pine, dry	22·1	·650	182	1092	541,975	·0319	364
	IMPORTED PINES.							
Un-known	*P. Douglassii.* Oregon Pine, dry	34·4	·180	378¾	2273	1,937,728	·0089	758
	P. Sylvestris.							
,,	Yellow Deal, Annual Rings vertical*	30·25	·188	353	2118	1,879,417	·0092	706
,,	Yellow Deal, Annual Rings horizontal *	31·7	·195	304¾	1828	1,769,037	·0098	609
	ENGLISH TIMBER.†							
	Fraxinus Excelsior. Ash, English, dry	47·	·211	333	2000	1,640,000	·01	666
	Fagus Sylvatica. Beech, English, dry	43·	·257	333	2000	1,345,000	·013	666
	Quercus Vars. Oak, English, dry	58·	·243	282	1690	1,420,000	·013	563

* Both cut from same deal. † Highest values for English timbers from Molesworth's Engineering Pocket Book.

In the dry woods the elasticity was unimpaired to ¾ of breaking strain; in the green ones to about a half.

The nature of the fracture in each case will be seen from the illustrations. Tasmanian trees are very large, and may be got quite free from knots and with the grain evenly hard, so that the above may be taken as ultimate breaking-weights of well-selected timber free from shakes and defects.

The results obtained for Deal could not be got in ordinary work, except with small scantlings, chiefly owing to the presence of knots; also, from the trees being small, the hard grain may be at many angles in a single plank. From these causes the timber does not give evenly throughout, and a large plank will not carry so much weight in proportion to its size as a small one will, in which these causes of failure have been eliminated.

TASMANIAN AND OTHER TIMBERS.

(A. O. Green.)

Arranged in order of stiffness from the deflections of specimens one inch square, supported at ends, span two feet and load one hundred pounds in centre of span.

Name.	W = 100 lbs. Deflection inches.	Breaking load. lbs.	Deflections at breaking.
Swamp Gum ....dry	·100	555¾	1·1
Stringy Bark .... ,,	·115	610¼	1·0
Leatherwood .... ,,	·150	543	1·5
Stringy Bark ....fresh cut	·153	341	1·1
Blue Gum ....dry	·170	560¼	1·1
Oregon Pine .... ,,	·180	379	1·25
Yellow Deal—annual rings vertical* ,,	·188	353	1·0
Yellow Deal—annual rings horizontal*........................dry	·195	304¾	1·1
Blue Gum ....fresh cut	·195	326¼	1·2
Myrtle or Beech ....dry	·210	491¼	1·4
Ash, English............ ,,	·211†	—	—
Celery Top Pine................ ,,	·238	387¾	1·1
Oak, English .... ,,	·243†	—	—
Beech, English .... ,,	·257†	—	—
King William Pine .... ,,	·655	182	1·655

* Cut side by side from one Deal.

† Calculated from the value of E given in Molesworths' Engineering Pocket Book.


Bluegum Unseasoned
Stringybark Unseasoned
Bluegum Seasoned
Stringybark Seasoned

Results of Experiment to ascertain the Resistance to Deflection and Rupture under a gradually increased Bending Stress of One Log of Blue Gum, received from Messrs. Richardson & Co.

Load applied at centre. Distance between supports, 10′ 0″.

Test No.	Description.	Dimensions, B.D.	Length.	Weight.	Total Stress in Pounds. — Deflection Inch at 12,000.	14,000.	16,000.	18,000.	20,000.	22,000.	24,000.	26,000.	28,000.	30,000.	32,000.	34,000.	36,000.	38,000.	40,000.	Ultimate Stress. lbs.	Ultimate Stress. tons.	Remarks
		inches.		lbs.																lbs.	tons.	
H.H.	*Received 21 feet long.*																					
2375	*Blue Gum Log, 9″ × 9″ (sawn)* ... ... *Sketch showing grain of wood*	9·00 × 9·00	10′ 9¾″	427	·22	·26	·31	·36	·42	·50	·57	·64	·75	·86	·98	1·14	1·38	1·73	...	39,445	17·6	*Failed by top side compressing. Cracked at 3 ins. deflection. Bent to 5 ins. Weight removed.*

Top side in Compression

Bottom side in Tension

Initial stress, 4000 lbs. (S = 1623. Average E = 2,666,840.—A. O. G.)

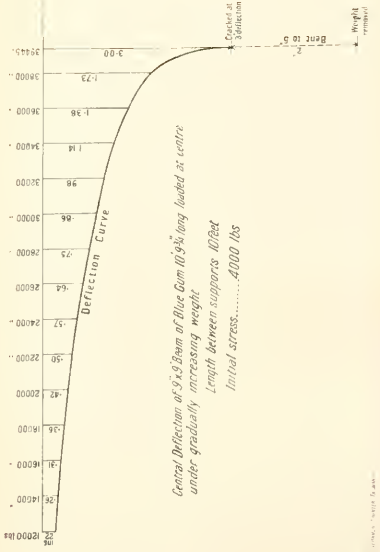
Results of Experiment to ascertain the Resistance to Depression and Rupture under a gradually increased Thrusting Stress.

Length for testing, 120 inches. Ends faced accurately true in lathe.

Test No.	Description.	Dimensions.	Area.	Weight. Actual.	Weight. Per cub. foot.	Total Stress in Pounds. — Depression Inch at 40,000.	60,000.	80,000.	100,000.	120,000.	140,000.	160,000.	180,000.	200,000.	220,000.	240,000.	260,000.	280,000.	300,000.	320,000.	340,000.	360,000.	380,000.	400,000.	Ultimate Stress. Total.	Ultimate Stress. Per sq. in.	Remarks.
		inches.	sq. ins.	lbs.	lbs.																				lbs.	lbs.	
H.H. 2376	*As above* ...	8·98 × 8·90	79·92	397½	71·57	·028	·046	·058	·070	·082	·094	·105	·118	·130	·142	·154	·166	·179	·195	·212	·229	·255	·309	...	380,100	4756	*Crushed.*

Messrs. S. Pearson & Son, 10, Victoria-street.

DAVID KIRKALDY & SON, 99, Southwark-street, London, S.E.
21st July, 1899.



The values given in the preceding tables for S, the transverse strength of a beam supported at the ends, and loaded in the centre of the clear span, are for breaking-weights, but the working load should never exceed one-third of this for static loads or one-sixth for moving loads; it is usual practice to take one-fourth for static and one-eighth for moving loads. The practice for railway bridges is one-fifth for static and one-tenth for moving loads.

To find the deflection that any weight in the centre of span will cause in a rectangular beam of any of the woods given in the table, supported at the ends—$\delta = \frac{W L^3}{4 b d^3 E}$ Multiply the weight in pounds by the cube of the length in inches, and divide the product by the product of four times the breadth, by the cube of the depth and by the value given for E in the table.

To find the breaking-weight in a rectangular beam of any of the woods given, loaded in the same way, $W = \frac{4 b d^2 S}{L}$ or multiply four times the breadth by the square of the depth by the value given for S, and divide the product by the length in inches. Or, by using the column $S^\times$, multiply the breadth by the square of the depth in inches by $S^\times$, and divide the product by the length of span in feet; or, by formula $W = \frac{b d^2 S^\times}{l}$

Again given the span in feet, the load in pounds, and the breadth in inches, of a beam, to find the depth in inches, so that the beam shall not bend more than one-fortieth of an inch to a foot, or one four-hundred-and-eightieth of its span, the formula is $\sqrt[3]{\frac{l^2 W A}{b}}$, or multiply the square of the length in feet by the load in pounds by the value given for A, and divide the product by the breadth in inches; this will give the cube of the depth, and the cube-root will be the result required.

It must be remembered to add half the total weight of the beam itself to the load for the total centre load upon the beam in all cases.

SEASONING AND SHRINKAGE.

Rankin's "Machinery and Millwork," page 471:—

Seasoning for carpenters, two years; for joiners, four years, and often much longer.

Shrinkage 2 to 8% transverse, usually 3%; loss of weight 6 to 40%.

Molesworth's "Engineers' Pocket-book," page 113, Mahogany, Walnut, or Oak seasoning:—

Inches of Thickness	$\frac{3}{8}''$	$\frac{1}{2}''$	$\frac{5}{8}''$	$\frac{3}{4}''$	$\frac{7}{8}''$	1″	$1\frac{1}{2}''$	2″	3″	4″
Months of Time	12	13	14	16	20	24	30	36	46	52

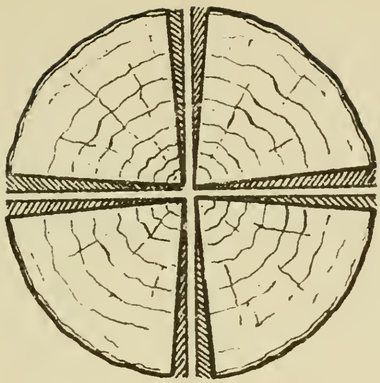
Barlow gives the shrinkage of Oak as 3% for the butt, 5% for the top, and the loss of weight as, at least, a third in drying.

T. A. Knight, in "Philosophical Transactions," vol. 107, p. 269, shows that Ash and Beech cut on the back, or parallel to the rings of growth, shrank 14% of the width, and warped; while the same cut on the quarter, or across the rings of growth, shrank $3\frac{1}{2}$% of its width, and did not warp.

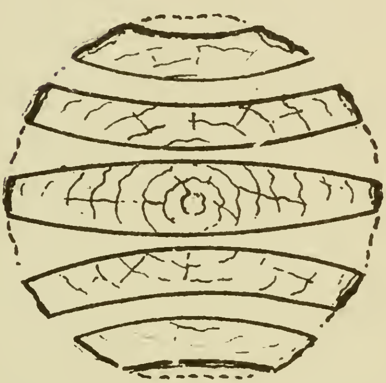
Tredgold quotes Rondelet's experiments, showing that ordinarily dry Fir will expand up to $1\frac{1}{3}$% of width, and Oak to $1\frac{1}{4}$%, under ordinary changes in the dampness of the atmosphere.

Tasmanian timbers lose from 22% to 40% of their weight in drying. The usual allowance for the shrinking of Tasmanian hardwood is from half an inch to an inch to the foot, or 4 to 8%; but this is only a rough general assumption, and no exact experiments have been made for the determination of the shrinkage. It is known generally that it varies considerably in the different timbers, that of Celery-top Pine being the least, and that of Stringy Bark probably the greatest; while, from the same kind of tree, timber grown on good moist land will shrink more than that grown upon poor rocky soil, and the young wood more than that of matured trees. It would be very useful indeed if the percentage of shrinkage, both radially and along the rings, were settled by experiment, for each kind of timber.

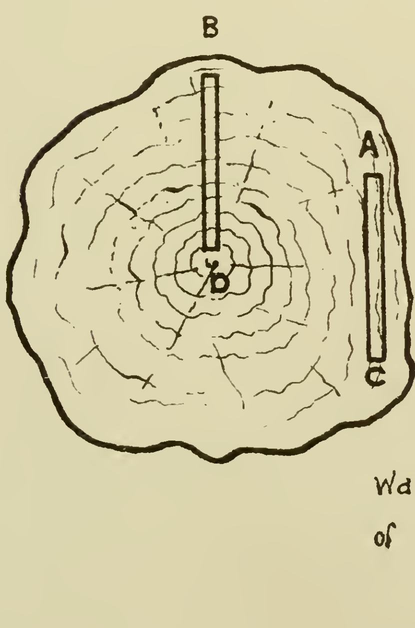
With regard to seasoning (most Tasmanian timber is sold unseasoned), the practice in England is given above, but after the length of time allowed for seasoning, for carpentry and the rougher sorts of work, the joiners will either season for several years more, or further dry the timber in a hot room before using it. During the time of drying, the timber is carefully stacked with numerous slats between the planks, and sufficiently weighted to keep it from buckling. As has



If a log is cut in four through centre, as the shrinkage is along the ring, the angle at centre will become less than 90° in drying. Also, the wood of the outer layers of the tree being less consolidated, shrinks more than that near the centre.



Shows shrinkage of plank from above cause.

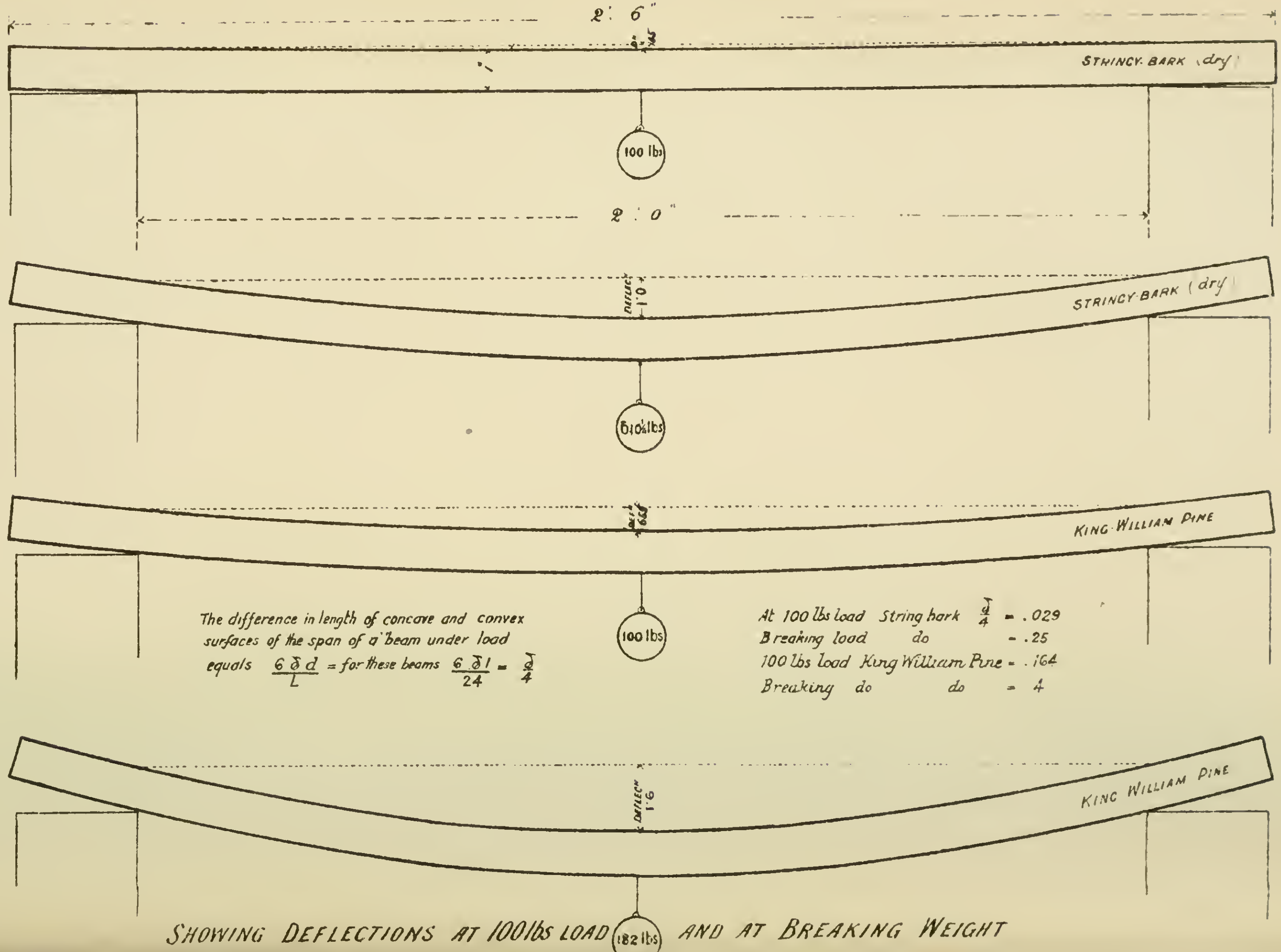


B. D. on quarter
A. C. on back.

See Tredgold; Joinery, Edition 7. Ency. Brit., Knight F.A. 91 Vol. Phil. Trans. experiment on Oak, also, Vol CVII. p269. - Ash & Beech cut on back or parallel to rings shrunk up to 14% of width and warped, the same cut on quarter 3½% of width & did not warp.

Scale

Experiments in Hobart on Stringybark & King William Pine



Showing Deflections at 100 lbs load and at Breaking Weight been before stated, one of the essentials of placing Tasmanian timber on the European market in plank is that it should be well seasoned and properly stacked during the seasoning.

The length of time given above as the practice of air-seasoning in Europe may be shortened to a few months by the use of properly-constructed drying-rooms, in which green timber can be stacked, slatted, weighted, and dried, at a temperature of from 100° to 140° Fahrenheit. The room should be so arranged that the atmosphere within it may be kept saturated with moisture, in order that the outer part of the timber shall not dry before the inner; this can be very readily done by the use of exhaust-steam. Towards the end of the process the moisture should be gradually diminished, and the timber allowed to dry off, and cool slowly. There is little doubt but that excellent results would be obtained at a very moderate cost from this treatment.

SUNDRY WEIGHTS OF ROUND, SPLIT, AND SAWN TIMBER.—(A. O. Green.)

Blue gum Piles at 75 lbs. a cubic foot.

Diameter in feet and inches—	1′ 0″	1′ 4″	1′ 8″	2′ 0″	2′ 6″	3′ 0″	4′ 0″
Weight per foot run of pile in pounds .. ... About	59	104	163	236	368	530	942
Number of running feet to a ton ... ... About	38	$21\frac{1}{2}$	$13\frac{3}{4}$	$9\frac{1}{2}$	6	$4\frac{1}{2}$	$2\frac{1}{3}$.

Stringy-bark piles weigh about 69 lbs. a cubic foot, or say 10 per cent. less than blue-gum.

Other Tasmanian woods weigh from 55 lbs to 70 lbs. a cubic foot in the log.

One foot super. or board measure of hardwood fresh cut weighs $5\frac{3}{4}$ lbs. to 6 lbs.

$8\frac{1}{3}$ cubic feet or 100 feet super of fresh cut stringy-bark weighs about 560 lbs.
$8\frac{1}{3}$ „ 100 „ dry stringy-bark „ 450 lbs.
$8\frac{1}{3}$ „ 100 „ imported deal „ 373 lbs.

THE FOLLOWING QUANTITIES WEIGH ABOUT A TON.

Timber.

Cubic feet. Super. feet.

33· or 400 of hardwood is usually considered a ton = 68 lbs. a cubic foot.
32·6 or 390 of fresh cut stringy-bark = 68·7 lbs. a cubic foot
30· or 360 of fresh cut blue gum = 74· „ „
32· or 384 of fresh cut blackwood = 70· „ „
37·3 or 448 of fresh cut wattle = 60· „ „
50· or 600 of imported pine or deal is usually considered a ton = 45 lbs. a cubic foot.
66· or 792 of deal dry enough for use is considered by English builders a ton = 34 lbs. a cubic foot.
60· to 72· or 840-864 of deal thoroughly dry weighs a ton = 30 to 32 lbs. a cubic foot.

Sleepers, Posts, and Rails.

No. to a ton.			Cubic feet.
12·34	blue gum sleepers weighs 182 lbs.	7′ × 10″ × 5″.	1 sleeper = 2·4305, and
13·3	stringy-bark sleepers weighs 168 lbs.	7′ × 10″ × 5″.	1 sleeper = 2·4305, and
14·7	blue gum sleepers weighs 152 lbs.	6′ 6″ × 9″ × 5″.	1 sleeper = 2·031, and
16·	stringy-bark sleepers weighs 140 lbs.	6′ 6″ × 9″ × 5″.	1 sleeper = 2·031, and
27·2	stringy-bark posts weighs 82·2 lbs.	7′ × 7″ × 5″ × 2″.	1 post = 1·191, and
51	stringy-bark fence rails	9′ × 7″ × 2″ × 1″.	1·55 rails = 1 cubic foot.
70	,, ,,	9′ × 6″ × 2″ × $\frac{1}{2}$″.	2· rails = 1 cubic foot.

Firewood.

80 Cubic feet of green gum weigh about a ton.
100 Cubic feet of dry gum ,, ,, ,,

Staves.

No. to a ton.			
504	Wattle	2′ 8″ × 4″ × 1″	About 13$\frac{1}{2}$ staves = 1 cubic foot.
432	Blackwood	2′ 8″ × 4″ × 1″	
298	Wattle	3′ 2″ × 5$\frac{1}{2}$″ × 1$\frac{1}{16}$	About 8 staves = 1 cubic foot.
256	Blackwood	3′ 2″ × 5$\frac{1}{2}$″ × 1$\frac{1}{16}$	
298	Wattle	4′ 0″ × 4$\frac{1}{2}$″ × 1″	About 8 staves = 1 cubic foot.
256	Blackwood	4′ 0″ × 4$\frac{1}{2}$″ × 1″	

Stringy-bark Palings.

308 palings	6′ × 6″	5 palings split from a billet 6″ × 2$\frac{1}{4}$″ × 2″ at the end.
370 ,,	5′ × 6″	
350 ,,	6′ × 6″	,, ,, split from a billet 6″ × 2$\frac{1}{4}$″ × 1$\frac{1}{2}$″ at the end.
429 ,,	6′ × 5″	

Shingles.

40 bundles of 96 each, 3840 shingles to a ton; each bundle weighs $\frac{1}{2}$ cwt.

Apple Cases.

Long Apple Case—

No. to a ton,			
768	top, bottom, and side palings	2′ 4″ × 7″ × $\frac{1}{3}$″,	26 = 1 cubic foot.
665	ends and divisions	1′ 2″ × 7″ × $\frac{7}{8}$″,	20 = 1 cubic foot.

Timber for 90 long apple cases weighs about a ton.
Timber for 145 half cases weighs about a ton.

Dump Apple Case—

No. to a ton.			
1221	side palings	1′ 8″ × 7″ × $\frac{1}{3}$″,	38$\frac{1}{2}$ = 1 cubic foot.
895	top and bottom palings	1′ 8″ × 9$\frac{1}{2}$″ × $\frac{1}{3}$″,	27 = 1 cubic foot.
460	ends	1′ 3″ × 9$\frac{1}{2}$″ × $\frac{7}{8}$″,	14 = 1 cubic foot.

Timber for 100 dump apple cases weighs about a ton.

HOBART PRICES.

LOGS—Per 100 feet super.

Gum or Hardwood	3*s*. 9*d*. to 4*s*.
Blackwood	10*s*.
Huon Pine	14*s*.

PILES.

1*s*. to 2*s*. 6*d*. a foot run for small.
2*s*. 6*d*. to 4*s*. 6*d*. a foot run for large.

SCANTLINGS—Per 100 feet super.

Gum, Quartering	5*s*.
,, Large	7*s*. to 10*s*.
,, Bridge beams	10*s*. to 20*s*.

ONE-INCH BOARDS—Per 100 feet.

Gum..	Green, 7*s*.; dry, 8*s*. 6*d*.
,, Tongued and grooved ...	11*s*.
,, Weatherboards, dressed	8*s*. 6*d*.
Huon Pine, 1-inch boards......	25*s*.
Blackwood, ,, ...	25*s*.

SUNDRIES.

Gum, Cart shafts..................	3*s*. per pair.
,, Cart felloes	8*d*. each.
,, Spokes	10*s*. per 100.
,, Fence posts	40*s*. to 50*s*. per 100.
,, Fence rails	30*s*. per 100.
,, 5-ft. palings	7*s*. 6*d*. per 100.
,, 6-ft. palings	8*s*. 6*d*. per 100.
,, Sawn lathes	10*s*. per 1000.
,, Shingles.....................	10*s*. 6*d*. per 1000.

STAVES.

Wattle staves, 2 ft. 8 ins.........	8*s*. per 100.
,, 4 ft.	10*s*. per 100.
Blackwood staves, 3 ft. 2 in. ...	12*s*. per 100.
Gum Top, called White Oak, 2 ft. 8 in.	8*s*. per 100.

LIST OF TASMANIAN

Local Name.	Family.	Species.	Length and diameter of trunk.
BEECH or MYRTLE	Corylaceæ	Fagus cunninghamii	40 ft. × 2 ft. to 4 ft.
BIRCH	Sapindeæ	Dodonæa viscosa	3 ft. × 6 in.
BLACK WATTLE	Leguminosæ	Acacia decurrens	12 ft. × 1 ft. 6 in.
BLACKWOOD	„	„ melanoxylon	30 ft. × 2 ft. to 4 ft.
BOOBYALLA	Myoporaceæ Leguminosæ	Myoporum insulare Acacia longifolia	3 ft. × 6 in. 4 ft. × 8 in.
BOX, NATIVE	Pittosporeæ	Bursaria spinosa	6 ft. × 1 ft. 6 in.
DOGWOOD	Rhamneæ	Pomaderris apetala	10 ft. × 10 in.
GUM, BLUE	Myrtaceæ	Eucalyptus globulus	120 ft. × 2 ft. to 6 ft.
„ CIDER	„	„ gunnii	20 ft. × 2 ft.
„ IRONBARK	„	„ sieberiana	40 ft. × 4 ft
„ MUELLER'S	„	„ muelleri	80 ft. × 3 ft.
„ PEPPERMINT	„	„ amygdalina	100 ft. × 3 ft. to 6 ft.
„ RED	„	„ stuartiana ? „ acervula	60 ft. × 3 ft.
„ STRINGY BARK	„	„ obliqua	120 ft. × 3 ft. to 6 ft.
„ TOPPED STRINGY BARK	„	„ hæmastoma ? „ amygdalina var.	100 ft. × 3 ft. to 4 ft.
„ SWAMP	„	„ regnans	100 ft. × 3f. to 8ft.
„ WEEPING	„	„ coriacea „ pauciflora	10 ft. × 2 ft.
„ WHITE	„	„ viminalis	80 ft. × 3 ft. to 6 ft.
HE-OAK	Casuarineæ	Casuarineæ suberosa	4 ft. × 1 ft.
HOLLY or COFFEE PLANT	Rubiaceæ	Coprosma hirtella	3 ft. × 6 in.
HONEYSUCKLE	Proteaceæ	Banksia marginata	6 ft. × 1 ft. to 2 ft.
HORIZONTAL	Saxifrageæ	Anodopetalum biglandulosum	12 ft. × 10 in.
IRONWOOD	Oleaceæ	Notelæa ligustrina	12 ft. × 1 ft. 6 in.
LABURNUM	Leguminosæ	Goodia latifolia	3 ft. × 6 in.
LANCEWOOD	Rutaceæ	Eriostemon squameus	20 ft. × 8 in.
LAUREL, NATIVE	Saxifrageæ	Anopterus glandulosus	3 ft. × 6 in.
LEATHER-WOOD	„	Eucryphia billardieri	10 ft. × 1 ft.
MINT-TREE	Labiatæ	Prostanthera lasianthes	3 ft. × 6 in.
MUSK	Compositæ	Olearia argophylla	6 ft. × 1 ft. 6 in.
NATIVE CHERRY	Santaleæ	Exocarpus cupressiformis	6 ft. × 1 ft.
NATIVE CURRANT	Rubiaceæ Epacrideæ Santaleæ	Coprosma microphylla Lupcopogon richei Leptomeria billardieri	3 ft. × 6 in.
„ PEAR	Proteaceæ	Hakea acicularis	
„ PEPPER	Magnolieæ	Drimys aromatica	6 ft. × 1 ft.
PINE, CELERY-TOP	Coniferæ	Phyllocladus rhomboidalis	25 ft. × 1 ft. to 3 ft.
„ HUON	„	Dacrydium franklinii	30 ft. × 2 ft. to 6 ft.
„ KING WILLIAM	„	Athrotaxis sleaginoides	30 ft. × 1 ft. to 6 ft.
„ OYSTER BAY	„	Frenela rhomboidea	10 ft. × 6 in. to 1 ft.
PINKWOOD or ROSEWOOD	Euphorbiaceæ	Beyera viscosa	12 ft. × 1 ft.
PRICKLY MIMOSA	Leguminosæ	Acacia diffusa	4 ft. × 6 in.
SASSAFRAS	Monimiaceæ	Atherosperma moschata	15 ft × 1 ft. to 3 ft.
SCENTWOOD	Apocyneæ	Alyxia buxifolia	3 ft. × 3 in. to 6 in.
SHE-OAK	Casuarineæ	Casuarina quadrivalvis	6 ft. × 1 ft. 6 in.
SILVER WATTLE	Leguminosæ	Acacia dealbata	12 ft. × 1 ft. 6 in.
TEA-TREE	Myrtaceæ	Leptospermum lanigerum	10 ft. × 6 in.
„	„	Kunzea corifolia	10 ft. × 6 in.
„	„	Melaleuca gibbosa	10 ft. × 6 in.
„	„	„ squarosa	10 ft. × 1 ft.
„	„	„ ericæfolia	20 ft. × 2 ft.
WARATAH	Proteaceæ	Telopea truncata	3 ft. × 6 in.
WHITE WARATAH	„	Agastachys odorata	3 ft. × 6 in.
WHITEWOOD TALLOW-WOOD	Pittosporeæ	Pittosporum bicolor	6 ft. × 1 ft.

TIMBER TREES.—(A. O. Green.)

Strength. $S=\frac{LW}{4bd^2}$	Specific Gravity. Well seasoned.	Well seasoned samples weight per cubic ft.	Remarks as to use, &c.
		lbs.	
2712–2804	·62–·85	39-54	General carpentry, cooper's work, furniture, 2 varieties, red and white. Plentiful.
..	..	..	Turnery, inlaying, &c. Common.
2050	·9	56	Ornamental wood, with variety of eolours. Common.
2300–2744	·616	37–40	A handsome joiner's and cabinet-maker's wood. Common.
..	..	..	Tough, suitable for wooden hoops, &c. Common on coast.
..	·837	52	Turners. Engraving blocks, &c. Common. [north.
..	·744	46	Mathematical instruments, cabinet and turner's work. Common in
2000–3500	·84–1·09	52–68	Buildings, railways, bridges, furniture, &c. Plentiful.
2400	·700	44	Inside work.
2400	·896	55–60	Buildings, railways, bridges, furniture, &c. Plentiful.
3200	1·001	63	” ” ” ” ”
2600	·75–1·039	46–65	” ” ” ” ”
2260	1·052	66	” ” ” ” ”
1800–3600	·77-1·05	48–66	Most durable, suitable for all purposes. Plentiful.
1500–2400	·776–·8	48–51	Suitable for carpenters, joiners, house fittings, floors, &c. Plentiful.
1400–3000	·776–·85	48–54	Plentiful. Very strong wood for nside w ork.
..	..	..	Common. Capentry and fencing.
1646 1788	·7–.76	44–48	For carpenters, joiners, house fittings, floors, &c. Plentiful.
..	·863	54	Cabinet-maker's and ornamental work; bold figure. Common.
..	·675	42	Cabinet-maker's and ornamental work. Common.
..	·700	44	A tough elastic wood for implements, tools, &c. Common.
3000	·875	58	Pulleys and bearing blocks, similar to *lignum vitæ*. Common N.E.
..	..	..	Turnery and inlaying.
..	·801	50	Turnery and Implements. Common.
..	..	..	Ornamental work. [Coast.
3200	·7	42-44	A light, tough, and elastic wood for implements, &c. Common West
..	..	..	Ornamental work.
..	·675	42	Handsome wood, for joiner's and cabinet-work. Common.
..	·790	49	A-red brown wood for cabinet-work. Common.
..	·739	46	Turnery and tools; handsome grain. Common.
..	..	..	Turnery, &c.
..	..	..	Common North and West.
2300	·65–·7	41–44	A dense, strong pine: general carpentry. Common N. and W.
1218	·529	33	Durable pine, often handsomely figured. Common W. Coast.
1019	·336–·385	21–24	Extremely light, strong, straight-grained. Common W. Coast.
..	·625	39	A strong pine for framing, poles, &c.; very durable. Local, East
..	·75	47	Tools, turnery, &c. [Coast.
..	..	..	Ornamental and implements. [mon.
..	·652	41	Plain, light-coloured, good for carving if felled in the winter. Com-
..	..	..	A sweet-scented wood for sachets, &c. Local, North Coast.
..	·663	41	A handsome, ornamental wood for cabinet-work. Common.
..	·775	48–49	Straight-grained, elastic wood, of general utility. Common.
..	·801	50	A tough wood for implements, tools, &c. Common.
..	..	..	” ” ” ”
..	..	..	” ” ” ”
..	..	..	” ” ” ”
..	·750	47	” ” ” ”
..	..	..	Turnery and inlaying.
..	·652	41	”
..	·801	50	Engravers, &c.

BOTANICAL DESCRIPTIONS OF EUCALYPTI.

By L. RODWAY.

Eucalyptus globulus (*Labillardiere*).—Tall, erect tree, even in exposed situations, tending to preserve a preponderating main-stem till the high forest age is reached, the branches few and acutely diverging; bark deciduous. Mature foliage alternate, stalked, lanceolate, acute, oblique, 6 to 12 inches long, 1 to 2 inches wide. Flowers solitary in the leaf axils. Outer operculum smooth, shed while the bud is approaching maturity; calyx and inner operculum rough, warted, and obscurely four-ribbed; mature calyx about ¾ inch in diameter; anther-cells parallel. Fruit broadly obconic, ¾ to 1 inch in diameter; capsule slightly protruding; valves obsolete. In Eastern Victoria the common form of this tree bears a three-flowered umbel in the axil, the flowers being half the size recorded in the type, and less warted. In Tasmania, where this species and *E. viminalis* are mixed, a form will occasionally be found consisting of odd trees in which the flowers are in threes, the operculum and fruit quite smooth, and the fruit about ⅓ to ½ inch in diameter, the valves much protruding. This, though very close to the Victorian form, may be a hybrid.

Eucalyptus viminalis (*Labillardiere*).—Very variable, rarely exceeding 50 to 70 feet; tending to diffuse branching. Bark usually smooth and deciduous, but sometimes scaly and persistent, even to the upper branches. Leaves oblique, lanceolate 2½ to 6 inches, narrow to broad. Flowers usually in threes, in the axils, seldom the umbel bearing many flowers. Operculum smooth, about as long as the calyx, dome-shaped to pointed; calyx smooth, obconic, about 2 to 4 lines long; anther-cells parallel. Fruit 3 to 5 lines diameter, hemispheric; valves of the capsule protruding.

Eucalyptus coriacea (*A. Cunningham*), *E. pauciflora* (*Sieber.*)—Attaining in favourable situations 60 to 70 feet; much branched, and rather spreading. Bark smooth, and deciduous from the base. Leaves alternate, oblique, lanceolate, and usually rather broad, 4 to 8 inches long, the primary veins bold, few, nearly as large as and nearly parallel with the midrib, giving the leaf a penninerved appearance. Flowers many, in axillary umbels. Operculum hemispheric, very short; calyx hemispheric, about 3 lines diameter; anther-cells diverging; stamens all or nearly all complete. Fruit pear-shaped, about 4 to 5 lines long; capsule sunk.

Eucalyptus sieberiana (*F. v. Müeller*).—A tree often attaining a considerable size, the main stem tending to predominate, but not as much so as in *E. globulus*. Bark persistent, thick, and furrowed to the branches. Leaves alternate, oblique, lanceolate, rather broad, 4-6 inches long; the veins not numerous, much smaller than the midrib, and coming off and travelling at a very acute angle. Flowers many, in axillary umbels, the common stalk much flattened; operculum very short, hemispheric. Calyx hemispheric, about 2 lines diameter; outer stamens without anthers; anthers with diverging cells. Fruit pear-shaped, capsule sunk, about 4 to 6 lines diameter.

Eucalyptus hæmastoma (*Smith*).—A tall, erect tree, the main stem preponderating; branches few and sub-erect. Bark smooth, deciduous, except fibrous towards the base. Leaves lanceolate, oblique, about 6 inches, veins few, obtuse, obscure, netting freely. Flowers many, in axillary axils, the common stalk rather long and flat. Operculum short, hemispheric; calyx hemispheric, about 2 lines diameter, on a relatively-long stalk. Outer stamens barren; anthers with divergent cells. Fruit broadly pear-shaped, 3 to 4 lines diameter, the rim broad and red, capsule nearly level; the valves usually protruding.

Eucalyptus obliqua (*L'Heritier*).—In shady situations, with a tall, preponderating stem, branches sub-erect; in the open, a medium-sized tree with spreading branches, and an undefined stem in the branching portion. Bark normally persistent, thick and fibrous to the upper branches; at an altitude the bark tends to become thinner and more deciduous, even to the base. Leaves 4 to 5 inches long, ovate, acute, oblique, very unequal-sided; veins few, freely netting. Flowers many, in axillary umbels; operculum very short, convex; calyx about 3 lines diameter, tapering into the stalk. Stamens all perfect; anthers with diverging cells. Fruit pear-shaped, about 4 lines diameter; capsule sunk.

Eucalyptus regnans (*F. v. Müeller*).—A tree attaining very large proportions, with a preponderating stem, except where grown in open lowlands. Bark thin; fibrous at the base, deciduous above. Leaves in the typical tree ovate-lanceolate, oblique, about 2 inches long, rather thick; veins few, obscure; in aberrant forms, the leaves are broad and very oblique. Flowers many, in axillary umbels. Operculum short and convex. Calyx obconic, about 2 lines diameter. Stamens all perfect; anther-cells diverging. Fruit turbinate, or sometimes approaching a pear-shape, about 2½ to 3 lines diameter.

Eucalyptus amygdalina (*Labillardiere*).—Most variable in stature, flowering when a small shrub, or attaining 100 feet or more; stem preponderating, except in some open situations, where the branches may spread. Bark thick, persistent, and fibrous in the typical form, deciduous and smooth from the base in some narrow-leaved forms, but not in others (*E. linearis, Denh.*). Leaves very variable, narrow lanceolate in the type, but varying from narrow linear to ovate; nearly equal-sided, veins few and obscure, 2 to 4 inches long. Flowers many, in axillary umbels: operculum short, convex; calyx hemispheric, mostly 2 lines diameter, sometimes more, anther-cells diverging. Fruit nearly hemispheric, rarely tending to pear-shaped, about 2½ lines diameter; capsule level with the rim, or slightly sunk.

Eucalyptus müelleri (*T. B. Moore*).—A tall, erect tree, with a preponderating stem, in suitable situations attaining even 200 feet height. Bark deciduous, smooth from the base. Leaves oblong, nearly or quite equal-sided, thick and shiny, alternate and stalked, 2 to 3 inches long. Flowers three together, in axillary umbels, the stalks all very short. Operculum short, hemispheric, and usually with a blunt central point. Calyx hemispheric, about 4 lines diameter; anther-cells parallel. Fruit turbinate (whiptop-like), about ½ inch diameter, valves usually protruding. This tree differs but slightly in structure from *E. vernicosa, Hooker*, and may be but a luxuriant form.

Eucalyptus urnigera (*Hooker*).—A tall, erect tree, with a preponderating stem. Bark smooth and deciduous. Leaves oblong, equal-sided, and about 2 to 3 inches long in sub-Alpine situations, but gradually becoming even linear and 6 to 9 inches long at a lower elevation. Flowers three together, in axillary umbels, the stalks and common stalks long. Operculum from very short and nearly flat to hemispheric and umbonate (centrally projecting); according to elevation. Calyx in sub-Alpine plant narrow ovate, and much constricted below the rim, about ½ inch long. Fruit similar in shape, but about ¾ inch long; the capsule much sunk. In lowland forms the fruit is sub-globose, and about ½ inch long, with the capsule slightly sunk; anther-cells parallel.

Eucalyptus acervula (*Hooker, not of Sieber*).—A medium-sized tree, with a strong tendency to branch, close to *E. gunnii*, and combined with it by *von Müeller* and some Continental botanists. Bark smooth above, coarsely scaly below. Leaves broadly oblong, thin, and rather shining, often undulated, equal or nearly equal sided, 2 to 4 inches long. Flowers many, in axillary umbels. Operculum hemispheric, with a well-developed apex. Calyx 2 to 3 lines diameter, hemispheric; anther-cells parallel. Fruit obconic, 3 to 4 lines diameter; capsule slightly sunk.

Eucalyptus risdoni (*Hooker.*)—A small to medium-sized tree, with a branching, often drooping, tendency. Leaves in the typical form apposite and connate, but often, without reference to size or locality, becoming, except where very young, alternate, stalked, oblique, narrow, ovate-lanceolate, few and obscurely veined, 2 to 6 inches long. Flowers many, in axillary umbels. Operculum very short, nearly flat, and rough. Calyx about 3 lines diameter, hemispheric; anther-cells diverging. Fruit hemispheric, or sometimes pear-shaped, about 4 lines diameter; capsule hardly or not at all sunk. Closely allied to *E. amygdalina* (*Labillardiere*), and combined with it by *von Müeller.*

This completes the list of *Eucalypts* that attain size enough to yield timber.

LOCAL NAMES AND GENERAL APPEARANCE OF GUM TREES.

Local Names.

Blue-gum.—*E. globulus* (*Labillardiere*).

White-gum.—*E. viminalis* (*Labillardiere*).—This is also called Manna-gum and Swamp-gum.

Weeping-gum.—*E. coriacea* (*A. Cunningham*).

Iron-bark.—*E. sieberiana* (*F. v. Müeller*).

Gum-topped Stringy.—*E. hæmastoma* (*Smith*). Also called White-topped Stringy.

Stringy-bark.—*E. obliqua* (*L'Heritier*).

Swamp-gum.—*E. regnans* (*F. v. Müeller*). Also known as Mountain Ash, Gum-topped Stringy, Peppermint-topped Stringy, &c.

Black Peppermint.—*E. amygdalina* (*Labillardiere*). This usually includes all Peppermints with stringy-bark.

White Peppermint.—*E. linearis* (*Dehnhart*). Peppermints with narrow leaves and smooth white bark, the persistent portion at the base scaly.

BLUE PEPPERMINT.—*E. risdoni var elata.* Also known as White-gum and Cabbage-gum.
RED-GUM.—*E. acervula (Hooker).*
MOUNTAIN RED-GUM.—*E. Müelleri (Moore).*
DROOPING-GUM.—*E. risdoni (Hooker).*
CIDER-GUM.—*E. gunnii (Hooker).*
MOUNTAIN PEPPERMINT.—*E. coccifera.*
E. urnigera (Hooker), E. cordata (Labillardiere), and *E. vernicosa (Hooker),* have not yet received generally-accepted popular names, and will be referred to here as the Urn-bearing, Heart-leaved, and Dwarf-gum respectively.

Blue-gum is usually easily recognised in the forest by its erect habit, the stem, even in the branching portion, remaining distinct, and the branches few and erect. This habit is shared by few other species, and from those it may be distinguished by the character of the bark, which is scaly and never fibrous at the base, and above smooth, green to grey, and stripping off in long ribbons. *Stringy-bark,* on the other hand, except where close growth compels it, seldom acquires the same erect preponderating stem; the branching is more copious and spreading, and the bark in the typical forms persistent, and fibrous to the upper branches. In trees at a considerable elevation the bark is less persistent, and in many cases is shed from close to the base, but the base is still fibrous. The *Peppermints* vary greatly, and are primarily distinguished in the open by their small leaves; in critical cases reference will have to be made to the scientific description to avoid error. *Black Peppermint* has the erect habit, and a persistent, dark, fibrous bark to the upper branches, but forms are constantly met with where the persistent bark is not as copious. Stunted forms of this, which flower when merely shrubs, have a tendency for the bark to turn scaly. *White Peppermint* has a much more branching and spreading tendency, the bark white and smooth from the base, where the persistent bark is coarsely scaly. *Blue Peppermint* has the habit and bark of the last, but the leaves are much larger and broader, and the fruit larger; it is a connecting-link with *Drooping-gum,* which again has the same habit and bark, but the leaves are in pairs opposite one another, and *joined at the bases.* *Mountain Peppermint* is very similar to *Blue Peppermint,* but the leaves are still broader, and the fruit very much larger, and often three together, a feature not found in other *Peppermints.* *Swamp-gum* is the name given to a perfect series of forms connecting *Black Peppermint* with *Stringy-bark.* In the typical form the habit is that of *Blue-gum,* but the persistent bark, though thin, is fibrous, and continues a considerable distance up the stem; but in parts, however, the bark is deciduous from close to the base, and strips off above in ribbons, as in *Blue-gum,* leaving besides the more critical details merely the basal bark for identification. *Iron-bark* has the habit of a large *Stringy-bark,* but the persistent bark is nearly black, very thick, and coarsely furrowed. It occurs only on the North-Eastern portion of the State. *Gum-topped Stringy* is very similar to the latter, but tends to be more erect in habit, and the bark is less coarse and less persistent. It also is confined to the same locality. The name, when applied in other parts, refers to other species. *Weeping-gum* varies in habit, being erect, with a preponderating stem in damp forests, and much branched, spreading and drooping in the open. The bark is smooth from the base, and green to nearly white in colour. To distinguish it it is very necessary to examine the leaves, the parallel venation of which at once separates it from any form but *Iron-bark.*

White-gum seldom exceeds the dimensions of a small tree, with a much branched and spreading habit—the main stem soon lost in branches. The bark varies in deciduousness, is sometimes smooth and white from the base, sometimes persistent to the upper branches; this persistent bark is never fibrous, but more or less scaly. The leaves of this tree are most variable; they run from the shape and size of a typical *Blue-gum* to small and narrow-linear, as in narrow-leaved *Peppermints.* Reference is already made in the botanic description of *Eucalyptus globulus* to the probable hybridisation with this species.

The *Cider-gum* of the Midlands and Lake Country is more cf the character of a large bush, seldom exceeding 20 feet. The bark is smooth and white from the base; some forms have, when young, large round leaves opposite in pairs, and joined at the base, but this seldom continues long after the flowering period is reached. The leaves of this Gum are not oblique, but equal-sided, and the flowers are always three together.

Red-gum is very closely allied to the last, and in Australia is often considered but a form of it. It is a small to medium sized tree, much branched and spreading. The bark is persistent more or less up the stem, and is coarsely scaly. The leaves are equal-sided, shining, and often undulated on the margin. The flowers usually six to eight together. The name *Red-gum* has merely a local significance, as it has no relationship to the various Red-gums of Australia.

Mountain Red-gum is a different tree altogether; it has a tendency to a tall central stem, but is much influenced by surroundings, attaining a height of 150 feet in some parts, dwindling down to a mere shrub in others. The bark is smooth from the base, green, blotched with red-brown. *Dwarf-gum* is very close to this in form of organs, but appears to maintain a distinct character. It seldom exceeds 3 to 5 feet in height. Leaves are small, nearly round, opposite but stalked, equal-sided, thick, and shiny. The flowers are solitary or three together. It appears to occur only on the sub-alpine plains of the West and South-West.

The *Urn-bearing gum*, at an altitude of about 2000 feet, is exactly similar to the *Mountain Red-gum* in general appearance, both of habit, bark, and foliage, but the fruit is shaped like a Grecian urn. Below this altitude the bark becomes ashy-white, the leaves long and narrow, and the fruit approaches the fruit of *White-gum.* The *Heart-leaved gum* is a small, erect tree, with a smooth bark, the old bark being shed in scales. The leaves are pale and opposite in pairs, but, unlike those of *Drooping-gum*, are not united by their bases.

L. RODWAY.

NOTES ON TASMANIAN CONCHOLOGY.

By C. Hedley, F.L.S.

(Read June 10th, 1902.)
(Issued June 17th, 1902.)

(*Plate.*)

The study of Tasmanian conchology has been facilitated by an excellent catalogue published last year by the late Prof. Tate and Mr. W. L. May in the Proceedings of the Linnean Society of New South Wales. Therein certain species ascribed to Tasmania by the Rev. J. E. Tenison Woods were rejected from the fauna chiefly because no later observer had taken them. Though apparently of foreign origin, their exclusion could not be wholly justified until that origin was ascertained. At the invitation of Messrs. A. Morton and W. L. May I undertook their examination. From the result it appears that five West Indian species were supplied to Tenison Woods, which he erroneously described as Tasmanian, and as new to science. They are :—

Pleurotoma weldiana, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 137, identical with *Drillia fucata*, Reeve, Conch. Icon. Pl. xx., f. 169.

Ethalia tasmanica, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 146, is the common West Indian *Modulus modulus*, Linne.

Adeorbis picta, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 146, is *Chlorostoma fasciatus*, Born, Woods's type answers well to fig. 2a of Pl. 63 of Fisher's Monograph in the "Coquilles Vivantes."

Astele turbinata, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 145, is *Chlorostoma scalare*, Anton, another well-known West Indian shell.

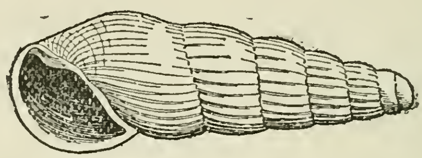
Semele warburtoni, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 158, is *Codakia orbicularis*, Linne; a common Antillean species

An examination of the type of *Turbo cucullata*, Ten. Woods, Proc. Roy. Soc. Tas , 1877 (1879), p. 121, shows it to be *T. radiatus*, Gmelin ; a shell common to tropical Queensland. Another unrecorded synonym of this appears to be *T. pallidus*, Perry, Conchology, 1811, Pl. 49, f. 5.

Having inspected the type of *Chione macleayna*, T. Woods, Proc. Roy. Soc. Tas., 1879, p. 38, I consider it identical with *C. stutchburyi*, Gray ; a common New Zealand species, and therefore probably not Tasmanian.

Allportia expansa, Ten. Woods, Proc. Roy. Soc., Tas., 1876 (1877), p. 28. At my request Miss Lodder sent me some examples of this species. The material received corresponded exactly to Wood's description, and was, I believe, rightly identified. It is certainly not a mollusc, but a planarian. My friend, Mr. T. Whitelegge, considered that it is probably *Polycelis australis,* Schmarda. It had better be excluded from the molluscan catalogue.

The existence of the order Heteropoda in Tasmanian waters has been overlooked by Tate and May. The occurrence in Bass Straits of a species of FIROBOIDA is noted by Macdonald. Trans. Roy. Soc., Edinburgh, xxiii., 1862, p. 5, pl. i., ff. 1-4.



RISSOINA GERTRUDIS, Ten. Woods, Pro. Roy. Soc., 1876, p. 146. This species approaches *R. elegantula,* Angas; whether or not intermediate forms unite these two, I leave to the decision of those better acquainted with the species. The illustration published by Tryon is very bad; possibly it was based on a different species. I add a drawing of the type specimen in the Tasmanian Museum.

CYCLOSTREMA WELDII, T. Woods. It is generally admitted that this and *C. australe,* Angas are synonymus. Tate and May regard the latter as having priority, but Pritchard and Gatliff award it to *C. weldii.* As a matter of fact, *C. weldii* was published Feb. 27th, 1877, and *C. australe* on June 1st, 1877.

TROCHUS RINGENS, Menke Fischer, in the Coquille Vivantes, Troque, 1879, p. 214, notes this species from "Ile Van Diemen." It is not included in any Tasmanian catalogue.

NOTE ON *EUCALYPTUS LINEARIS*, DEHNHARDT.

(A Supposed Tasmanian Species.)

By J. H. Maiden, Director Botanic Gardens, Sydney, Corresponding Member.

(Read July 8th, 1902.)

(Issued July 23rd, 1902.)

In a paper entitled "The Common Eucalyptus Flora of Tasmania and New South Wales," read by me before the Australasian Association for the Advancement of Science at its Hobart meeting last January, I drew attention to a small smooth-barked Mount Wellington tree, closely related to *Eucalyptus amygdalina*, Labill., and considered to be *E. linearis*, Dehnhardt.

I have recently received for study, from the Imperial Natural History Museum of Vienna, a type specimen of Dehnhardt's species, which is, however, in bud only. The original label in Dehnhardt's handwriting is in German, of which the following is a translation :—

"I pray you read my description in the Catalogue. The tree is 40ft. high, with a slender stem, and flowers the second time."

The reference to the "Catalogue" is doubtless to the "Catalogus plantarum horti Camaldulensis," which contains the description of the species, and which I have given in full in my paper already referred to. The work in question was published at Naples, and I understand the Hortus Camaldulensis was a garden near that city. The first edition was published in 1829, and the second in 1832, and should be noted in case any claims for priority arise.

Dehnhardt's plant is, without doubt, a cultivated one, and bearing in mind the marked way in which seedling Eucalyptus plants differ from their parents, it is not likely to be absolutely identical with the Mount Wellington plants to which it has been referred. The idea becomes stronger with me that *E. linearis*, Dehn., will prove to be a perfectly smooth-barked form of *E. amygdalina*, with unusually thin, linear leaves. If so, this form of *E. amygdalina* might be named var. *linearis*.

My researches in European herbaria in regard to this genus has brought to light another named species which is con-specific with *E. linearis*. It is *E. pulchella*, Desfontaines.

The original work not being in any Australian library, I obtained a copy of the description from Kew. It is as follows :—

"*Eucalyptus pulchella*, Desf. Ramulis filiformibus; foliis alternis, lineari-subulatis: floribus axillaribus, umbellatis, operculo convexo, mucrone obtuso, brevissimo.

"Ramuli filiformes, paniculati. Folia uncias 2 longa, lineam 1 lata, utrinque acuta. Petioli breves. Flores in umbellulas axillares dispositi. Pedunculus communis folio multoties brevior, 10-12—florus."

(*Cat Hort. Paris.* Ed. 3, 408, 1829.)

Dehnhardt contracts this description into:—

"*Eucalyptus pulchella.* Ramulis filiformibus; foliis alternis lineari-subulatis. Ramulis filiformibus panicularis. Folia uncias 2 longa, lineam 1 lata."

(Dehnh. *Cat. Pl. Hort. Camald.* Ed. 2, p. 20.*)

Walpers' description, published in 1845, is also adapted from the original, and is as follows:—

"Ramulis filiformib foll. alternis lineari-subulatis, florib. axillarib. umbellatis; operculo convexo, mucrone obtuso brevissimo.—Crescit——— ?"

(Walpers' *Repert.* III. 927.)

Bentham perhaps saw the species, but he pronounces it to be "very doubtful"

I have recently received some specimens from the Vienna Herbarium labelled "*E. pulchella*, Hort., Kew." They are in bud, and are identical with *E. linearis*, Dehn.

Undoubtedly the name *pulchella* was well bestowed, for the specimens have especially long, narrow, linear leaves, which are very graceful.

The upshot of my investigation is that:—

E. linearis, Dehnhardt, and *E. pulchella*, Desfontaines, are specifically identical. Both were named from plants raised in Europe. In my Australasian Association for the Advancement of Science paper I have put forth a plea for a final investigation by Tasmanian botanists as to whether a certain Mount Wellington tree is identical with *E. linearis*, Dehnh., and, if so, whether it is con-specific with *E. amygdalina*, Labill.

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* In my A.A.A.S. paper I quote *E. pulchella*, and also *E. rubricaulis*, as they follow Dehnhardt's description of *E. linearis*. My identification of *E. pulchella* is given below. I have also seen *E. rubricaulis*, Desf., which is not identical with *E. linearis*, and may not be a Eucalyptus at all.

NOTES ON SOME REMARKABLE TASMANIAN INVERTEBRATES.

By Arthur M. Lea, F.E.S., etc.

(Read July 8th, 1902.)

(Issued July 23rd, 1902.)

(*Plate.*)

Under the above heading I propose from time to time to give notes on some remarkable Tasmanian insects, and probably other invertebrate forms of life. The notes, whenever possible, will be illustrated with sketches. The present deals with one of the walking-stick insects, being the first record of the occurrence of this remarkable family (*Phasmidæ*) in Tasmania.

Acrophylla tasmaniensis, n. sp.

Of a dingy, testaceous brown; wings black, costal area on its basal half variegated with yellow and black, the outer half testaceous brown. Antennæ very finely pubescent.

Head without granules, anterior half wrinkled; ocelli absent. Antennæ thin, joints 23 in number, first the length of second and third combined, second slightly more than half the length of third, terminal joint almost the length of the three preceding combined. Prothorax not quite as long as head, surface wrinkled, and with a few very small granules. Mesothorax more than twice the length of prothorax and head combined, with small scattered spines. Tegmina nearly three times as long as wide, apex rounded. concealing about half the length of the folded wings. Wings about once and one-half as long as wide, the costal area about one-third of the whole. Abdomen about two-thirds of the total length of body, fifth segment inflated on each side posteriorly, sixth raised in middle of base; anal styles long, parallel-sided, somewhat wavy, apex rounded. Meso- and metasternum with a few small granules; ovipositor longer than three apical segments. Legs long and thin, anterior femora serrate, the others with small spines, of which the largest are on the middle of the upper surface; tibiæ feebly spinose (the anterior almost bare of spines), the intermediate each with a large tooth on the upper surface before the middle.

Lengths in millimetres:—Head, 8 [*5½]; prothorax, 7 [5]; mesothorax, 31 [19]; metathorax, 16 [13]; abdomen (exclusive of anal styles), 89 [54]; antennæ, 26 [11½]; anal styles, 20 [8]; anterior femora, 39 [23], tibiæ, 42 [26], tarsi, 16 [11]; intermediate femora, 28 [18], tibiæ, 30 [18], tarsi 13 [8½]; posterior femora, 34 [20], tibiæ, 38 [22], tarsi, 15 [10] ; tegmina, 19 [2½] ; wings, 20 [3] ; total length (including anal styles), 170† [102].

Habitat, Burnie.

(Presented to the Tasmanian Museum by Miss Dora Shoobridge.)

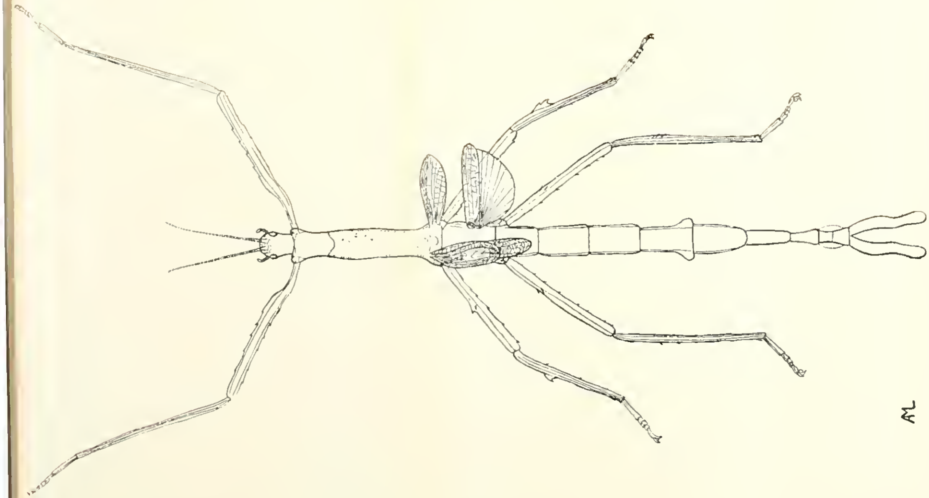
The specimen (a female) appears to be somewhat discoloured, as there are traces of green on the mesothorax under surface of tegmina and anal styles ; the ovipositor is also somewhat damaged. The large tooth of the intermediate tibiæ is single on the left, but double on the right.

The species appears to be allied to *A. chronus* (Westwood, Catalogue of Phasmidæ, p. 114, supplementary plate V., fig. 2), but should be distinct on account of the posteriorly inflated fourth abdominal segment and large teeth of the intermediate tibiæ. From Westwood's figure it differs in the shape of the tegmina and length of wings ; the latter, however, are described as being very variable in length. The colours of the wings are very different to those given for *chronus*, the membranous portion being entirely black, whilst in the figure it is drawn (and also so described) as being variegated. The serrations and spines of the legs are also very different to those on Westwood's figure.

An immature specimen, evidently belonging to this species, was presented to the Department of Agriculture by Mr. W. C. Weymouth. Its antennæ consist of but 24 joints each. The spines and serrations of the legs are the same as in the type, even to the peculiar dentition of the intermediate tibiæ. The tegmina and wings are very small, of almost equal size and shape, and of a dull greenish yellow, with thickened edges, they look like scales. The general colour of the body is rather paler than that of the type.

* The lengths given in brackets are those of the immature specimen.

† It is, therefore, the longest (although not the largest) insect at present known to occur in Tasmania.



NOTE ON A SPECIES OF EUCALYPTUS NEW TO TASMANIA.

By J. H. Maiden, F.L.S. (Corr. Member),

Director, Botanical Gardens, Sydney.

(*Read September 8th*, 1902.)

(Issued September 10th, 1902.)

Eucalyptus Macarthuri, Deane and Maiden, between Deloraine and Chudleigh Junction, January, 1902.

Swanport, Dr. Story (labelled *E. Stuartiana*, by Mueller).

For an account of this species see Proc. Linn. Soc. N.S.W., 1899, 448, with figure. Its discovery in Tasmania was the outcome of the Australian Association for the Advancement of Science Meeting at Hobart, and came about in the following way:—Mr. R. H. Cambage, L.S., of Sydney, was travelling in the train between Deloraine and Chudleigh Junction when he espied a rather umbrageous tree, with fibrous bark up to the branchlets, in grassy flats or depressions, which become filled up with water during the wet weather, on the right bank of the Meander River. From its situation and habit of growth he considered it might be *E Macarthuri*, which he had seen in New South Wales. When he came to the above meeting at Hobart he communicated to me his suspicions, and as it was impossible for him to examine the tree personally, I made a special journey to Deloraine, found the tree in question, and obtained specimens, which proved the species to be E. *Macarthuri*, Deane and Maiden. I have since seen specimens in the Melbourne Herbarium, collected by the late Dr. Story at Swanport, Oyster Bay, Tasmania, and referred to by Mueller at the time to be *E. Stuartiana*. Further inquiry will doubtless greatly extend the range of the species, which will probably be found in Victoria also ere long.

We thus add an additional Eucalyptus species to the flora of Tasmania, which now stands at 18, since in my paper on "The common Eucalyptus flora of Tasmania and New South Wales," read at the Hobart meeting, I produced evidence that the number stood at 17.

This species of Eucalyptus promises to have commercial importance through the researches of Mr. H. G. Smith, who has shown that its oil contains geranyl acetate in large quantities, which oil, when rectified, has a delicious odour of roses, which is remarkable in the genus. As I do not know the extent to which this interesting species occurs in Tasmania, it will be desirable for oil distillers not to fell the trees, but to lop the branches only.

A. De Candolle, in his Prodromus, iii., 218, described a plant under the name of *Eucalyptus pilularis*, Smith, which is not that species. The plant must be referred to as *E. pilularis*, A. DC., and following is a translation of his description :—

"Operculum conical, with a rather shorter calyx tube, the peduncles very short and subangular, flowers 6 or 7 in the head, leaves linear-lanceolate acuminate, with the veins confluent at the tops into an intramarginal one. New Holland, Sieber, plant exs. nov. holl. No. 474. I doubt whether this specimen of Sieber's that I have described is Smith's species or not? Is Sprengel's species different by reason of its corymbose inflorescence? Our flower-buds, the size of a grain of millet, peduncles 2 or 3 lines, nearly one half shorter than the petioles. Leaves 3 inches long and 5 lines broad."

It will be thus seen that the plant is Sieber's No. 474, an original specimen of which I have been able to examine from two sources (*a*) The Berlin Herbarium; (*b*) The Barbey-Boissier Herbarium at Geneva. The first specimen is in bud only, and the second is in bud and fruit. It turns out to be *E. Macarthuri*, Deane and Maiden, and thus the identity of a puzzling plant has been set at rest. Sieber's No. 474 is in Bentham's Flora Australiensis, iii., 240, referred to *E. viminalis*, Labill: which is a mistake.

This erroneous reference to *E viminalis* reminds me to warn collectors that some small fruited multiflowered forms of *E. Gunnii* (*e.g.*, vars: *acervula, maculosa,* and perhaps *rubida*) may, in the absence of notes on the bark and suckers, be referred to *E. Macarthuri.*

PRACTICAL ASTRONOMY IN TASMANIA, AND A PROPOSAL FOR A SCHOOL THEREOF.

By Professor Alex. McAulay, M.A.

(*Read September 8th*, 1902.)

The leading English scientific newspaper "Nature," dated 24th July, 1902 (p. 304), has a paragraph on the present condition of meteorology in Australia. It is worth reading:—

> "We understand from recent Queensland newspapers that it has been determined to abolish the Weather Bureau of that colony as from the 30th ult., and that the services of Mr. C. L. Wragge and his special staff have been dispensed with. In a letter addressed by the Premier of Queensland to the Federal Prime Minister it is pointed out that this apparently retrograde step is owing to the urgent necessity for reducing in every branch of the public service the estimates of expenditure of the State, and that it is one of the "most unfortunate" results of the large deficit in the revenue brought about by drought and other causes. Prior to federation, the Weather Bureau formed part of the Post and Telegraph Department of Queensland, and all telegrams and correspondence passed free. But during the last fifteen months the Federal Government has charged for these communications at the rate of about £4,000 a year, which expense cannot be borne any longer by the Queensland Government. The Premier writes that he feels sure the States in general will welcome any reasonable suggestions for a continuance of the work of the Bureau under federal control. We may, therefore, hope that the existing instruments and stations will be utilised, as far as practicable, in the interest of meteorological science. Truly the Colonies are in this respect following the mother country, and we may soon expect the Empire, so active in neglecting science, to be the laughing stock of civilised peoples."

Our meteorological service has been, as you all know, closely connected with the Queensland one, to the advantage of both.

Apparently it is the federation of the States that has brought about the disastrous check to what is both a commercial and scientific work in this part of the world, and I think you will all agree that it is the Federal Government which is responsible for helping the various States back to their original efficiency in these matters.

I leave to others the task of defending the utility of meteorological observations, and will immediately proceed to my more special theme; but, before dismissing meteorology, I would like to remind any who may hear or read this paper that *continuity* in meteorological records is essential for their full utility, and it is pennywise and pound foolish to establish such records for a time, then discontinue them, and later undertake them once more.

The meteorological service in this State, as in many other parts of the world, is performed by the same staff as the astronomical service, and it is of this last I wish to speak in full.

I shall not hesitate to repeat what I have already said to the Society two months ago, partly because it refers to a matter that I think the public should, for its own benefit, take seriously to heart, and partly in order to make the present paper complete.

I propose to consider our subject under the following heads:—

(1) Practical astronomy of Tasmania in the past.

(2) The uses and desirabilties of practical astronomy in such a community as ours.

(3) The present.

(4) Proposals as to the future.

I.

Practical Astronomy of Tasmania in the Past.

With regard to the past I propose to say very little, though it would be interesting if somebody could be induced to look thoroughly through the proceedings of this Society and elsewhere to make a proper history of the subject.

Mr. Kingsmill two months ago gave you some account of the official work for the Government performed in the past. I would like to call attention to the other practical astronomical work that has been done here.

We have had two enthusiastic astronomers in our midst, who performed their work merely for the love of it, true amateurs, in the highest sense of the word—Mr. Abbott (died 1883) and Mr. Biggs (died 1901). Each of these had a private observatory, furnished with very fair instruments, and each did useful work. I am sorry to say that, as far as I know, there is no such amateur, with the necessary instruments in the State to-day.

It is of interest to know that what are, I believe, the two most valuable instruments which belonged to those two observers are likely now, after a number of years of idleness, to be put again to useful work.

The transit instrument of Mr. Abbott has recently been acquired by the University by purchase. It has been housed and nearly completely repaired. Its various adjustments in its new home have just been commenced by the students of the University. It is a larger instrument than the Observatory possesses, and it is probable that its performance will be found correspondingly more accurate.

I may say for the benefit of those of my hearers who are not conversant with the technical terms of Astronomy that the chief object of a transit instrument (other than one of the first class, which has additional uses) is to obtain the true time as accurately as it can be obtained. No other instrument is nearly so accurate for this purpose, and the time in all the States of Australia is at present obtained by means of transit instruments.

Mr. Biggs' equatorial telescope was left by him as a bequest to the Royal Society. The Royal Society has recently offered it on loan to the University, and it is at present stored at the University, though not in such a way as to be capable of use. The University has not yet signified its acceptance of the loan, probably because an expense of some £60 will be necessary to house, mount, and repair it. This telescope is an 8¼-inch reflector (Newtonian), and is, therefore, much superior to the equatorial at the Observatory.

It is much to be hoped that the University will see its way to accepting the offer, and so secure (let us hope for all time) the benefit to students of observing the wonders of the Heavens, after listening to the dry-as-dust description of them in the lecture room. It is to be remarked also that the students may be expected, with such an opportunity, to add to the knowledge of the human race, and this is no little reason why the offer should be accepted.

I look forward to the time when an Astronomical School of renown shall be firmly established here. Our opportunities in the matter of position are great. Let us not neglect them for petty passing reasons.

While considering practical astronomy in Tasmania in the past, we ought not to omit a reference to the transit of Venus in 1874. The main interests of that transit were, of course, world-wide, but Tasmania (did she but know it) has herself benefited by the visually insignificant fact that in 1874 Venus passed between the earth and the sun, and there fore was visible as a dot on the sun's face. Tasmania's gain is owing to the fact that on account of her valuable position in the far south, in this matter of finding the sun's distance, as in many other astronomical respects, she was at once seen to be a place where the necessary astronomical observations ought certainly to be made. But the Astronomer Royal of England said "No," for we do not know her longitude sufficiently accurately—and that was true, we *did* not. America came to the rescue. "Why not," said America, "find the longitude accurately?" So they came, found the longitude, observed the transit, and went.

I will not preach here of the importance of knowing the longitude. I will only say that it is a very complicated matter to obtain it, a matter requiring costly instruments, much knowledge, and much painful training, and the result is that we know where we are on this planet.

The result with regard to longitude is that for all time we know the following fact:—We know that a certain piece of masonry (at present in existence in the Barrack Square) is 9m. 25.66s. east of the centre of the transit instrument in Melbourne. The Melbourne longitude is itself in doubt, and I will now read you an extract from a letter I have received from Mr. Baracchi, the Victorian Government Astronomer, on that point:—

"(1st) The present adopted longitudes of Sydney and Melbourne are:—Sydney, 10h. 4m. 49.44s.; Melbourne, 9h. 39m. 54.00s.

"The Nautical Almanac still persists in giving the values adopted by Ellery Russell, and Todd, in their longitude report of 1886. I suppose, as the differences are small, and the values by no means final, it is considered unnecessary to introduce changes at present. In the American Ephemeris the value 9h. 39m. 54.00s. is adopted for Melbourne, and 10h. 4m. 49.54s. for Sydney.

"When it will be time to introduce changes in our longitudes, my values of 1895 (Report A.A.A.S., 1895, pp. 185-208) will have to be further reduced, owing to the smaller values obtained for Madras later. I adopted for Madras 5h. 20m. 59.275s. The new and latest determination, gives 5h. 20m. 59.113s. Adding this to former results, with double weight, we obtain 5h. 20m. 59.167s., which, in my opinion is, at present, the best available value for the longitude of Madras, and, as no further measures have been made east of Madras since 1888, the longitudes of Sydney and Melbourne may be considered to be—Sydney, 10h. 4m.

49.33s.; Melbourne, 9h. 39m. 53.93s. (0.04s. was dropped arbitrarily when Zone time was introduced, simply for convenience).

"But I have no intention of altering our longitude at present, for two reasons—(1st) Because the values are by no means final. (2nd) Because there will be probably soon, an opportunity for fresh independent determinations of Australian longitudes via America, and via Cape of Good Hope, through Cocos Island.

"(2nd). The uncertainty of the present longitudes.—On the strength of the new Madras value, I think that the values—Sydney, 10h. 4m. 49.33s.; Melbourne, 9h. 39m. 53.93s.; Hobart, 9h. 49m. 19.59s.; are within 0.7s. for Melbourne and Sydney, and within 0.8s. for Hobart.

"(3rd). The true value of Harkness' position relative to Melbourne.—This value is 9m. 25.66s. (This is the only available value). [Harkness was the chief of the American 1874 transit of Venus Expedition to Tasmania.]

"(4th). Harkness' position.—This is his transit pier."

The piece of masonry in question is really very precious to Tasmania. If she allows it to become undecipherable, she will be put to much expense and much trouble once more to determine her longitude.

Commander Pury-Cust some time ago recommended that this piece of masonry should be suitably inscribed with the record of its meaning. This could be done at a trifling cost, and I believe will be done, but in case there should be hesitation on the part of the public or Ministry, I now make the necessary appeal. The only reason that the Premier has not yet been informed (for he has not) what to put upon the stone is that his advisers (Mr. Kingsmill and myself) have not yet found exactly what the record ought to be.

Mr. McDonald, of the Observatory, first informed me of the special nature of the observations, which were made by the American Transit of Venus Expedition, and led me to recognise the meaning of the three marks left by them in the Barrack Square. He has also lent those stereoscopic photographs of the instruments and position used, which are now in your hands. I should like to enter into more detail about the transit operations, but I have not time.

Two students of the University (Mr. McDonald and Mr. Kay) have lately found by surveying with instruments lent by Mr. Walker (an old student and present graduate), that the Harkness position and the present Observatory are situated relatively thus:—

Present Hobart Observatory relative to the transit of Venus (transit instrument) pier.

Lat. 3.61″ S., Lon. 0.051 s. W.

The present (1902) revised position of our Observatory is therefore

Lat. 42° 53′ 28.2″ S., Lon. 9h. 49m. 19.54 s. E.,

whereas in recent years the adopted values have been

Lat. 42° 53′ 28.3″ S., Lon. 9h. 49min. 19.76 s. E

II.

The Uses and Desirabilities of Practical Astronomy in such a Community as Ours.

I will now repeat and correct my remarks of two months ago. I said then that the keeping of time was so necessary for an island State such as Tasmania that it was imperative to know the time as accurately as possible. This I still believe. I also said (in the deputation of this Society to the Premier) that a first-class Observatory kept time to 1/100 of a second. This I said in ignorance. It is not so. Of this, more directly.

It is imperative to know the time as accurately as possible for this reason: Mariners depend upon the time for their position. I could say how they know their position North or South of the Equator by direct observations with the sextant, but this would occupy too much time, and I will only speak of how they determine their position East or West of some ascertained spot. They do this by means of their chronometers and sextant observations. If ocean mariners had a say in colonial politics, they would undoubtedly say, "Please give us time correctly; chronometers are excellent in their way, but their indications depend ultimately on observations of the stars, and these observations can only be properly carried out at fixed Observatories."

The rate of chronometers at sea is of the utmost importance, not only to mariners, but to the general public who travel by sea, for an error in the rate of one second in two days may mean an error of ten seconds in 20 days, and an error of 10s. in the chronometer may mean nearly three statute miles' error in position.

Is Tasmania a place where time should be kept accurately? I have no hesitation in answering "Yes." Tasmania has a port where steamers from South Africa call on their way to distant ports; other steamers call which are destined for a long voyage (say, starting from Sydney), after staying for a time at Hobart. It is absolutely necessary that we should be able to give them the same time as they received in Sydney, for if they receive it from us, they can ascertain their chronometers' rates at sea, and they cannot obtain these rates otherwise.

I have said before, and I say again, that it is in extreme cases sometimes necessary to know the time to one second, in order to make the necessary provision that means all the difference between life and death to many souls.

With regard to this question of keeping time, I again quote from Mr. Baracchi's letter, and you will see that I was wrong in saying that in a first-class observatory an accuracy of 1/100 of a second was attainable:—

"(5th). Whether an accuracy of 0.01s. is attained in time keeping at this Observatory.—In time determinations, we aim at an accuracy of 0.01s., but I do not think we attain it often. I can't say whether we ever attain it. Under the best conditions in regard to atmosphere, instrument and observer, with a complete set of observations, viz., from six to ten standard clock stars, and from two to four azimuth stars, the clock error at the middle time of the observations can be determined probably within 0.03s.; greater accuracy is possibly attained on occasions, but is uncertain. Changes in personal equation are the disturbing causes.

"In ordinary time-keeping, viz., dropping of time signal at 1 p.m., and rating chronometers for the shipping, in all of which cases we *have* to *rely* on the rate of the standard clock for several hours, the uncertainty is much greater and the limit of accuracy that we can depend upon with safety is 0.1s."

I should also here like to read a quotation from Mr. Morton's paper in the Papers and Proceedings of the Royal Society for 1900-1901 (p. 122), and another from the paper by Mr. Abbott, to which Mr. Morton's paper directed me:—

"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."

[Quotations from "Time Signals," by Abbott, May, 1865, p. 45.]

That it is highly desirable in the interests of science to establish a practical School of Astronomy in Tasmania is illustrated by the discussions which arose in connection with the Leake Bequest. The whole of those discussions have a most direct bearing on our present position. The Leake Bequest of £10,000 purported to establish a School of Astronomy, but, unfortunately, the money proved not available for that purpose. At the same time, the possibilities led to a discussion of the suitability of Hobart for astronomical work, and I will now read extracts from the proceedings of the Royal Society of 1892:—

[Quotations from "Leake School of Astronomy," by Russell, p. 26, and from letter by Waterhouse, p. xiv.]

III.

Practical Astronomy in the Present.

Practical astronomy in Tasmania in the present, I am sorry to say, consists solely of what the Government is prepared to believe is useful; that is to say, it consists of keeping time for the whole island by the transit instrument at the Observatory. As accurate time is kept as it is possible to keep by such means, and it is telegraphed every day to very many points in Tasmania automatically from the Observatory clock. The ball—that is, the mariners' signal—is not, but undoubtedly should be, dropped automatically. There is no standard clock in the Observatory, and the public of Tasmania depends on the charity of two private citizens for their clock service.

Not even surveyors (unless lately) make practical astronomical observations in order to determine their meridian. I remember some years ago being rather surprised at a well known surveyor's evident delight in finding a new (to him) and very accurate (compared with his old compass method) means of determining his meridian. This struck me, and still strikes me as something pathetic. I cannot help thinking that if we would allow ourselves a little more outside enlightenment, we might save ourselves a great deal of expense and worry, if only in litigation.

IV.

Proposals Concerning Practical Astronomy in the Future.

In what I have now to say, I would ask you to remember Mr. Russell's remarks in connection with the Leake Bequest, which you have just heard. The advantages of combining the teaching of practical astronomy to students with observing are there properly emphasised.

Probably, if what I have now to propose should be adopted, such a School of Astronomy as Mr. Russell anticipated, would grow up, even without the inestimable advantage of a bequest of £10,000, and such a school would be a great benefit to the whole of Australia.

The Meteorological Department is over-worked, under-manned, and under-paid. It is inevitable that under these conditions some of its work is not as efficiently performed as it would be were its resources adequate.

My proposal is that that department be relieved of the astronomical work, but let it be most clearly understood that I, for one, will not counsel any such re-arrangement of duties if a single penny be as a consequence diverted from the Meteorological Department.

I propose that, leaving the pecuniary position of the department precisely as it is at the present, the whole astronomical work be forthwith handed over to the University. It may be asked how this is to be done, since the University finds difficulty in performing its present duties efficiently.

I will now make certain definite suggestions for the effecting of this scheme. The suggestions are definite, rather because I want a practical discussion here and elsewhere to be raised, than because of their intrinsic merit.

Let those who are competent pull the suggestions to pieces as much as they like, so long as the main object is kept in view, namely, the high desirability of laying the foundation of a really valuable School of Astronomy in Tasmania. Such a school (there are many in the United States) would be a benefit and a credit to the whole of the Commonwealth, and it would also be a benefit to the world at large.

I would submit then to your consideration the following suggestions:—

(a) No funds to be diverted from the Meteorological Department.

(b) The Meteorological Headquarters to remain in the Barrack Square, as at present, even if the Square be altered, as lately suggested by the Minister of Lands.

(c) The Government astronomical work to be handed over to the University on certain conditions.

(d) All the astronomical instruments to be transferred to the University grounds, and re-erected there, at the cost of the Government.

(e) Loan of the Transit Instrument in the possession of the Melbourne Observatory, which for many years was lent to Adelaide, to be asked for.

(f) Automatic connection between the Observatory clock and the time ball to be established by Government.
(g) Proper clocks to be provided by the Government.
(h) The University to grant site of new Observatory, and site of a residence for a new officer.
(i) The new officer to have the following duties:—
  (a) Observing time for the island.
  (b) Teaching in the University, astronomy, surveying, practical physics, and such parts of the mining course as it is possible and desirable for him to do.
(j) The salary of the new officer to be £350 a year, of which the Government provide £150 and the University £200.

(N.B.—The Observer would have to reside at the University. He might perhaps live in the house at present occupied by Professor Williams. If he lived rent free, the University's contribution to his salary should perhaps be only £175.)

In conclusion, let me say that the University is faced with the unpleasant reality that it cannot continue to teach what it professes to teach without the appointment of some such officer. I am recommending merely that his appointment be seized as the opportunity of starting what in the future may be of inestimable value to the whole world—the establishment of an efficient School of Astronomy, in a high southern latitude, and in a climate peculiarly suitable for astronomical work.

TYPHOID IN HOBART AND MELBOURNE, AND THE INFLUENCE OF DRAINAGE ON ITS PREVALENCE.

By James Jamieson, M.D.,

Health Officer, City of Melbourne.

(*Read October 13th*, 1902).

At the meeting of the Intercolonial Medical Congress at Melbourne, in 1889, the subject of typhoid was largely considered, and was adopted as the matter of discussion at one of the general meetings. At the end of that discussion a series of resolutions were proposed and carried unanimously. The first affirmed: "That the prevalence of typhoid is owing mainly to insanitary conditions, and above all to contaminated water supply, defective drainage, and improper disposal of night soil." By the second it was declared: "That while there is reason to believe that the sources of the water supply of Melbourne are carefully guarded, it is certain that, as regards drainage and night soil disposal the arrangements are very unsatisfactory, and to these defects must be ascribed in great measure the excessive prevalence of typhoid fever year after year." By the third it was affirmed: "That in the opinion of this Congress, it is the imperative duty of the Government to take immediate steps for bringing about an improvement in the sanitary condition of Melbourne, and specifically for the construction of a proper system of underground drainage, which shall include the removal of night soil by water carriage."

Though these resolutions had properly enough special application to Melbourne, the affirmations were equally true of other places where conditions at all similar prevailed. The late Dr. Richard Bright, who took part in the discussion, and seconded the last of the resolutions, declared in a very positive way his belief that the excessive prevalence of typhoid in Hobart, in the years just preceding the meeting of the Congress, was greatly owing to the pan system.

The resolutions took the shape they did very largely to strengthen the hands of the medical profession in Melbourne in their struggle for sanitary reform. It may be assumed that their unanimous adoption and vigorous wording had the effect intended, since the Government soon after engaged the services of an eminent London engineer to report on the best method for carrying out a scheme of underground drainage In 1890 that report was received, and a Metropolitan Board of Works constituted, with control of water supply and drainage. With some modifications the proposed plans were adopted, though for several years progress seemed to be slow.

About five years ago house connections began to be made, and now (August, 1902) 48,000 buildings out of about 100,000 have been connected with the sewers, and the pan system abolished, so far at least as concerns these places. Of course very much remains to be done, and as was proper, the central and more populous districts, and the suburbs on the line of the outfall drain, were the first to benefit. Clearly the full advantages from the point of view of sanitation are far from being attained, but it may be possible to show that they are considerable.

It might have been expected that an enlightened self-interest would have led the citizens of Hobart, as a place of summer resort, to realise the enormous benefits any such place must derive from a good sanitary reputation. And there is nothing more likely than a fear of typhoid to check the influx of visitors. Without throwing doubt at all on the attractions of Hobart, both as a beauty spot and a good health resort, it must be admitted that, up till quite recent times, it shared the evil fame of Melbourne as a hot-bed of fever. And a comparison of the mortality returns brings out some striking points of similarity between the two cities. Taking the period since 1890, such a comparison brings out the very striking fact that the specially fatal years in both places were 1890-91 and 1898, and the year between these, showing the lowest typhoid mortality was also the same, viz., 1893.

The concomitant variations are much too striking to admit of explanation by the easy way of "accidental coincidence." They strongly confirm the opinion, which I have long held and frequently expressed, that general conditions of the meteorological kind have much to do in determining the fluctuations of typhoid prevalence in particular localities from year to year. I must admit further that my endeavours to fix the exact nature of these meteorological, so-called cosmic, conditions have been attended with rather a scant measure of success (*v.* Proceedings of the Australasian Association for the Advancement of Science, Vol. II., Melbourne, 1890, and *Australian Medical Journal*, March, 1890). And, indeed, looking at the enormous fluctuations in the typhoid mortality, year by year and in almost a parallel way, in the two cities, it might seem as if they had been left at the mercy of these general conditions up till quite recent times.

But knowledge has grown, and from application of that knowledge improvements of many kinds have resulted. And just as the fatality from consumption was steadily becoming less in most countries, independently of any recognition of its infectious character, and without much in the way of special precautions, so with typhoid the death rate has been undergoing diminution, even though certain essential improvements may not have been adopted.

In a paper read before the Royal Society of Tasmania by Dr Gregory Sprott in August, 1898, the argument in favour of the adoption of a proper drainage scheme was put in a very forcible manner. At that time both Hobart and Melbourne showed very unfavourably in the comparison of mortality rates, not only with European conditions, but even with Sydney. Since then there has been a great change for the better, and for several years it has been a pleasure to me to be able to point out that the deaths from typhoid in Melbourne had at last been reduced to such an extent that the mortality compared favourably with that of the great English towns. And comparatively low as the rate now is, there is every reason to hope, from analogy of what has happened elsewhere, and notably in some of the German cities, that the lowest point has not yet been reached.

In presenting, in tabular form, the death rates from typhoid for a series of years, in Hobart and Melbourne, it is not necessary to go further back than 1890, as by the help of these figures we can make comparison of periods for which reliable census figures of population are available. Calculations based on estimates are apt at times to be fallacious, and especially in our case, where census periods are as long as ten years apart.

The following table gives a comparison of the rate of mortality from typhoid, in Hobart and in Melbourne, for the 12 years 1890-1901 :—

Per 10,000 of Population.

	Hobart.	Melbourne.
1890	5·1	8·5
1891	16·7	3·9
1892	5·7	3·2
1893	2·5	2·6
1894	4·8	3·5
1895	5·8	3.2
1896	4·	3·3
1897	3·4	2·6
1898	8·1	4·7
1899	1·6 (? 2·)	2·9
1900	1 6 (? 2·)	1·9
1901	2·	1·4

The rates for Hobart are taken from the reports of the health officer, and as regards at least the years 1899, 1900, they almost certainly require correction, since the population had been overestimated by almost 6000, implying an addition to the rate of about one-fourth, and making it more probably 2· than 1·6, as given in the table. On the other hand the census returns showed that the estimates of population for Melbourne had been a close approximation to the true numbers. On analysing the figures given, the first thing at once noticeable is the great decline in the mortality rate in both cities, in the three last years of the period. Another is that the fluctuations from year to year are much greater in

Hobart than in Melbourne, owing of course to the smallness of the population not allowing of a correct average being easily got. But it has further to be noted, that with all the fluctuations the rate for Hobart has never come so low as that which has been found in Melbourne for the last two years, and notably in 1901. It is manifest from the fact that the mortality has been so much below the average in both places, that general conditions have on the whole been favourable during the last three years. The improvement in the typhoid mortality rate has doubtless been in great measure owing to advances in sanitation, better guarding of milk and water supplies, better cleansing of streets, lanes, and house surroundings, more care in the disinfection and ultimate disposal of night soil, and possibly other things not so obvious. But things being equal in all these respects, it might fairly have been expected that in Hobart the swing of the pendulum would have been more distinct with the small population than in Melbourne with the large. It might have been expected that, in one or other of these favourable years, the rate would by chance have fallen lower than in Melbourne, just as it was lower in 1893, than in any of the earlier years of the period, and far higher in 1891 and 1898 than at any time in the period. Many conditions being the same in both places, it seems as if there had been something at work in Melbourne of a special kind, not operative in the Tasmanian capital. It is not easy to think of anything greatly different in the two places but the drainage system adopted in the one and not in the other. Things being equal the mortality ought to be lower in Hobart, with its excellent undulating site, and its comparatively small and scattered population.

It is worth making a further comparison, viz., between Melbourne and the rest of the State of Victoria, to see whether it favours this view :—

PER 1,000 OF POPULATION.

	Melbourne.	Rest of Victoria.
1890	8·5	3·2
1891	3·9	2·5
1892	3·2	2·2
1893	2·6	1·9
1894	3·5	3·
1895	3·2	1·9
1896	3·3	2·3
1897	2·6	2·
1898	4·7	4·7
1899	2·9	2·9
1900	1·9	2·
1901	1·4	1·78

Here we have in some respects the same thing seen as in the previous table. With a large population, scattered over a large area, the fluctuations of course are not nearly so great as those shown for Hobart. But what is also apparent is that, while on the whole the mortality has been lower in Extra Metropolitan Victoria than in the Metropolis, this has now ceased to be the case. Something has happened in the last two or three years in Melbourne to make the rate lower than in the rest of the State, though the same thing had never happened in any other year of the period.

To the casual observer the differences just pointed out may seem trifling, but in a place like Melbourne, with a population of about half a million, a lowering of a death rate by even 1 in 10,000 of population represents 50 lives saved annually, and these in turn may represent about 500 fewer cases of typhoid. The value of 50 lives of persons in the prime of life, as most typhoid patients are, and the cost of 500 cases of tedious illness, are not matters which can be dismissed as trifles. By themselves, in fact, they make in their saving a considerable offset against the expense of sewerage. And when, to these savings, there is added the comfort, almost the luxury, of living in a sewered house, as compared with another in which the night pan is ever apt to reveal its offensive presence, and where foul water of every kind has to trickle along from house drains to right-of-way and street, it may well be a question whether the offset is not a full one. It will be for the people of Hobart, who have much to gain in the reputation of their city as a health resort, in addition to the savings and gains just mentioned, to decide whether it is not a grievous mistake to allow present conditions to continue longer than is absolutely necessary. I do not wish to refer specifically to other sanitary defects which reveal themselves easily to the trained, perhaps even to the untrained, observer. Many of them would disappear with the completion of a proper system of drainage. With these improvements accomplished, Hobart should be second to no other place in the Australian Commonwealth as a health resort; and it is hardly stretching prophecy too far to express the conviction that, among the benefits obtained, there would be complete, or almost complete, immunity from outbreaks of typhoid.

SEWAGE PURIFICATION AND DISPOSAL.

(Edwin H. Wilkinson, Engineer for Drainage, Hobart.)

(Read October 13, 1902.)

The subject of the disposal and the purification of sewage is one that has of late years received the close attention of the greatest scientists. More especially is this the case in the United Kingdom. It will be my endeavour this evening to describe a few of the various methods adopted for purifying the sewage, and the agencies whereby this state is brought about, together with various methods of disposal in use in various parts of the world. For much of the information contained in this paper (for which I claim no originality) I am indebted to the work by Mr. Dibdin on the purification of sewage and water. A very great deal of useful matter was also obtained from a recent "Report on the Latest Methods in use in the United Kingdom and elsewhere," by Mr. J. Davis, M. Inst. C.E., who was until lately Engineer-in-Chief for Sewerage Construction in New South Wales.

In the bacterial disposal of sewage, as carried out at many places, we assist nature in carrying out her work without offence and without danger to us. When an animal dies and remains unburied in the fields, Nature's scavengers, in the form of bacteria, soon make themselves evident, and in a comparatively short time entirely dispose of the carcase.

In order to more forcibly impress upon you this bacterial life, which plays such an important part in the purification of sewage, I ask your permission to be allowed to quote from some of the remarks of Mr. W. J. Dibdin, late Chemist to the London County Council.

Firstly, sewage consists of animal substances, largely composed of fibrine, gelatine, chondrine, albumen, etc.; and, secondly, vegetable substances, such as starch and woody fibre (cellulose), gummy matters, with tannin, etc. The decomposition takes place by the active organisms, "aerobic," as they were called by Pasteur in contradistinction to the anaerobic organisms. As their name implies, the first-named live only in the presence of air, whilst the latter live in the absence of air. When air is freely present the aerobic organisms destroy the organic matters in an inoffensive manner.

According to Dibdin, the nitrogen of the gelatine, etc., is resolved with either the production of ammonia and the oxides of nitrogen, or possibly set free as uncombined nitrogen. The oxygen and hydrogen, forming a considerable portion of the matters, are recombined into water, and the carbon into "carbon dioxide," or carbonic acid gas, as it is generally called. Similar transformations take place with these elements in vegetable matters, but a longer time is usually required for the completion of the process than is the case with animal substances, as they do not form so suitable a medium for the support of the microbic life. Woody fibre, especially paper pulp, is more refractory, and will require a much longer time for its disruption, but in the end the same transformation occurs, and carbonic acid, water, etc., are formed as a result.

It will be understood that the substances mentioned are intended to represent only types of compounds actually present in such a heterogeneous mixture as that which we are considering.

In the process known as combustion, or burning, the organic matters combine with oxygen, but the same action is brought about by the life processes of animals.

In the case of the higher animals, when the food is taken into the stomach, it there undergoes the process of digestion, and a portion is absorbed into the system, where, by the action of the blood, it is eventually oxidised as it rushes through the lungs, in which it is freely exposed to the air taken in by the breath. Thus is kept up a slow process of oxidation, marvellous in its character and action. It matters not whether it is meat and bread eaten by human beings; grass, etc., by horses or fowls; or a mixture of these things by microbes or by the direct action of fire; the final result is precisely the same, viz., combustion, fast or slow, as the case may be. But in bringing about this result we must not neglect to ensure an ample supply of oxygen, otherwise we shall have foul gases formed, such as sulphuretted hydrogen, and so create a nuisance.

Here we must further consider the action of the minute organisms already referred to as "bacteria," or "microbes."

These are minute living bodies, some of which are ever present in various forms in or on every substance known; and whenever the circumstances are favourable they bring about the destruction of the organic matters simply by living on them. In reference to their general character that while at first they were thought to belong to the animal kingdom, it is now generally accepted that they are plants. With reference to the size of the bacteria, it is, indeed, difficult to describe them in popular language. They vary in length from one-five thousandth to one-twenty-five thousandth of an inch. When viewed under the most powerful microscopes they appear to be a little larger than dots of ink on paper. "If," say Pearman and Moore in their work on "Applied Bacteriology," "we could view an average human being, under an equal degree of magnification, he would appear to be about four miles in height."

In a volume equal to the 66th part of a grain, Bujivid estimated no less than eight thousand millions of microbes.

With reference to the incredible rapidity with which the bacteria multiply under conditions favourable to their growth and development, Cohn writes as follows:—"Let us assume that a microbe divides into two within an hour, then again into eight in the third hour, and so on. The number of microbes thus produced in 24 hours would exceed 16½ millions; in two days they would increase to 47 trillions: and in a week the number expressing them would be made up of 51 figures. After 24 hours the descendants from a single bacillus would weigh 1-2666lb.; after two days over a pound; after three days, 7,366 tons. It is quite unnecessary to state that these figures are purely theoretical, and could only be attained if there were no impediments to such rapid increase."

"Fortunately for us," observe Messrs. Pearman and Moore, "various checks, such as lack of food and unfavourable physical conditions, prevent unmanageable multiplications of this description. Naturally the question will at once arise as to what becomes of the dead bodies of those bacteria which succumb in the struggle for existence. A dead bacterium is only so much food for his friend, who evidently considers that all is fish that comes to his net."

The figures given show what a tremendous vital activity micro-organisms or "bacteria" possess, and it may be seen at what speed they can increase in water, milk, broth, yeast, and other suitable and nutrient media. You can realise from the foregoing remarks the enormous force which the sanatarian has at his disposal for the rapid and effectual destruction of waste animal and vegetable matters by the action of the life processes of these minute scavengers, provided that the conditions of their environment are carefully arranged, so as to afford them the freest possible scope.

If any porous material, such as coke breeze, burnt clay, etc., be placed in a vessel or tank, and sewage water admitted thereto, a large proportion of the filth contained therein will adhere to the rough sides of the coke or other material, and the organisms will commence their work by feeding and multiplying so that in a short time the whole surface of each particle of coke or other material which may be employed, will be covered with them. Let the water be drawn off gently, after sufficient time has been allowed for the adherence of the fine particles of matter to the coke. Air will be admitted as the water is lowered, and a fresh impetus will be given to the little workers, who will soon be ready for another supply of food to be given to them in the form of a second quantity of foul water. The organisms at work under circumstances such as these are the ærobic microbes previously described. The anærobic do not depend on the air for their existence, and it is this class that carries on the purification process in what are known as septic tanks. It will be seen these processes may continue indefinitely, and that we can bring about the destruction of objectionable matters completely and economically for as long a time as may be desired.

Such, then, is Nature's method of purification.

The process is termed biological, but it must not be supposed that because this term is used in reference to the treatment of sewage, it is intended to imply that the micro-organisms are provided by the bed itself, and that the sewage does not contain them. The organisms are to be found in all sewage, and they are by the sewage conveyed into the beds, where large surfaces are provided, and on which the bacteria are cultivated.

Having, with these few introductory remarks, given an idea of the great activity of micro-organisms, and of their enormous power in working out purification of sewage, it will perhaps be interesting to hear of what is being done with their assistance in a few of the more important cities of the United Kingdom.

For much of my information on this subject I am indebted to Mr. J. Davis, M.I.C.E., late Engineer-in-Chief of the Sewerage Construction Branch of the Public Works Department of New South Wales, who last year presented his report to the Minister for Public Works on the "Latest Methods in use in the United Kingdom and elsewhere."

In order that we may start at the beginning I shall first deal with Scott-Moncrieff's methods.

It appears that Mr. W. D. Scott-Moncrieff commenced his experiments on a practical scale in 1891. He erected what he called a "cultivation tank," measuring 2ft. 9in. wide, 10ft. long, and 3ft. deep at the deepest end. Excluding the grease by means of a trap, he allowed the entire sewage and waste water from one dwelling house to enter the tank at the lowest end. The sewage passed through a perforated plate, which was fixed about one foot from the bottom of the tank. Underneath this plate the solids were arrested. Above the perforated plate was a layer of flint, through which the liquid portion rose until it reached the level of the outlet drain. The mean depth of the filtering material was 14in., and the space underneath the plate 5 cubic feet.

Mr. Scott-Moncrieff states that the invariable result, where he put down installations of these tanks, based upon an allowance of 3 or 4 cubic feet for each inhabitant served, has been the almost complete liquefaction of the solid matter, and the sludge in every case was a negligible quantity. His next step was to pass the effluent from the cultivation tank through shallow, open earthenware drains filled with coke, but it appears that this treatment had very little effect upon the effluent. However, it was observed that when it passed into an almost stagnant, but bacterially very active, ditch, in the proportion of one to three respectively, the effluent purified what was before a polluted stream. This fact (which to many may be hard to believe) will again be demonstrated further on in this paper, when dealing with experiments carried out with the Manchester sewage.

Using Mr. Scott-Moncrieff's own words, he states that this proves two things:—"First, that the ditch was a very active oxidising agent; and, secondly, that the organic matter coming from the 'cultivation tank' was in a condition highly susceptible to further oxidising changes, and was in a much more unstable molecular condition than the raw sewage, which had seriously polluted the stream when untreated."

He next devised a highly oxidising apparatus consisting of nine wooden boxes (perforated), 7in. deep, and each having an area of 1 square foot, which he placed 2in. apart and above each other. These he filled with coke about the size of beans. In utilising the filtering material for restoring oxygen to the sewage to the fullest extent, he used V-shaped tipping channels, so that the liquid would be evenly distributed.

Installations have been carried out on this plan in several places, notably at Birmingham, at Chelmsford, and at Caterham, under the sanction and authority of the War Department. At the latter place there is exceedingly strong sewage from the barracks, which accommodate 1,200 persons.

Dr. Rideal, who was asked by the War Department to report on the efficiency of the installation at Caterham, states the results are satisfactory, and that "the process has been successful in destroying completely four-fifths of the total organic matter present in raw sewage."

Septic Tanks.

Under the septic tank system the largest installation as yet carried out is at Barrhead, where the works are designed to serve a population of 10,000, and to purify a maximum flow of sewage and storm water of 400,000 gallons per day.

The works consist of two grit chambers, four septic tanks, and eight bacteria beds, all of which are built with concrete. The sewerage main discharges into the grit chambers, from which the sewage passes, without screening, into the septic tank.

When the septic tank system was first introduced it was thought that it was necessary to exclude all light and air. It is now found by experience that the results obtained from raw sewage are the same whether the tanks in which the anærobic microbes are active, is covered or open. This may be due, perhaps, to the coating of hard scum which is formed in the tank, and which would tend to exclude the light and air.

There may be cases, however, where, for various reasons, it would be advisable to cover the tanks. For all practical purposes it is settled beyond dispute that the open is as efficient as the closed tank.

Manchester Sewerage.

To prevent the pollution of the Manchester Ship Canal, in 1896 proceedings were instituted against the Corporation at the County Police Court, and an order made calling upon the Council to do what was necessary within 12 months. This period has had to be extended, as it was found impossible to make the necessary experiments to enable a conclusion to be arrived at in the time given.

Eventually a scheme was prepared for conveying the effluent from Davyhulme to the tidal River Mersey at Randall's sluices. When this scheme was referred to a poll of the ratepayers it was rejected by a large majority. Messrs. Latham, Frankland, and Perkins, experts, who were called in to advise the Council upon the question, supported the ratepayers in their decision.

The Council thereupon decided to appoint the three experts already named to advise them and report on the whole question of sewage purification and disposal.

Up to this time no adequate experience had been gained in the use of bacteria beds with sewage diluted with trade refuse.

Upon getting to work the experts named confined their attention to the three methods which had been already before the Council:—

1. Treatment by land.

2. Conveying the effluent into the tidal portion of the river.

3. Bacterial treatment.

Regarding the question of land treatment, they agreed with the committee in rejecting it; firstly, on account "of the great initial cost of land, drainage, conduits, laying out, etc.;" secondly, "of the obvious difficulty of obtaining a sufficient area;" and, thirdly, "of the general unsuitability of the land in and around Davyhulme." With respect to this, they instanced the case of Birmingham, which is now feeling the formidable dimensions of its sewage farm to such an extent that other and more compact modes of dealing with the sewage are being undertaken.

The extension of the sewer to Randall's sluices was condemned from an engineering point of view.

Under their direction, certain beds were constructed at Davyhulme, and experiments were made with them. The filtering medium used in the upper bed was clinker, 3in. to 1in. gauge; and in the lower bed 1in. to ¼in. gauge. Two other beds of similar size, and a fifth, much smaller, were afterwards added, but the clinkers used were of much smaller mesh, as it was found that the coarser filters allowed sludge to get into the body of the bed, and so into the drains below. The material used in the third, fourth, and fifth beds varied from ¾in. to ⅛in. mesh.

Settled sewage was first used, the beds being filled once each day for the first week, and twice a day for four weeks. The beds, having acquired a high degree of efficiency at the end of this period, were filled three times a day for a further term.

As the application of settled sewage was attended with such satisfactory results, it was decided to apply raw sewage on the same lines. For the first month the raw sewage was applied once each day, and the settled sewage twice. This having proved satisfactory the raw sewage alone was applied three times a day, and was continued for nearly two months, when four fillings per day were tried. After the first week the rough bed showed signs of clogging, and settled was therefore resorted to. The experiments with these beds have extended over a period of two years. The effluent from septic tanks was, instead of settled sewage, ultimately passed through the beds. The capacity of the beds was at first rapidly reduced, but when the solids in suspension from the raw sewage had previously been removed, by bacterial action in the septic tank, and the beds had got fairly to work, they maintained a capacity of one-third of the capacity of the bed without filtering material. When a bed fell below this proportion a short period of rest would be the means of restoring it. The larger beds were constructed to contain 10,000 gallons before the clinkers were put in, and when working their capacity was 3,333 gallons.

The beds were treating the effluent from the septic tank at the rate of 600,000gal. per acre, with a resultant degree of purification of 0.5 grains per gallon oxygen absorption in 4 hours; and 0.04 grains per gallon of albumenoid ammonia. The limits of impurity adopted by the Mersey and Irwell joint committee (the authority which has the responsibility of the conservation of the rivers in question) is 1 grain and .1 grain respectively.

In their report the experts say: "The results of the treatment of the open septic tank effluents . . . . . have, from the first, surpassed our most sanguine expectation."

It has been found, with the use of the effluent from either open or closed septic tanks, one contact with a bacteria bed has been sufficient to secure adequate purification.

At the end of 1898 an experimental installation of the septic system was got to work. After it had been working about nine months to try its powers of dissolving solids, garbage was tipped into the tank. After 279 barrow-loads were put in, it was decided to cease. The tank was constructed in size sufficient to hold half a day's supply of sewage. If it had been used as a precipitating tank, at the end of fourteen months the quantity of sludge produced would have been about 12,000 tons, but, upon being emptied, it was found to contain 4,000 tons of sludge, and the garbage had been wholly dissolved. The greater portion of this residue was inorganic matter; the proportions were 60 per cent. inorganic and 40 per cent. organic. A large proportion of the inorganic matter, if not the whole, is recognised to consist principally of silt from the street surfaces, and silt pits are being specially constructed to intercept it before the sewage reaches the septic tank. The rapid rate at which the sewage was passed through the tank may account for the comparatively large amount of organic matter, 1,333 tons. Notwithstanding this, it is a very great attainment to have succeeded in destroying two-thirds of the solid matter, and that, too, when passing the sewage through the tanks twice as fast as is usual in other places. Experiments made at other places show that the most perfect bacterial action is obtained by allowing the contact to be twenty-four hours. A closed septic tank was treating sewage during the whole time the sewage was passing through the open septic tank, and samples of the effluent, taken under similar conditions, show that the results for all practical purposes may be regarded as the same.

The sludge which is not retained in the septic tank passes away in a highly-divided condition in suspension, and by gasification.

From samples of the effluent taken from

the maximum flow the results show that the suspended matter varies from 11.6 to 4.9 grains per gallon.

Exhaustive experiments have been made to determine the effect the effluent from the bacteria beds would have upon the waters of the Manchester Ship Canal. Average samples of the filtrates were taken from the bacteria beds in operation on 132 days. A similar quantity of water was taken from the Ship Canal, and the two were mixed. The Ship Canal water, except in a few cases, when it had been diluted by heavy falls of rain, was putrescible to a high degree, but when mixed with an equal quantity of the filtrate, the mixtures in 117 cases were non-putrefactive. This shows clearly that the organic impurities of the Canal water had been oxidised at the expense of the nitrates in the filtrate, and thus vastly improved. It also bears out the fact demonstrated by Mr. Scott-Moncrieff, and already alluded to.

Of several the following were among the conclusions and recommendations made to the Council by the three experts:—

1. That the bacterial system is the system best adapted for purification of the sewage of Manchester.

2. That any doubts which may have arisen in the first instance as to its suitability . . . . have . . . . been entirely banished. The results obtained have altogether exceeded our expectations.

3. . . . . by passing the sewage as it arrives at the works through an adequate system of screens, etc., the further important advantage is gained, whereby those anærobic or septic processes are developed, and which resolve into gaseous and soluble products the organic suspended matter present in the sewage. A large proportion of the sewage sludge which otherwise accumulates, and the disposal of which causes so much trouble and expense, is thereby abolished. The above anærobic or septic process is found to take place as effectively in an open tank as in a closed one.

It has been demonstrated that the septic tank can effectually dispose of between 40 and 60 per cent. of the suspended matter present in the sewage. A kind of digestive process goes on whereby much of the insoluble suspended organic matter, especially that of animal origin, is liquefied or dissolved. This is probably entirely due to the action of those living organisms previously alluded to, by whose vital processes some ferment or ferments are produced which digest these substances. Vegetable fibre is more resistant, and is but little affected. In alluding to this phase of the subject, Dr. Thresh, in a recent paper, says:—"What is wanted is the discovery of some organism capable of being cultivated and utilised, which possesses the special power of digesting vegetable fibre." In the same paper he mentions a visit he paid to the old sewage works at Buxton, where he found the settling tank almost full of deposited matter. Using his own words, he states that "a few days later some kind of fermentation had set in, and the fluid was effervescing vigorously and in a very short time practically the whole of the solid matter had been dissolved and carried away."

At Leeds, where the Corporation are carrying out extensive experiments with the bacterial purification of their sewage, the oldest of their septic tanks had been working over fifteen months. Three-quarters of the solids in suspension were left therein, and no sludge had been removed, yet after inspection it was found that the tank contained no more sludge than it did six months earlier. Such a condition showed that there had unquestionably been an enormous consumption of sludge in the tank by septic processes.

Before concluding this paper a reference to the Liernur system of sewerage might prove of interest. The town or city to be served is divided into districts, according to circumstances, and in a centrally situated position a closed receiver is provided for each district, into which the fæcal matter is drawn by vacuum. There are cast iron pipes laid along the streets, and so situated as to enable house connections to be conveniently made. These pipes convey the sewage to the district receivers. From the central station the vacuum there formed is conveyed to the district receiver, and the influence of this causes the sewage to flow by suction to the receiver. The district receivers are in turn emptied by applying the vacuum to the main receiver at the central station. Briefly then, the Liernur system consists of ordinary street sewers (4in.) connected to a main sewer (10 to 12in.), without any openings. At one end, by the house, is a patent syphoned box. At the outfall works is a steel plate cylinder, in which a vacuum is created, say once a day. The result is, the sewage remaining in the boxes and sewers is carried off to the works at six times the speed of water-carried sewage, the air flush being depended upon to cleanse the pipes thoroughly.

From information supplied by the English representatives of the system, and also by their engineer, Mr. Theodore Rennert, M. Inst. C.E., there are three installations at work; one at Amsterdam, one at Trouville-sur-Mer, and the other at a gold mine in Johannesburg.

It is understood that at Amsterdam it was the intention of the designers only to evaporate the fæcal matter, but this has been found impracticable. It is now customary to use a small quantity of water for flushing purposes—about 1 gallon per person. The house slops at Amsterdam are not taken into the sewerage system, but are discharged into the various canals that intersect the city.

According to Mr. D. I. Sanches the engineer in charge of the works, the total population of Amsterdam is about 500,000, and of these about one-fifth, or 100,000, are served by the Liernur system. The street pipes are now laid to an uniform grade from the upper end to the district receivers, and with ordinary junctions, as it was found that the vertical junctions, with right-angled bends, which were originally designed, readily got stopped.

The average number of persons connected with a district receiver (of which there are 50) is 2,000. The greater portion of the closets are of the special Liernur kind. The mode of treating the sewage devised by Liernur has been entirely abandoned. The expense of drying the sewage was so great, even without the household slops, and with only the small quantity of water used as a flush, that it was found necessary to discontinue the method.

The sewage, as soon as convenient, after its arrival at the works, is precipitated by means of lime, and the supernatant liquor and the sludge are boiled separately for the purpose of throwing off the ammonia. This is sold, and a fair revenue is derived. The supernatant water is thereupon discharged without further treatment into the canal, and the sludge is mixed with house rubbish and removed in barges as manure.

Such a process is wholly objectionable. Thousands of gallons of sewage are stored in large, open tanks, waiting for a number of days to be treated. Another source of no inconsiderable nuisance is the method of mixing the sludge (previously deprived of its ammonia) with the house refuse. In cases where the town to be served is flat some mechanical means of raising and removing the sewage is necessary, and it becomes apparent that each case therefore must be taken on its merits. However desirable it may appear to evaporate the moisture and produce the powder manure, the question of cost would make the method prohibitive. With the knowledge we now possess as to the bacterial action, which can be so readily engaged in resolving sewage into its elements, there is certainly no necessity to resort to evaporation as a means of disposal.

Coming to Hobart the author said that within the next few months the citizens would be asked to say whether or not a scheme for the drainage of the city on modern sanitary principles was desirable. Many were averse to allowing crude sewage to empty itself into the harbour, on the grounds of pollution, but, at the present time the foul slop waters from the houses were allowed to discharge into the street channels, whence they found their way into the natural water-courses, and so on to the waters of the Derwent estuary. From the configuration of the city and its environs, and from an engineering point of view, the natural place for discharging the sewage was at Macquarie Point, where there was deep water, enhanced by an ample tidal flush. With the expenditure of a few thousand pounds, over and above the sum required for a complete system of sewerage, the sewage of Hobart could be rendered quite innocuous, and purified to such an extent that the waters of the harbour would always retain their present standard of purity. It could readily be accepted as a fact, from the knowledge we now possessed of bacterial action, that, by passing all the solid matters through septic tanks before they entered the harbour, the liquefaction of the sewage could be assured, and the pollution of the estuary reduced to a negligible quantity.

ON TENISON-WOODS TYPES IN THE TASMANIAN MUSEUM, HOBART,

By W. L. May.

Read October, 1902.

It is known to all workers in Australian Conchological Science that the late J. E. Tenison-Woods, during the years 1875 to 78, described a large number of Tasmanian Marine Shells in the proceedings of this Society.

His species are usually fairly well described, but he published no figures, and with a few exceptions the specimens he used were not marked as types.

Owing to many of these species also occurring on the coasts of Southern Australia, and which have since been discovered and worked up by scientists there, they have taken an important place in their investigations, but owing to the want of figures, and particularly types to authoritatively settle uncertainties and differences of opinion, some confusion and considerable irritation have been caused. The Tasmanian workers could not definitely assert that any species referred to them was certainly Woods' species without the type, and could only assume that it was so because it agreed with specimens so named in the Museum, or through tradition handed down by W. Legrand, C. E. Beddome, and others, and they were in consequence sometimes taunted with not knowing their own shells.

In this way some errors crept in amongst lists and collections, and Australian workers made frequent mistakes, for which on the whole they had considerable excuse.

So lately as during the preparation of the Revised Census of Tasmanian Marine Shells, *Tate and May*; the authors were still troubled by this want of definite types, and did not venture to quote the Museum specimens as such, unless so marked, which made the work less complete and authoritative than it otherwise would have been, and also led to several errors. But a better day has dawned, and it is the object of this paper to make public the steps lately taken to place this vexed subject on a satisfactory basis.

During the sittings of the last Congress of the A.A.A.S. at Hobart in January, 1902, several leading conchologists were present from various Australian States, and after some preliminary conversation on the subject, they formed a committee to investigate, and if possible settle, the question as to whether Tenison-Woods's species so named were the types, and, if so, definitely mark them as such. The names of those comprising the committee should be a sufficient guarantee of careful and thorough work, and it is not probable that their decisions will ever be seriously questioned. They are as follows:—Charles Hedley, conchologist, Australian Museum, Sydney; G. B. Pritchard, Melbourne; Miss M. Lodder, Tasmania; W. L. May, Tasmania. With the cordial consent of the Curator, Mr. Alexander Morton, the work was taken in hand. As a preliminary, I was able to state that to my personal knowledge the collection, so far as Woods's species were concerned, had remained practically unaltered since his time.

All his species described before the publication of his census are labelled with slips cut from that work, or in his handwriting. Those described since are in his handwriting. It therefore seemed to us all that it was sufficient evidence that we were dealing with his type specimens if they were labelled as described, particularly as the shells always agreed with his description, and sometimes had some peculiarity which further identified them. In some cases the author's handwriting was on the card in addition to the printed label, and there are some instances in which they are marked as "type." An additional point in evidence was that Woods described some half dozen exotic species received from Ronald Gunn with the mistaken identification of their being Tasmanian. There is but one specimen of each in the Museum, and there is no doubt that they are the type, but they were not so indicated with the other species, and labelled with slips from the census. See also Woods's note at the end of his paper "On some Tasmanian trochidæ." P.R.S., Tasmania, 1879, where he makes certain corrections of some names contained in his census. He says, "I have to thank Mr. W. F. Petterd and Mr. W. Legrand for having carefully gone over the *whole of the type specimens* for me to ascertain the above corrections. The italics are mine. None of the species referred to in this note were marked as type. We therefore unanimously agreed to take the above indications as a guide, and were able to definitely decide as to over 150 species, which are now marked as *type*.

The following is a full list of these types, with a few remarks where necessary as to the condition of the specimen, etc., or where some fresh facts have been ascertained which it seemed well to place on record. I have thought best to keep entirely to Woods's names as they were described. The corrections of both generic and specific names will be found in Tate and May's Census. I have also taken the opportunity to correct some errors in that work particularly affecting these species, but where I consider they have correctly treated the synonomy, and properly identified the species, I shall not again refer to them. I have also prepared drawings from the types of such species as have not yet been figured, or but inaccurately or wrongly so, and they will appear as figures in the text of this paper, which I hope will be of distinct service to workers in Australasian Conchology.

It seemed as well to add for general information that the whole of the types of Tate and May's species (with the exception of Cantharus kingicola now in possession of Dr. Vercoe, of Adelaide, S.A.), amounting to 30 species, are also in the Tasmanian Museum, as well as a considerable number of W. F. Petterd's types, and one of C. E. Beddome's, viz., *Leda lefroyi.*

LIST OF TYPE SPECIMENS.

Murex zonatus.
Trophon assisi.
Trophon australis.
Trophon brazieri.
Trophon clathratus.
Trophon goldsteini.
Trophon squammosissima.
Trophon umbilicatus.
Purpura albolirata.
Purpura littorinoides.
Purpura popinqua.
Pisania tasmanica.
Ranella epitrema.
Fusus legrandi.
Fusus spiceri.
Siphonalia clarkei.
Siphonalia castanea.
Siphonalia turrita.
Siphonalia pulchra.
Cominella tasmanica.
Cominella tennicostata.

Josepha tasmanica. This type was, but is no longer, in the collection. The late C. E. Beddome told me that he had the loan of this, and several other types, which he sent to Tryon, to assist him with his Manual. They were returned to him and handed to the late Curator, but have never been replaced in the collection, and cannot now be found.

Nassa tasmanica.

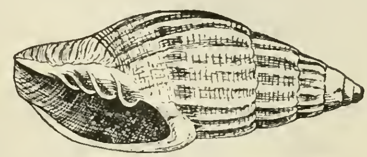
Mitra franciscana.

Mitra granatina. The same remarks apply to this as to *Josepha.* From my recollection of the shell I should certainly consider it to have been an exotic species.

Mitra legrandi. There are three small and probably original specimens on the card, and one larger and perhaps later addition. The former, which we regard as typical, are young shells, and are the variety *Schomburgki* angas.

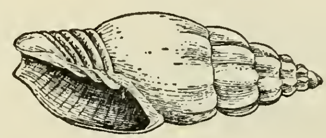
I agree with Pritchard and Gatliff, P.R.S., Victoria, p. 189, 1899, in uniting these species together with *Scalariformis*. The large specimen mentioned seems to be a form of *vincta*.

Mitra scaliformis.
Mitra tasmanica. (Fig. 1.)



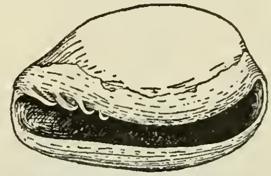
(Fig. 1.)

On the card are 4 specimens, amongst which it is easy to identify the type and vars. A and B. I consider this to be a very distinct species, not to be confounded with any one of our ribbed mitras: its peculiar form and distinct spiral liræ are very constant. Woods gives no habitat, but the few speimens I have received are from the Derwent Estuary. Var. A. This is *M. tatei* angas, and in no sense a var. of this species. Var. B is very distinct, and whilst I do not consider it to be a variety of this, it has some resemblance in form. It almost merits a specific name; but these shells are so variable and so overloaded with synonomy already, that, without a large series of specimens, it would be unsafe to separate it as a new species. It may be an extreme form of *M. vincta* or *M. scalariformis*. I have 2 specimens from Port Esperance, exactly similar. Fig. 2.



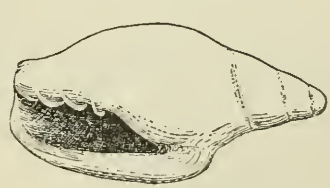
(Fig. 2.)

Mitra teresiæ.
Mitra weldi.
Mitra scita.
Marginella allporti.
Marginella cypræoides. (Fig. 3.)
Marginella minutissima.
Marginella stanislas. I now believe this to be a syn. of M. volutella.



(Fig. 3.)

Marginella tasmanica. (Fig. 4,)
Columbella badia.
Columbella roblini.
Columbella dictua. I consider now that these 3 species should be combined as varieties of one very variable form. *C. vincta*, Tate, should also be included; in fact, one of the specimens mounted as *C. badia* is the variety *vincta*. Reeves's figure *C. irrorata* is, in my opinion, another variety.



(Fig. 4.)

Columbella legrandi. (Fig. 5.)
Columbella minuta.
Columbella xavieriana.
Columbella miltostoma.
Conus carmeli.
Conus macleayana.
Drillia philipineri.
Drillia tœniata.
Drillia agnewi.

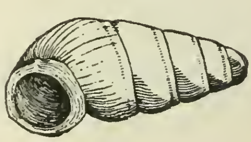

(Fig. 5.)

Drillia weldiana. C. Hedley, Notes on Tasmanian Conchology, 1902, identifies this as D. *fucata, Reeve.* Woods refers to this species in his description. It is certainly exotic.

Drillia immaculata.
Drillia atkinsoni.
Drillia minuta.
Drillia incrusta.
Mangelia desalesi.
Mangelia meredithæ.
Mangelia St. Gallæ.
Mangelia atkinsoni.
Cythara tasmanica
Daphnella tasmanica.
Daphnella varix.
Cancellaria tasmanica.
Tenagodus weldii.
Turritella acuta.
Turritella atkinsoni.
Turritella granulifera.
Crossea cancellata.
Crossea labiata.
Eulima micans.

Eulima tasmanica. (Fig. 6.)

This is undoubtedly a *Rissoia,* but is wrongly placed as a synonym of *R. dissimilis* by Tate and May. It appears to be distinct from all other species, so should stand as *R. tasmanica..* It is almost identical in form with the species figured in Tate and May as *Rissoia tumida,* but the oblique striæ are very fine, so that unless it is very carefully observed it appears smooth, and even polished.


(Fig. 6.)

Syrnola bifasciata.
Syrnola michaeli.
Styloptygma tasmanica.
Odontostoma tasmanica.
Parthenia tasmanica.
Elusa bifasciata.

Turbonilla angasi.

Turbonilla macleayana.

Turbonilla mariæ.

Turbonilla tasmanica. From further careful examination of the type this is certainly *Truncatella scalarina* in the undecollated state; the specimens are very white.

Aclis tristriata.

Bittium minimum.

Cerithiopsis tasmanica.

Triforis tasmanica.

Triforis tasmanica. Var. A. The specimen is broken, but what remains shows it to be *T. pfeifferi* Cr. and F.

Diala punctata.

Diala tessellata.

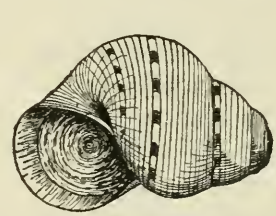
Diala tumida. The shell figured as such in Tate and May, Fig. 67, is not this species; the type shows it to be closer to *Rissoia olivacea* of which it may be a variety; it is longer, with flatter whorls and fewer ribs than is shown by typical *olivacea* from Port Jackson. The type is much beach worn.

Fossarus bulimoides. The type is a juvenile example of *Adelacteon casta*. A. Adams.

Fossarus tasmanicus.

Cingulina australis.

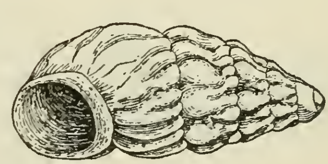
Littorina hisseyana. (Fig- 7.)



(Fig. 7.)

Rissoina St. Claræ.

Rissoina flindersii. I find this has been wrongly united with *Diala pagodula* by Tate; first in his "Revision of the Recent Rissoidæ of Australia," T.R S.S. Aus., 1899, and similarly in Tate and May Census, p. 388. An examination of the type shows it to be a *Rissoia* of the section *Amphithalamus*, the mouth being quite characteristic, and entirely different from *Diala*. I have examples of the species from South Australia. Fig. 8.



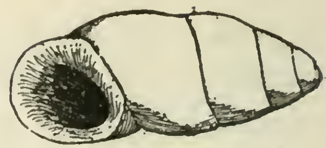
(Fig. 8.)

Rissoina gertrudis. See Notes on Tasmanian Conchology, 1902. C. Hedley.

Rissoina concatenata. Type badly broken.

Rissoa cyclostoma.

Rissoa cyclostoma. Var. rosea. This has been re-named *R. woodsi*, by Pritchard and Gatliff, P. R. S. Victoria, 1901, who rightly regarded it as distinct from *R. cyclostoma*. The types have bleached perfectly white. Fig. 9.

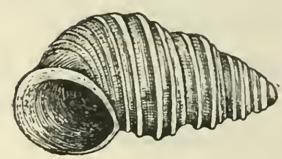


(Fig. 9.)

Rissoa fasciata.

Rissoa cheilostoma.

Rissoa agnewi. (Fig. C.) This is distinct from *R. layardi Pett.*, which will now be restored to specific rank; they are somewhat closely related, but whilst in the latter the keels are close set; in the former they are separated by a considerable interval. Fig. 70 in Tate and May, represent *R. layardi*. The type of which I have seen. Fig. 10.



(Fig. 10.)

Rissoa mariæ.
Rissoa melanura.
Rissoa atkinsoni.
Rissoa minutissima
Rissoa unilirata
Rissoa maccoyi.
Rissoa siennæ
Rissoa brazieri
Rissoa angeli.
Rissoa punctato-striata.

Cyclostrema weldii
Cyclostrema susonis
Cyclostrema micra

The types of these three species are crushed to atoms, which disaster occured during an unfortunate removal some years ago. Happily I had carefully examined them when intact, with the result given by Tate in T. R. S. S., Aust. XXIII, Cyclostrema, and in Tate and May.

Cyclostrema josephi.

Cyclostrema immaculata. Type crushed.

Adeorbis picta. This = *Omphalius faciatus*, Born. *Vide* C. Hedley, Notes on Tasmanian Conchology, June 10, 1902.

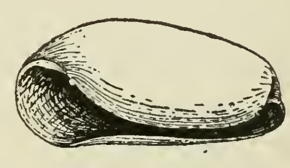
Ethalia tasmanica. This = *Modulus modulus*, Linne. Hedley loc. cit.

Liotia annulata. Type crushed. Same remarks apply to this as to *Cyclostrema*.

Liotia incerta.

Liotia tasmanica.

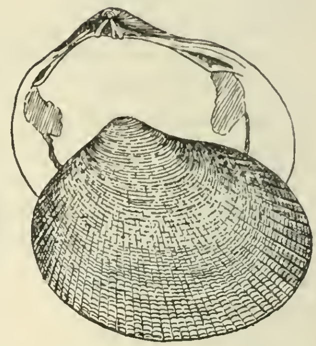
Turbo simsoni.
Turbo cuculata. This = *T. radiata*, Gmel. C. Hedley loc. cit.
Monilea rosea.
Monilea turbinata. This = *Omphalius scalaris*, Anton. Hedley loc. cit.
Clanculus aloysii.
Clanculus raphaeli.
Clanculus philomenæ. I now think that these three species may all be varieties of *C. yatesi*, Crosse.
Clanculus angeli.
Clanculus dominicana.
Gibbula multicarinata.
Gibbula aurea. This seems to be conspecific with *G. smaltata*, Fischer, and is possibly distinct from *G. tiberiana*, Crosse = *Thalotia tessellata*, Ten. Woods.
Gibbula dolorosa.
Gibbula weldii.
Zizyphinus allporti.
Zizyphinus legrandi.
Margarita tasmanica.
Diloma australis.
Euchellus tasmanicus.
Schismope atkinsoni.
Macrochisma tasmanica.
Tugalia tasmanica.
Tugalia australis.
Patella chapmani,
Patella tasmanica.
Acmæa alba.
Acmæa crusis.
Acmæa petterdi.
Acmæa marmorata.
Cylichna atkinsoni. (Fig. 11.) It is larger and more tapering than any examples of *C. pygmæa* A.Ad. that I have seen, but is otherwise very similar.



(Fig. 11.)

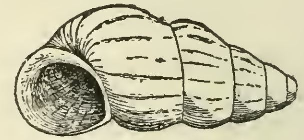
Aplysia tasmanica.
Ampullarina minuta seems to be young of *A. fragilis.*
Auricula dyeriana.
Dentalium weldiana.
Gastrochaena tasmanica.
Neœra tasmanica
Semele warburtoni. This = Lucina *(Codakia)* orbicularis Linne (C. Hedley loc. cit.)
Myodora tasmanica.
Gouldia tasmanica. Types considerably broken.

Macoma mariæ.
Chione macleayana? = C. Stutchburyi Gray juv., probably exotic.
Callista victoriæ.
Dosinia immaculata.
Rupellaria reticulata.
Lucina minima. (Fig. 12.) There are two specimens mounted on the card, representing different species. The larger example has the valves separated, and was doubtless that from which Woods described his species, as he refers to the interior; so I regard this as the type, especially as it agrees well with the description and *dimensions* given. It is very close to *L. perobliqua*, Tate, but that shell seems to be stronger and coarser in the sculpture, especially in the earlier stages of growth, when it approximates in size to *L. minima.* I regret that I have no juv. examples of *perobliqua* for comparison. The other specimen mounted is *L. tatei.* It is a much smaller shell than the other, and does not seem to have been opened. It will be noticed, too, that on a careful reading of Woods's description it will not apply to this species.


(Fig. 12.)

Diplodonta tasmanica.
Pythina tasmanica.
Cardita atkinsoni.
Mytilicardia tasmanica.
Kellia atkinsoni.
Limopsis tenisoni.
Mytilus crassus.
Pecten mariæ.

I also take this opportunity to publish a figure of Rissoia rubicunda, Tate and May. It was overlooked when preparing the figures for the Revised Census. Fig. 13.


(Fig. 13.)

SOME ADDITIONS TO THE BRYOLOGICAL FLORA OF TASMANIA.

By W. A. Weymouth.

Part III.

Read December 1st, 1902.

The first and second parts of this series appeared in the Papers and Proceedings of the Royal Society of Tasmania for the years 1893 and 1894-5 respectively. They dealt only with mosses. The present paper includes both mosses and hepatics.

For the skilled determination of the mosses I am still indebted to the courtesy of Professor V. F. Brotherus, of Helsingfors, Finland, whose fourth and fifth parts of "Some New Species of Australian Mosses" furnish the description of new species that follow.

The hepatics have been very kindly determined by Herr F. Stephani, of Leipzig, through the courteous intervention of Dr. E. Levier, of Florence, who has rendered me great service in the preparation, submission, and return of my specimens.

Under the first of the following headings are given the original descriptions of five new mosses, and the names only of four others, bringing the total of new species added to Mr. R. A. Bastow's list of 1386 up to 37. The second heading covers eleven mosses already known elsewhere, but now first recorded for Tasmania.

The third part consists of new hepatics, numbering 17, the descriptions of which are, I am assured, in course of publication by Mr. Stephani in his elaborate work, "Species Hepaticarum," but are not now available to me.

The fourth part gives those hepatics which, while not new to science, are now newly recorded for Tasmania. These number no fewer than 92 species to be added to Bastow's enumeration in the Proceedings of this Society for 1887. It is interesting to note that of these one, *Acrobolbus piliferus*, is among Archer's Hepatics, but does not appear to have been noted locally; and a second, *Mastigobryum accretum*, doubtfully recorded as found by Gunn over 70 years ago, is now confirmed by Mr. Stephani on recent specimens.

New Mosses.

29. *Anomodon tasmanicus*, Broth., n. sp.

Dioicus; gracilis, caespitosus, caespitibus laxis, ochraceis; *caulis* secundarius flexuosus, hic illic ferrugineo-tomentosus, dense foliosus, superne subfasciculatim ramosus, ramis erecto-patentibus, haud complanatis, vix' ultra 1 cm altis, dense foliosis, simplicibus vel furcatis, obtusis; *folia* sicca laxe imbricata, flexuosula, sicca erecto-patentia, stricta, e basi vix auriculata ovato-lanceolata, hyalino-mucronata, c. 1,3 mm longa et c. 0,4 mm lata, marginibus basi revolutis, integerrimis, nervo lutescente, pellucido, ubique dorso papilloso, superne flexuosulo, infra apicem evanido, cellulis rotundatis, c. 0,010 mm, valde papillosis, obscuris. Caetera ignota.

Patria. Tasmania, Hobart, Knocklofty, Novr. 1888, alt. 1,000ft. W. A. Weymouth, n. 1571.

Species e minoribus, cum nulla alia commutanda.—*Brotherus's Australian Mosses*, V. p. 137.

30. *Bartramidula Weymouthi*, Broth., n. sp.

Hab.—Port Cygnet, on roadside bank, Lymington, Sept., 1889. W.A.W.

31. *Bryum* (*Eubryum*) *argillicola*, Broth., n. sp.

Dioicum; caespitosum, caespitibus laxis, pallide viridibus, haud nitidis; *caulis* brevissimus, basi longe radiculosus, dense foliosus, innovationibus usque ad 5 mm altis, erectis, strictis, ubique dense foliosis, gemmis microphyllinis copiosis axilliferis; *folia* erecto-patentia, carinato-concava, ovata, nervo excedente aristata, marginibus revolutis, integris, angustissime indistincte limbata, nervo crasso, rufescente, in aristam crassam, strictam, acutam, integram longe excedente, cellulis oblongo rhombeis, basilaribus rectangularibus, *innovationum* marginibus superne minute denticulatis, nervo arista denticulata, cellulis apicalibus angustioribus; *seta* vix 1,5 cm alta, sicca flexuosula, tenuissima, rubra; *theca* nutans, crassa, ovalis, pallida, demum atrofusca, collo crasso, sporangio breviore, sicca deoperculata sub ore haud constricta; *annulus* triplex, faciliter revolubilis, c 0,10 mm latus; *peristomium* duplex; *exostomii* dentes lanceolato-subulati, c. 0,4 mm longi et c. 0,075 mm lati, lamellis c. 20, lutei apice hyalini, scabridi; *endostomium* liberum, sordide flavidulum, minute papillosum; *processus* carinati, anguste perforati, hyalini; *cilia* bina, bene evoluta, appendiculata, papillosa, hyalina; *spori* 0,015 mm, lutescenti-virides, laevissimi; *operculum* conicum, acute apiculatum.

Patria. Tasmania, Port Cygnet, Lymington, ad terram argillosam, Sept., 1889. W. A. Weymouth, n. 1846.

Species *Br. brachytheciellae* C. Müll., cujus specimina sterilia tantum possidemus, valde affinis, sed innovationibus gemmiferis, foliis superne serrulatis dignoscenda.—*Brotherus's Australian Mosses*, V. p. 118.

32. *Bryum* (*Eubryum*) *microsporum*, Broth. n. sp.

Dioicum; caespitosum, caespitibus humilibus, densis, pallide lutescenti-viridibus, haud nitidis; *caulis* brevissimus, basi fusco-radiculosus, dense foliosus, innovationibus vix ultra

5 mm altis, erectis, strictis, dense foliosis, ob folia accrescentia clavatis; *folia* sicca adpressa, humida suberecta, carinato-concava, oblongo-ovata, longe aristata, marginibus inferne revolutis, integris, limbata, limbo concolore, e seriebus cellularum angustarum 3—4 formato, nervo lutescente, basi rufescente, in aristam elongatam, flexuosulam, integram excedente, cellulis teneris, laxe oblongo-hexagonis, basilaribus rectangularibus, *innovationum* superne minutissime denticulata; *brac'eae perichaetii* multo minores, longe aristatae, marginibus erectis, integris; *seta* 3—5 cm alta, stricta, tenuis, fuscescenti-rubra, nitidiuscula; *theca* pendula, sporangio oblongo, collo sicco ruguloso, dimidiam partem sporangii aequante, pallide fuscidula; *annulus* c. 0,15 mm latus, per partes secedens; *peristomium* duplex; *exostomii* dentes lanceolato-subulati, c. 0 55 mm alti et c. 0,1 mm lati, lamellis c. 25, pallidi, apice hyalini, scabridi; *endostomium* liberum, flavidulum, minutissime papillosum; *processus* carinati, late perforati; *cilia* bina, elongata, longe appendiculata, papillosa, hyalina; *spori* 0,010—0,012 mm, lutescenti-virides, laevissimi; *operculum* convexo-conicum, apiculatum.

Patria. Tasmania, Peppermint Bay, Mason's Creek, Nov. 1889. W. A. Weymouth n. 1848.

Species *Br. altiseto* C. Müll. habitu similis, sed inflorescentia dioica, foliis longius et tenuius aristatis nec non theca angustiore optime diversa. — *Brotherus's Australian Mosses*, V. p. 116.

33. *Bryum (Eubryum) ovicarpum*, Broth., n. sp.

Dioicum; pusillum, gregarium; *caulis* brevissimus, basi radiculosus, dense foliosus, subgemmiformis, innovationibus brevissimis, inferne nudis, apice dense foliosis: *folia* imbricata, ovata vel ovato-ovalia, nervo excedente longe aristata, marginibus erectis, integris, elimbata, nervo crasso, rufescente in aristam elongatam, strictam, acutam, integram, hyalinam excedente, cellulis laxe rhombeis, basilaribus subrectangularibus; *seta* 1 cm alta, tenuissima, rubra; *theca* nutans, minuta, cum collo crasso, ruguloso, pallidiore ovato-ovalis, atropurpurea; *annulus* per partes secedens, c. 0,075 mm latus; *peristomium* duplex; *exostomii* dentes lanceolato-subulati, c. 0,4 mm alti et c. 0,06 mm lati, lamellis c. 15, pallidi, basi rufescentes, apice hyalini, scabridi; *endostomium* liberum, flavidulum, minutissime papillosum; *processus* carinati, angustissime perforati; *cilia* bina bene evoluta, brevissime appendiculata, hyalina, papillosa; *spori* 0,010 mm, ochracei, laevissimi; *operculum* alte conicum.

Patria. Tasmania, Hobart, ad terram, Dec., 1891. W. A. Weymouth, n. 1834.

Species *Br. pacythecae* C. Müll. affinis, sed theca minuta, ovato-ovali prima fronte dignoscenda.—*Brotherus's Australian Mosses*, V. p. 117.

34. *Eriopus tasmanicus*, Broth., n. sp.

Dioicus; gracilis, viridis, superne lutescenti-fuscescens, haud nitidis; *caulis* 2—3 cm altus, adscendens, superne arcuatus, complanatus, cum foliis 2,6—3 mm latus, inferne dense, superne parcius radiculosus, radiculis elongatis, fuscis, dense foliosus, subsimplex; *folia* sicca imbricata, humida planiuscula, *lateralia* erecto-patentia, obovata, apiculo acuto terminata, marginibus erectis, superne minutissime serrulatis, late limbata, limbo e seriebus 4—5 cellularum angustarum formato, nervis binis, brevissimis, altero saepe obsoleto, cellulis in medio folii ovali-hexagonis, 0,050—0,060 mm longis et c. 0,025 mm latis, superne sensim minoribus, basilaribus oblongo-hexagonis, *dorsalia* et *ventralia* adpressa, minora. Caetera ignota,

Patria. Tasmania, Hobart Waterworks, Gentle Annie, March, 1894. W. A. Weymouth.

Species *E. cristato* (Hedw.) Jaeg. affinis, sed statura multo minore foliisque minutius serrulatis, latius limbatis facillime dignoscenda.—*Brotherus's Australian Mosses*, V. p. 125.

35. *Fissidens leptocladus*, C. Müll.-Broth., n. sp.

Hab.—Guy Fawkes Rivulet, near Hobart, on rocks, Sept., 1890, and Jan., 1897. W.A.W., Nos. 385, 2,157.

36. *Philonotis rigens*, Broth., n. sp.

Hab.—The Bridge Gully, near Glen Rae, Wattle Hill, Jan. 1891, W.A.W., No. 556.

37. *Weissia* (*Hymenostomum*) *Weymouthi*, C. Müll., n. sp.

Hab..—On wet bank, Cradoc, Huon, Sept., 1889, W.A.W., No. 163.

New Varieties.

3. *Acanthocladium extenuatum*, Brid., var. *rivuletorum*, Broth., n. var.

Hab. — West Coast, on the ground, banks of creeks, Macquarie Harbour, Nov., 1896. T. B. Moore (Herb. W.A.W., No. 2,069).

4. *Sphagnum Australe*, Mitt., var. *grandiosum*. Warnst., n. var.

Hab.—Huon, on old tramway, Arve Road, Franklin, W.A.W., No, 2,063.

Mosses New to Tasmania.

41. *Barbula unguiculata*, Hedw.

Hab.—New Town, on the ground in paddock Foster-street, March, 1893. W.A.W., No. 1,487.

42. *Bryum cupulatum*, C. Müll., f. *seta breviore.*

Hab.—Launceston streets, Aug , 1886. A. J. Taylor. (Herb. Bastow and W.A.W.)

43. *Bryum* (*Eubryum*) *laevigatulum*, Broth.

Dioicum; gracile, caespitosum, caespitibus densis, inferne ferrugineis, superne laete viridibus, nitidiusculis; *caulis* fertilis humilis, longe radiculosus, apice foliosus, innovationibus singulis vel binis, 1 cm altis, dense foliosis obtusis; *folia caulina* erecto-patentia, elongate oblonga, obtusiuscula, marginibus erectis, integerrimis, limbata, limbo e seriebus tribus cellularum composito, nervo crasso, rufescente, cum apice evanido, cellulis ovali-vel oblongo-hexagonis, basilaribus subrectangularibus, *innovationum* sicca imbricata, humida erecto-patentia, subcymbiformi-concava, oblonga, marginibus erectis, superne minutissime serrulatis, limbata, limbo triseriato, nervo cum apice evanido vel in apiculum erectum excedente, cellulis ovali-vel oblongo-hexagonis, basilaribus subrectangularibus; *bracteae perichaetii* internae foliis multo minores, lanceolatae, archegonia numerosa includentes; *seta* vix 1,5 cm alta, flexuosula, tenuis, purpurea; *theca* horizontalis vel nutans, pyriformis, collo sporangium aequante, sicca laevis, deoperculata sub ore haud constricta, demum rubra; *annulus* 0,10 mm latus, per partes secedens; *peristomium* duplex; *exostomii* dentes c 0,35 mm longi et c. 0,09 mm lati, lutei, apice hyalini, lamellis c. 20; *endostomium* liberum, sordide hyalinum, minute sed densissime papillosum; *processus* dentium longitudinis, carinati, anguste perforati; *cilia* rudimentaria; *spori* 0,015—0,017 mm, lutescentes, laevissimi; *operculum* convexo-conicum, apiculatum. Species *Br. laevigato* Hook. fil. Wils. affinis, sed statura multo minore et peristomio ciliis rudimentariis raptim dignoscenda.—*Broth. Australian Mosses,* IV., p. 88.

Hab.—New Town Falls, on rock, August, 1889. W.A.W., No. 1,845. Locality unrecorded. W.A.W., No. 1,849.

(Also New Zealand.)

44. *Campylopus Kirkii,* Mitt.

Dr. Brotherus says:—"That moss from Tasmania which my friend A. Geheeb, under the name of *Dicnemon Moorei*, Broth. Geh., mentions in Revue Bryologique, 1897, p. 67, I have by a further examination found to be *Campylopus Kirkii*, Mitt., earlier found in New Zealand."—Australian Mosses, IV., p. 74.

Hab.—West Coast, on the ground, Jones's Track, Macquarie Harbour. T. B. Moore (Herb. W.A.W., 2,015 *b*).

45. *Campylopus subappressifolius*, Broth. Geh.

Hab.—West Coast, Mount Darwin, damp places, alt. 3,400ft., March. 1893, T. B. Moore (Herb. W.A.W., No. 1,556); and on gravelly button-grass hills, Jones's Track, South Sprent River, T. B. Moore (Herb. W.A.W., No. 2,015).

46. *Hedwigia albicans* (Web.) Lindb.

Hab.—Hobart Rivulet, on dry rock, January, 1898, W.A.W., No. 2,167.

47. *Sphagnum centrale*, C. Jensen = S. intermedium, Russow.

Hab.—Brown's River, 1885, F. Abbott (Herbs. Bastow and W.A.W.). In a bog, Brown's River, 1894, C. D. Hazell (Herb. W.A.W., No. 1,915). Form *brachy-dasyclada*, R. A. Bastow, No. 531 (Herb. W.A.W.)

Var. *flavo-glaucescens*, Russ.

Hab.—Blue Tier Range, Sept., 1897, W. P. Kirwan (Herb. W.A.W., No. 2,123). Weldborough, Murphy's Creek, Aug., 1897 (f. *brachyclada*, Warnst.) P. H. Weymouth (Herb. W.A.W., No. 2,122).

Var. *fusco-pallescens*, f. *brachy-dasyclada*, Warnst.

Hab.—Weldborough, in a bog, Aug., 1897, W.A.W., No. 2,121.

Var. *flavo-pallescens*, f. *brachy-dasyclada*, Warnst.

Hab.—Blue Tier Range, Sept., 1897. W. P. Kirwan (Herb. W.A.W., No. 2,124).

48. *Sphagnum cuspidatum* (Ehrh.)

Var. *submersum* (Schimp.), f. *serrulata* (Schlieph).

Hab.—West Coast, floating in water of sandy ditch, West Strahan, Oct., 1893, W.A.W., No. 2,063.

49. *Tortula panduræfolia*, Hpe. C.M.

Hab.—Mount Rumney, Nov., 1885. R. A. Bastow (Herb. W.A.W.) On stone, behind Knocklofty, near Hobart, Jan., 1888, W.A.W., No. 1577.

50. *Ulota fulva*, Brid.

Hab.—West Coast, on wood, Comet-Dundas road, Oct., 1893, W.A.W., No. 1,654.

51. *Zygodon obtusifolius*, Hook.

Hab.—West Coast, on trees, Sophia Point, Macquarie Harbour, T. B. Moore, No. 26 (Herb. W.A.W., No. 1,999).

New Hepatics.

1. *Aneura dentata*, Steph., n. sp., 1899. Species Hepaticarum I.

Hab.—Lottah, on wet bank, August, 1897, W.A.W. (a few admixed fragments); and St. Crispin's, Mt. Wellington, on rocks, Jan., 1899, W.A.W., Nos. 570, 572-574.

2. *Aneura gracilis*, Steph, n. sp., 1899. Species Hepat. I.

Hab.—Guy Fawkes Rivulet, near Hobart, Jan., 1897, W.A.W.; Deep Creek and Bower Creek, Mt. Wellington, alt. 1,600ft., Dec., 1897; Hobart Rivulet, Jan., 1898; St. Crispin's, on tree fern and on face of wet rocks, alt. 2,200ft., and Watchorn's Hill, on bank of watercourse near State-school, Jan., 1899, W.A.W., Nos. 252a, 296/7, 309, 328, 363, 369, 434, 566, 568.

3. *Aneura longiflora*, Steph., n. sp., 1899. Species Hepat. I.

Hab.—Blue Tier near Lottah, Aug., 1897, and Bower Creek, Mount Wellington, alt. 2,000ft., Dec., 1897, W.A.W., Nos. 208, 210, 360.

4. *Aneura tasmanica*, Steph., n. sp., 1899. Species Hepat. I.

Hab.—Guy Fawkes Rivulet, on wood, Sept., 1892, and Jan., 1898; Deep Creek, on stony bank, alt. 1,600ft., Dec., 1897; and Bower Creek, on wet rock, Dec., 1898, W.A.W., Nos. 228, 252, 307, 428. Locality unrecorded, R. C. Gunn (Herb. Mitten and Hobart Museum).

Of Gunn's specimen, which was marked *Sarcomitrium crassum* by Mr. Mitten, Herr Stephani writes:—"*Aneura* "*crassa* (Schwgr.) Nees is not to be found in any European "collection. It is reported to be collected 'in the Australian "Islands.' Such a vague expression does not permit us to "consider Gunn's plant as a reliable original. See my "*Species Hepat.* I., p. 274."

5. *Cephalozia verrucosa*, Steph., n. sp., 1899. Species Hepat. I.

Hab.—On the Cataract Hill, Launceston, July, 1899, W.A.W., No. 694.

6. *Cephaloziella Levieri*, Steph., n. sp., 1899.

Hab.—Deep Creek, on stony bank (a few scraps with *Lepidozia glauca*, Steph.), alt. 1,600ft., Dec., 1897, W.A.W., No. 316 in part.

7. *Cheilolejeunea Weymouthi*, Steph., n. sp., 1899.

Hab.—Hobart Rivulet, on wet rock on margin, Nov., 1898, W.A.W., No. 403.

8. *Fimbriaria tasmanica*, Steph., n. sp., 1899.

Hab.—Beltana, on the Recreation Ground, June, 1899, and Launceston, on Trevallyn Hills, July, 1899, W.A.W., Nos. 672, 711, 714, 716.

9. *Fossombronia dentata*, Steph., n. sp., 1897.

Hab,—Launceston, on earth, Trevallyn, Sept., 1892, W.A.W., No. 13.

10, *Isotachis pusilla*, Steph., n. sp., 1899.

Hab—Longley, on roadside bank, Huon-road, May, 1899, W.A.W., No. 649.

11. *Lejeunea* (*Eulejeunea*) *cuspidistipula*, Steph., n. sp., 1899.

Hab.—Mount Wellington, on live tree trunk (on *Zygodon* sp.), 25th Dec., 1897, alt. 2,500ft., W.A.W., No. 412.

12. *Lepidozia sexfida*, Steph., n. sp., 1899.

Hab.—Huon-road, on roadside bank, Longley, May, 1899, W.A.W., No. 650/1. North and South Upper Huon, on roadside banks, May, 1899, W.A.W., Nos. 652, 654/5, 660, 663.

13. *Lophocolea Weymouthi*, Steph., n. sp., 1899.

Hab.—Mount Wellington, Bower Creek, on trunk of tree fern, and on rocks, Dec., 1898, and St. Crispin's, on decayed wood, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 420, 421, 565.

14. *Plagiochila squarrosa*, Steph., n. sp., 1900.

Hab.—On rock, Newman's Creek, Tasman Peninsula, Feb. 1899, W.A.W., No. 819.

15. *Radula Weymouthi*, Steph., n. sp., 1899.

Hab.—On decaying sassafras branch, Wellard Rivulet, Tasman Peninsula, Feb., 1899, W.A.W., No. 628.

16. *Riccia tasmanica*, Steph., n. sp., 1899.

Hab—Beltana, River Derwent, on the ground, June, 1899, W.A.W., No. 674 *ex parte*.

17. *Tylimanthus homomallus*, Steph., n. sp., 1897.

Hab.—Blue Tier, Dec., 1895, E. McGregor (few specimens picked out—Herb. W.A.W.)

Hepatics New to Tasmania.

1. *Acrobolbus piliferus* (Mitt. sub *Gymnanthe*), Schiffn.

Hab.—No locality or date recorded, W. Archer.

In Archer's Herbarium, Hobart Museum, there is a specimen named by Mitten *Gymnanthe pilifera*, but it does not appear to have been previously recorded for Tasmania.

2. *Acrobolbus unguiculatus* (Hook. *f.* Tayl.), Mitt.

Hab.—South Upper Huon, on bank of roadside ditch, May, 1899, W.A.W., 659, 662 *b*.

3. *Anastrophyllum schismoides* (Mont.), Steph.

Hab.—Blue Tier, Dec., 1895, E. McGregor. Herb. W.A.W., No. 195.

4. *Aneura Colensoi*, Steph. Species Hepat. I.

Hab.—Hobart Rivulet, on damp earth at margin of stream, Jan., 1898, W.A.W., Nos. 362, 366.

5. *Aneura erecta*, Steph. Species Hepat. I.

Hab.—Mount Wellington, on wood, Deep Creek, Dec., 1887, Bower Creek, Jan., 1888, on rock St. Crispin's, Jan., 1899, W.A.W., Nos. 406 in part, 569.

6. *Aneura minima*, Carr. Pears.

Hab.—Mount Wellington, on a tree St. Crispin's, Dec., 1895; on wet bank, Falls Track, Nov., 1896, W.A.W., Nos. 108, 179, 181, 207.

7. *Aneura nitida*, Colenso.

Hab.—Mount Wellington, on decayed wood St. Crispin's, Dec., 1895, W.A.W., No. 105.

8. *Aneura perpusilla*, Colenso.

Hab.—Tasman Peninsula, on decayed wood, Wellard Rivulet, Feb., 1899, W.A.W., No. 804.

9. *Aneura polymorpha*, Colenso.

Hab.—Hobart, on earth, Salvator Rosa Glen, W.A.W., No. 129 (b). Mount Faulkner, on bank of creek near Skye Farm, Dec., 1892, Mrs. Pettifer (Herb. W.A.W., No. 188).

10. *Aneura prehensilis* (Hook. *f.* Tayl.), Mitt.

Hab.—Mount Wellington, on log, Bower Creek, Dec., 1898, W.A.W., No. 431.

11. *Aneura stolonifera*, Steph. Species Hepat. I.

Hab.—Tasman Peninsula, 1893, Rev. John Bufton (Herb. W.A.W., 399). Mount Wellington, on wet bank Falls Track, Nov., 1896, W.A.W., No. 415.

12. *Anthoceros carnosus* (Hook. *f.* Tayl.), Steph. Species Hepat. I.

Hab.—Mount Wellington, on wet rocks Deep Creek, Dec., 1887, on rocks near the Springs, Dec., 1890 and 1894, W.A.W., Nos. 54, 54 (b) 55.

13. *Anthoceros crassus*, Steph.

Hab.—Western Rivulet, W. Archer. (Herb. Archer in Hobart Museum.)

14. *Cephalozia exiliflora* (Tayl.), Steph.

Hab.—Mount Wellington, on wood Deep Creek, alt. 1,600ft., Dec., 1887, and Geeveston, on burnt log, Nov., 1892, W.A.W.

15. *Chandonanthus squarrosus* (Hook.), Mitt.

Hab.—Mount Wellington, on the Springs Track, alt. 2,000ft., Nov., 1890, W.A.W., No. 73.

16. *Cheilolejeunea muscicola*, Steph. Species Hepat.

Hab.—Hobart Rivulet, on rocks in running water, Jan., 1898, W.A.W., No. 373.

17. *Chiloscyphus affinis*, Gottsche.

Hab.—River Mersey, on shady earth bank near Latrobe Waterworks, March, 1893, W.A.W., and Mount Wellington, on wet rock in Bower Creek, Dec., 1898, W.A.W., No. 426.

(Also Australian Alps, F. v. M.)

18. *Chiloscyphus asperrimus*, Steph. Species Hepat.

Hab.—West Coast, Moore's Track to Frenchman's Cap, T. B. Moore. (A few fragments picked out.)

19. *Chiloscyphus commutatus*, Steph. Species Hepat.

Hab.—Tasman Peninsula, on shady rocks, and on wet decayed wood, Newman's Creek, W.A.W., Nos. 604, 612.

20. *Chiloscyphus cuneistipulus*, Steph. Species Hepat.

Hab.—Mount Wellington, Deep Creek, Dec., 1887, alt. 1,600ft., W.A.W., No. 97 (a few specimens).

21. *Chiloscyphus ligulatus*, Colenso.

Hab.—Franklin, Price's Rivulet, Feb., 1892, W.A.W., No. 50. Mount Wellington, on wet rocks Guy Fawkes Falls, Sept., 1892, and St. Crispin's, alt. 2,200ft.. Dec., 1895, and on face of dripping rocks Hobart Rivulet, Aug., 1896, W.A.W., 49, 115, 117.

22. *Chiloscyphus Moorei*, Steph. Species Hepat.

Hab.—West Coast, on Jones's Track, and on hard button-grass plains, Macquarie Harbour, Nov., 1896, T. B. Moore. (Herb. W.A.W., Nos. 150, 168.)

23. *Chiloscyphus Mülleri*, Gottsche.

Hab.—D'Entrecasteaux Channel, on wet bank of roadside drain, Middleton, Aug., 1894, W.A.W., 178.

(Also Australian Alps, F. v. M.)

24. *Chiloscyphus odoratus*, Mitt.

Hab.—Mount Wellington, on wood Deep Creek, alt. 1,600ft., Dec., 1887, W.A.W., No. 53.

25. *Chiloscyphus physanthus* (Tayl.), Mitt.

Hab.—Mount Wellington, Deep Creek, Dec., 1887 (fragments with other hepatics), W.A.W., and Guy Fawkes Rivulet, May, 1890, W.A.W., No. 184.

26. *Chiloscyphus trispinosus*, Mitt.

Hab.—Tasman Peninsula, on wood. Newman's Creek. March, 1891, W.A.W. (picked out from *Tricholea tomentella*),

27. *Fossombronia perpusilla* (Col.), Steph.

Hab.—Launceston, on earth, Trevallyn Hill, Sept., 1892, W.A.W., Nos. 389, 395.

28. *Frullania cinnamomea*, Carr. et Pears.

Hab.—Tasman Peninsula, on fallen sassafras, Newman's Creek, Feb., 1899, and Launceston, on rock, Cataract Hill, July, 1899, W.A.W., Nos. 776, 705.

29. *Frullania cranialis*, Tayl.

Hab.—Mount Wellington, on trunk of *Prostanthera*, Deep Creek Track alt. 1,600ft., Jan., 1899, W.A.W., Nos. 580, 582.

30. *Frullania pentapleura*, Tayl.

Hab.—Kempton, on rock on the Sugar Loaf, May, 1892, and Mount Wellington, on a tree, St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 217, 581.

31. *Frullania pycnantha*, Tayl.

Hab.—Launceston, on rock, Cataract Hill, July, 1899, W.A.W., Nos. 706, 707.

32. *Frullania spinifera*, Tayl.

Hab.—Guy Fawkes Rivulet, near Hobart, on trunk of tree, Jan., 1899, and Tasman Peninsula, on English oak, Carnarvon, Feb., 1899, W.A.W., Nos. 473, 476, 477, 775.

33. *Hymenophyton leptopodum* (Tayl.) Dum.

Hab.—Mount Wellington, Deep Creek, Dec., 1887, on wood, Guy Fawkes Rivulet, Jan., 1897, on rock and roots, Hobart Rivulet, Jan., 1899, on wet rocks St. Crispin's, Jan., 1899, W.A.W., Nos. 124, 457, 458, 460, 563 (in part).

34. *Hymenophyton podophylla*, Nees et Mont.

Hab.—Mountains towards Lake Pedder, Schuster, 1875, with f. flowers.—*Frag. Phyt. Aus. XI.*, p. 67 (supplement).

35. *Isotachis grandis*, Carr. et Pears.

Hab.—Mount Wellington, on top, amongst *Sphagna*, Feb., 1888, alt. 4,166ft., W.A.W., No. 57. West Coast, Sophia Point, Macquarie Harbour, T. B. Moore (Herb. W.A.W., No. 131).

36. *Isotachis inflexa*, Gottsche.

Hab.—Huon-road, on roadside bank near the Halfway Bridge at Longley, Feb., 1892, W.A.W., No. 401.

(Also Blue Mountains, N.S.W., 1871, W. Woolls.)

37. *Lejeunea* (*Eulejeunea*) *Drummondi* (Tayl.).

Hab.—River Mersey, on trunk of tree near Latrobe Waterworks, March, 1893, W.A.W., No. 125. Guy Fawkes Rivulet, near Hobart, on *Prostanthera*, Jan., 1899, W.A.W., Nos. 469, 482. Tasman Peninsula, on rocks Newman's Creek, and on wood Wellard Rivulet, Feb., 1899, W.A.W., Nos. 613, 629.

38. *Lepicolea attenuata* (Mitt.) Spruce.

Hab.—Mount Wellington, Wellington Falls, March, 1886, R. A. Bastow (Herb. W.A.W., 66*d*). On rocks, Sept., 1891, and near the Organ Pipes, Dec., 1894, W.A.W., Nos. 186, 198. West Coast, Comet-Dundas Road, Grubb's Tramway, Zeehan, and West Strahan, Oct., 1893, W.A.W., Nos. 66, 66*b*&*c*. Blue Tier, Dec., 1895, E. McGregor, and Sept., 1897, W. P. Kirwan (Herb. W.A.W., No. 214.) West Coast, Macquarie Harbour, Nov., 1896, T. B. Moore (Herb. W.A.W., No. 167.)

39. *Lepidozia asymmetrica*, Steph.

Hab.—Mount Wellington, Deep Creek, Hobart Rivulet, and Bower Creek, Dec., 1897, Jan. and Dec., 1898, W.A.W., Nos. 281, 345, 364, 406*b*. North Upper Huon, on roadside bank, May, 1899, W.A.W., No. 653.

40. *Lepidozia chætophylla*, Spruce.

Hab.—Tasman Peninsula, on tree fern, Wellard Rivulet, Feb., 1899, W.A.W., 808.

41. *Lepidozia chordulifera*, Tayl.

Hab.—West Coast, Jones's Track, T. B. Moore. (Herb. W.A.W., No. 135.)

42. *Lepidozia concinna*, Colenso.

Hab.—Mount Wellington, St. Crispin's, Jan., 1899, W.A.W., No. 591*b*, alt. 2,200ft.

43. *Lepidozia glauca*, Steph.

Hab.—Mount Wellington, Deep Creek, alt. 1,600ft., Dec., 1897, W.A.W., No. 316.

44. *Lepidozia magellanica*, Steph.

Hab.—Tasmania, locality not recorded, W.A.W.

45. *Lepidozia parvitexta*, Steph.

Hab.—Mount Wellington, Bower Creek, alt. 1,500ft., and St. Crispin's, alt. 2,200ft., Jan., 1888, Nov., 1890, Dec., 1895, W.A.W., Nos. 3, 67, 106. West Coast, Macquarie Harbour, July, 1893, and Nov., 1896, T. B. Moore (Herb. W.A.W., Nos. 132, 166). Blue Tier, Dec., 1895, E. McGregor.

46. *Lepidozia Saddlensis*, Massalongo.

Hab.—West Coast, Mount Darwin (amongst *Symphyogyna obovata*, 1893, T. B. Moore. (Herb. W.A.W., No. 381.)

47. *Lepidozia setiformis*, De Notaris.

Hab.—Sandfly Road, near Ludbey's, Dec., 1888, W.A.W., No. 410 (a few fragments).

48. *Lophocolea allodonta*, Mitt.

Hab.—Port Esperance, on wood, main road, W.A.W., No. 46. Mount Wellington, East Slope and Bower Creek, Dec., 1897, W.A.W., Nos. 261, 350, 356. Tasman Peninsula, on tree, Wellard Rivulet, Feb., 1899, W.A.W., No. 816 in part.

49. *Lophocolea alternifolia*, Mitt.

Hab.—Mount Wellington, on fallen branches of trees, Bower Creek, Dec., 1897, W.A.W., No. 343.

50. *Lophocolea australis*, Gottsche.

Hab.—West Coast, Porteus's Gully, Queen River Road, Feby., 1891, W.A.W., No. 94 (few fragments) Mt. Wellington: on wet rock in Bower Creek, Dec., 1898; on stony bank, Deep Creek Track, near Trolly hut, Jan., 1899; on rock Watchorn's Hill, Jan., 1899. W.A.W., Nos. 418, 496, 511.

51. *Lophocolea bispinosa* (Hook. f Tayl.) Mitt.

Hab.—Hobart Rivulet, Dec., 1897, and Jan., 1898. Mt. Wellington, on the Springs Track, and on rocks Deep Creek, Dec., 1897; on rock in Bower Creek, Dec., 1898; and on rock St. Crispin's, Jan., 1899. New Town Rivulet, June, 1899. W.A.W., Nos. 241, 274, 302/3, 372, 427, 515/6, 519, 521, 719.

52. *Lophocolea Bridelii*, Gottsche.

Hab.—Blue Tier, Sept., 1897, W. P. Kirwan (Herb. W.A.W.). Mt. Wellington, on rock Deep Creek, Dec., 1897; on rock and native laurel St. Crispin's; on Deep Creek track, and at Watchorn's Creek, Jan., 1899. W.A.W., Nos. 304, 493, 514, 517, 575.

53. *Lophocolea Campbelliana*, Steph. Species Hepat.

Hab.—Hobart Rivulet, Dec., 1892. W.A.W. (amongst *Dicranum*).

54. *Lophocolea corticola*, Steph. Species Hepat.

Hab.—Mt. Wellington, on rock St. Crispin's, Jan., 1899, W.A.W., No. 558. Tasman Peninsula, on wet decayed wood Newman's Creek, and on decayed wood Wellard Rivulet, Feb., 1899, W.A.W., Nos. 606, 608.

55. *Lophocolea erectifolia*, Steph. Species Hepat.

Hab.—Mount Wellington, St. Crispin's, Dec., 1895, W.A.W., No. 111.

56. *Lophocolea Lauterbachii*, Steph.

Hab.—Tasman Peninsula, on a tree Wellard Rivulet, Feb., 1899, W.A.W., Nos. 564 in part, 802.

57. *Lophocolea Moorei*, Steph. Species Hepat.

Hab.—West Coast, on track to Frenchman's Cap, 1893 (amongst *Radula plicata*), T. B. Moore (Herb. W.A.W., No. 138). Huon-road, on wood Millhouse's Falls, March, 1893, W.A.W., No. 92. Mount Wellington, on wood St. Crispin's, Dec., 1895, and Jan., 1899, and on stony bank Deep Creek, Dec., 1897, W.A.W., Nos. 280/1, 502/3.

58. *Lophocolea multipenna*, Tayl.

Hab.—West Coast, King River, T. B. Moore (Herb. W.A.W., No. 163); on wood near Leslie Junction, Dundas, Oct., 1893 (amongst *Plagiochila ramosissima*), W.A.W., No. 767. Mount Wellington, on rocks in running water, St. Crispin's, Jan., 1899, W.A.W., No. 513.

59. *Lophocolea planiuscula*, Tayl.

Hab.—Franklin, Huon, on old tramway Price's Rivulet, Feb., 1892, W.A.W., No. 119. Mount Wellington, Falls Track, Nov., 1896, W.A.W., No. 202.

60. *Lophocolea rotundistipula*, Steph. Species Hepat.

Hab.—Mount Wellington, on boulders in running water, St. Crispin's, alt. 2,200ft., W.A.W., No. 107.

61. *Lophocolea rupicola*, Steph.

Hab.—Mount Bischoff, on stone River Waratah, April, 1892, W.A.W., No. 187.

62. *Lophocolea submarginata*, Tayl.

Hab.—Mount Wellington, Bower Creek, Dec., 1897 (mixed with *Hymenophyton phyllanthus*), W.A.W.

63. *Lophocolea subporosa*, Tayl.

Hab.—Mount Wellington, on decayed wood, Bower Creek, Dec., 1897 (a few admixed fragments), W.A.W.

64. *Lunularia cruciata* (L.) Dum. = *L. Vulgaris*, Micheli.

Hab.—On the ground, Mona Vale, near Ross, August, 1899, W.A.W., 862.

65. *Marchantia cephaloscypha*, Steph. Species Hepat.

Hab.—Mount Wellington, north slope, Jan., 1888, W.A.W., No. 130. Hastings, on Hay's tramway, April, 1888, W.A.W., No. 130*b*. Latrobe, on the ground, Hazeldean, March, 1893, and Tasman Peninsula, on the ground near Brown Mountain, Jan., 1899, W.A.W., Nos. 128, 756. Gould's Country, Jan., 1897, Mrs. W. A. Weymouth (Herb. W.A.W., No. 206). Derwent Valley, Back River Creek, Dec., 1898, Miss Jean Downie (Herb. W.A.W., No. 446).

66. *Marchantia fusca*, Steph., Bull. Herb. Boiss., 1899.

Hab.—Mount Wellington, on wet bank Deep Creek, alt. 1,600ft., Dec., 1897, and on wet bank in bed of Bower Creek, alt. 2,000ft., Dec., 1898, W.A.W., Nos. 306, 447/8.

67. *Marsupidium setulosum*, Mitt.

Hab.—Mount Faulkner, on dry rocks near Skye Farm, Dec., 1892, W.A.W. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., No. 453).

68. *Mastigobryum accretum*, Lehm. Ldnbg.

Hab.—West Coast, on wood Grubb's Tramway, Zeehan, Oct., 1893, W.A.W., No. 229. Also near Leslie Junction, Dundas, Oct., 1893, W.A.W., No. 767 in part (a scrap). Dr. Levier says of this plant:—"Highly interesting. . . Mr. "Stephani writes that *Mastigobryum accretum*, an Australian "species not found in Tasmania since 1830, and quoted with "doubt, is now perfectly sure."

69. *Mastigobryum elegans*, Colenso.

Hab.—Mt. Wellington, St. Crispin's, Jan., 1888, W.A.W., No. 4. Blue Tier, Dec., 1895, E. McGregor.

70. *Mastigobryum Mittenii*, Steph. Species Hepat.

Hab.—Port Esperance, Aug., 1887, D. Purvis (Herb. W.A.W., 226.) Lymington (Port Cygnet), Sept., 1887, Rev. F. C. B. Fairey (Herb. W.A.W., 223). Mount Wellington, Springs Track, Dec., 1890; Deep Creek, Dec., 1893 and 1897, on a log St. Crispin's, Jan., 1899, W.A.W., Nos. 224/5, 227, 319, 532. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W.). West Coast, Moore's Track to Frenchman's Cap, T. B. Moore (Herb. W.A.W., 136); North-East Dundas, Oct., 1893, Miss C. Page. Weldborough, 1897, Gilbert Murphy (Herb. W.A.W., 487). Tasman Peninsula, Rev. John Bufton (Herb. W.A.W., 400); on decayed wood and on sassafras Wellard Rivulet, W.A.W., Nos. 642/3.

71. *Mastigobryum mooreanum*, Steph. Species Hepat.

Hab.—West Coast, Jones's Track, North Sprent River, T. B. Moore (Herb. W.A.W., 147).

72. *Metzgeria atrichoneura*, Spruce.

Hab.—Tasman Peninsula, amongst *Tylimanthus tenellus*, Wellard Rivulet, Feby., 1899, W.A.W., 761 in part.

73. *Metzgeria nitida*, Mitt. = *M. Australis*, Steph.

Hab.—Mount Wellington, Deep Creek, Dec., 1887; St. Crispin's, Dec., 1895; Bower Creek, Dec., 1897, and elsewhere, W.A.W., Nos. 27, 29, 32, 110, 242, 267, 462, etc. West Coast, Frenchman's Cap, and Jones's Track to Huon, T. B. Moore (Herb. W.A.W., Nos. 142, 146). Tasman Peninsula, on wood, Wellard Rivulet, Feby., 1899, W.A.W., Nos. 769, 784, 801.

74. *Metzgeria saccata*, Mitten.

Hab.—Mount Wellington, on *Orthotrichum tasmanicum*, growing on a falling branch, alt. 2,500ft., Dec., 1897, W.A.W., No. 407. Tasman Peninsula, on sassafras, Wellard Rivulet, Feb., 1899, W.A.W., No. 782 in part.

75. *Odontoschisma sp.* (incomplete).

Hab.—Launceston, on wood Trevallyn Gully, off First Basin, Jan. 1888, W.A.W., No. 42. West Coast, Jones's Track, T. B. Moore (Herb. W.A.W., No 154).

76. *Plagiochila apiculata*, Steph.

Hab.—Mount Wellington, on a bank St. Crispin's Track, on rocks St. Crispin's, and on rock Deep Creek Track, Jan, 1899, W.A.W., Nos. 542, 549, 551/2, 555.

77. *Plagiochila fuscella*, Tayl. (?—incomplete).

Hab.—Emu Bay, Jan., 1892, J. H. Royce (Herb. W.A.W., No. 68).

78. *Plagiochila incurvicolla* (Hk. f. Tayl.)

Hab.—Mount Wellington, Fork Creek, Oct., 1888, W.A.W. Hobart Rivulet, Dec., 1897, W.A.W., No. 245.

79. *Plagiochila intertexta* (Hk. f. Tayl).

Hab.—Mount Wellington, east slope, alt. 2,500ft., Dec., 1897, W.A.W., No. 270.

80. *Plagiochila Kingiana*, Gottsche.

Hab.—Hobart Rivulet, on damp earth at margin of stream, Jan., 1898, W.A.W., No. 365.

81. *Plagiochila pleurota* (Hk. f Tayl.)

Hab.—Mount Wellington, on sassafras Bower Creek, Dec., 1897, W.A.W., No. 339.

82. *Plagiochila ramosissima*, Lindenberg.

Hab.—West Coast, on wood near Leslie Junction, Dundas, Oct., 1893, W.A.W., No. 767.

83. *Plagiochila Taylori*, Steph.

Hab.—Mount Wellington, on rock in bed of Bower Creek, Dec., 1898; on rocks in running water, Millhouse's Creek; on rocks St. Crispin's, and on rock Deep Creek, Jan., 1899, W.A.W., Nos. 439, 545, 548, 550, 553/4.

84. *Plagiochila Traversii*, Gottsche.

Hab.—Hobart Rivulet, Dec., 1897, W.A.W., No. 247.

85. *Radula Mitteni*, Steph. Species Hepat.

Hab.—Guy Fawkes Rivulet, Nov., 1891; Jan., 1898; on rock Jan., 1899. Huon Road, Millhouse's Falls, March, 1893; Mt. Wellington, Bower Creek, Dec., 1898, W.A.W., Nos. 21, 90/1, 251, 425, 443. Tasman Peninsula, on shady rock Newman's Creek, on decayed wood and on musk Wellard Rivulet, Feby., 1899, W.A.W., Nos. 623, 625, 627, 630.

86. *Radula plicata*, Mitt.

Hab.—Mount Wellington, Bower Creek, Jan., 1888; New Town Falls, Aug., 1889, W.A.W., Nos. 1, 88. Port Cygnet, Homedale Gully, Sept., 1889, W.A.W., No. 9. Tasman Peninsula, Wellard's Track, Mch., 1891, W.A.W., No. 185. West Coast, Strahan West, Oct., 1893, W.A.W., No. 172. Blue Tier, Dec., 1895, E. McGregor (amongst *Lophocolea Moorei*).

87. *Saccogyna australis, Mitt.*

Hab.—Huon Road, Longley, at base of wet rocks near Bridge, Nov., 1892 (amongst *Sphagnum australe*), W.A.W. West Coast, Moore's Track to Frenchman's Cap (fragments amongst *Chiloscyphus asperrimus*), T.B. Moore (Herb. W.A.W.).

88. *Schistochila (?) Spegazziniana*, Massalonga.

Hab.—Macquarie Harbour, Birch Inlet, Nov., 1896. T. B. Moore, No. 185 (Herb. W.A.W, 169). Sterile.

89. *Symphyogyna interrupta*, Carr. Pears.

Hab.—Mount Wellington, Bower Creek, Jan., 1888, W.A.W., No. 23.

90. *Tylimanthus brecknockiensis* (Massalongo, Hep. Fueg., 1895, cum icone, sub-Adelantho), Steph.

Hab.—Mount Wellington, Deep Creek, alt. 1,600ft., Dec., 1887 (amongst Hymenophyton), and Dec., 1897; on rock East Slope, Dec, 1897; on wet rock and on wood St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 278, 283, 259, 563, 594. Huon-road, Millhouse's Creek, March, 1893, W.A.W., No. 122. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., 193). West Coast, Gordon River, T. B. Moore (Herb, W.A.W., 165).

91. *Tylimanthus crystallinus* (Massalongo, Hepat. Fueg., sub-*Gymnanthe*, 1885, p. 238, tab. 22), Steph.

Hab.—Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., 194). West Coast, Mount Darwin, T. B. Moore (Herb. W.A.W., 152).

92. *Tylimanthus perpusillus*, Colenso.

Hab.—Mount Wellington, on rock and wood St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 533/4.

TRACHYDOLERITE IN TASMANIA.

By W. H. Twelvetrees, F.G.S., Government Geologist.

[Read 1st December, 1902.]

In 1889 evidence was laid before this Society by Mr. W. F. Petterd and myself, demonstrating the existence in Tasmania of two centres or districts characterised by eruptive rocks derived from elæolitic and theralitic magmas.

I now submit further localities for rocks belonging to the same great felspathoid series. One of these is the Table Cape Bluff, near Wynyard, on the North-West Coast, and another is the Nut at Circular Head. A third is One Tree Point, Sandy Bay, near Hobart, where melilite basalt has been identified, but only the first two will be dealt with in these notes.

The tertiary basaltic rock which forms the headland near Wynyard came many years ago under the notice of the late Professor Ulrich, who thought at the time that he could recognise the small water-clear hexagons which are abundantly visible in prepared slides as sections of the felspathoid mineral nepheline. Both my colleague and I were, on the other hand, disposed to diagnose the mineral as apatite, and we learned from the lamented Professor shortly before his death that he had arrived at the same opinion. Mr. Thos. Stephens often communicated to me his idea that this coarsely crystalline rock was a distinct flow from our common olivine basalt. The mere difference in texture did not appear to me a valid reason for assuming any further difference between the two rocks. However, in drawing up a classification scheme, the occurrence of a dyke of limburgite on the Emu Bay Railway Line, nine miles from Burnie, led me to hesitate, in view of the fact that Rosenbusch classes limburgite as belonging to the theralitic magmas. Renewed examination of the doleritic rock at Table Cape and Circular Head showed the presence of a felspathoid. The optical tests were confirmed by staining, and a specimen was sent Home to Professor Rosenbusch It was referred by him to trachydolerite, the effusive form of essexite. I wish here to acknowledge the readiness with which the professor has always aided in solving difficulties in Tasmanian petrology. His letter reads as follows:—"The compact basaltic rock of the Table Cape Bluff and Circular Head is best referred to the trachydolerite group. Besides labradorite, augite, olivine iron ore, and abundant apatite, it contains a colourless mineral with a very low refractive index and abnormal double refraction, which gelatinises in weak acid and allows much Na_2O to go into solution. I regard it as analcime. It is always allotriomorphic, and it is highly probable that this mineral is derived from nepheline. In a special slice which I prepared I saw distinctly in an isotropic spot the interference figure of a negative uniaxial mineral (nepheline)."

The hornblende, haüyne, and sphene, which are common in typical trachydolerite, are absent, so the rock is not a normal member of the family.

In the Table Cape rock, olivine is abundant as phenocrysts; augite as prisms, also in grains of the second generation; labradorite in slender twinned prisms; apatite in vertical and hexagonal sections, iron ores in numerous grains and cubes. There is a great deal of the feebly refractive analcime in plates of extreme tenuity. In some slides thin rectangular sections of the mineral determined by Professor Rosenbusch as nepheline are present.

In the Circular Head rock, the augite is in larger crystals and plates, and exceeds the olivine in quantity. It is the violet-tinted variety of diopside so common in nepheline-bearing rock. Apatite is abundant in the slides in the form of short columns, spindle-shaped, or hexagonal sections. Titaniferous iron or magnetite has separated out. The interstitial groundmass abounds with microlites and with isotropic or feebly refractive material. It is apparently saturated with analcime, and in one instance natrolite could be detected.

The macroscopic aspect of these rocks is doleritic. The Circular Head variety is somewhat coarser in grain than that of Table Cape.

Briefly, the abundance of apatite and analcime warn us that we are not dealing with an ordinary basalt, and the presense of nepheline, in however small quantity, confirms this belief.

It is difficult to suggest what relation the rock of these Bluff bears to the ordinary Tertiary olivine basalt of the coast. Both are of Tertiary age, but each is the product of a different magma, and such rocks hitherto have not been found associated. The two families would be represented as under—

Normal olivine basalt	Trachydolerite
|	|
Diabase (Dolerite)	|
|	|
Gabbro	Essexite (not yet discovered)

The term trachydolerite here has not the original sense in which it was used in 1841 by Abich, who understood by it a basic trachyte or a rock intermediate between trachyte and basalt. Its alkali percentage is high, viz.—6 to 11%, against the usual 3% or 4% in ordinary basalt. The variety of constitution points strongly to essexite parentage, and as essexite occurs physically connected with elæolite syenite, so trachydolerite is associated with alkali trachytes, phonolites, tephrites, &c. Its sp. gr. is 2·86.

Professor F. Loewinson-Lessing differs from this Rosenbuschian view, and ranges trachydolerite among monzonitic magmas, and not among essexitic ones.* He treats it as equivalent to ciminite (Washington), a passage rock between basalt and trachyte, and would suppress ciminite in its favor or in favor of "trachyte basalt." It is, then, considered the effusive equivalent of gabbro syenite or monzonite. But, as there is reason to regard the basic syenite known as monzonite as being not so much a passage rock between syenite and gabbro, as between normal syenite and alkali syenite, so trachydolerite must be looked upon as intermediate, not between normal basalt and trachyte, but between tephrite and alkali trachyte. The occasional presence in it of haüyne, sodalite, barkevikitic hornblende, anorthoclase, leucite, and ægirine points to the alkali magma.

It is possible that some of our other Tertiary basalts may, on closer examination, prove to be trachydoleritic; and the eventual discovery of the parent plutonic rock, essexite, is probable.

* Kritische Beiträge zur Systematik der Eruptivgesteine: Tschermak's min. u. petrogr. Mittheilungen xix. 1900. iv. p. 303.

ON CERTAIN CALCAREOUS NODULES.

By Professor E. G. Hogg, M.A.

[Read 1st December, 1902.]

[Two photos.]

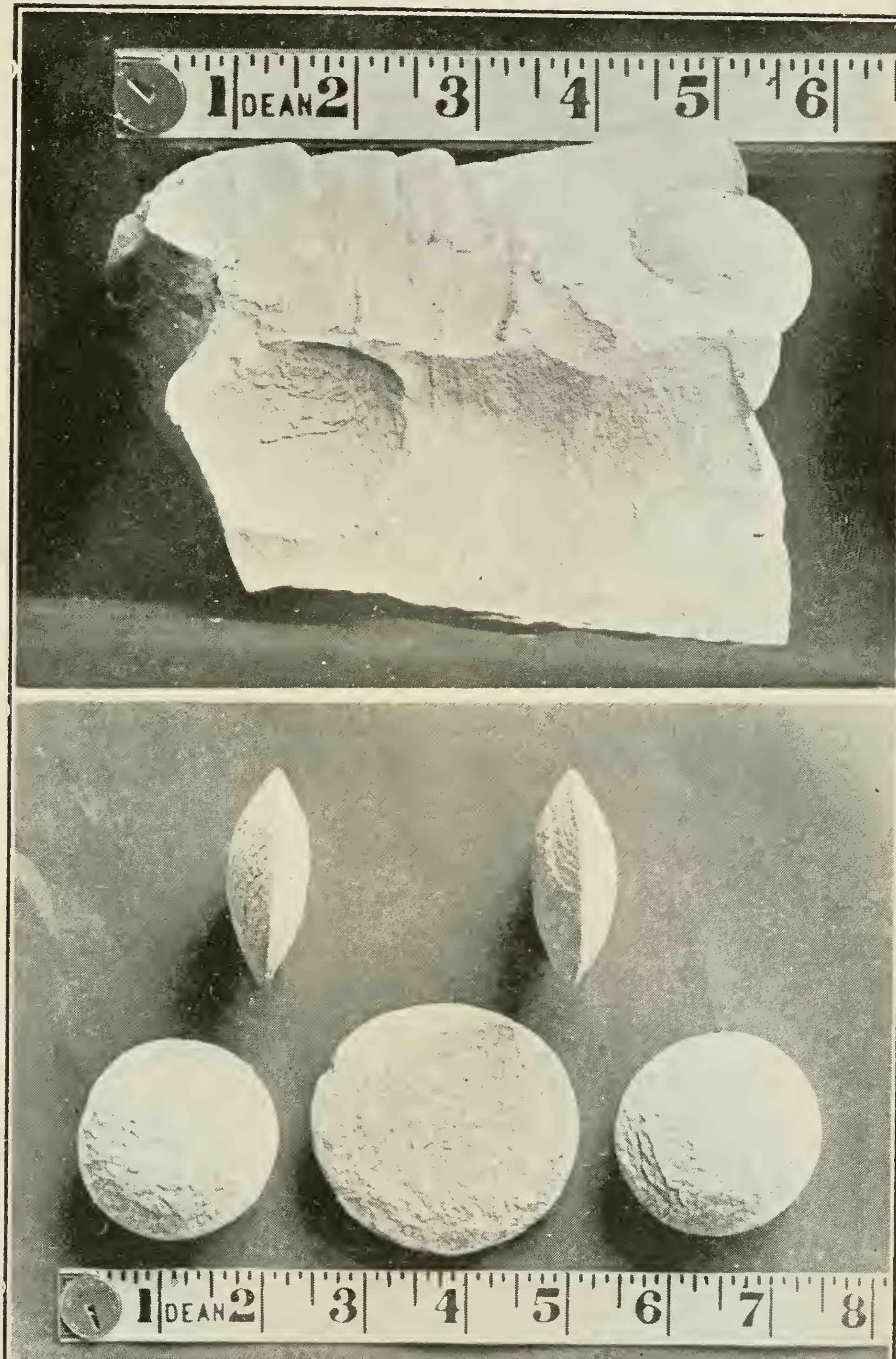
The nodules described in the following paper occur in certain bands in the upper members of the strata disclosed at Duff's quarry, in Forster-street, New Town. The nodule-bearing bands appear to be unfossiliferous, but both above and below them are other bands carrying numerous fossil impressions, including *Alethopteris australis*, *Thinnfeldia obtusifolia*, *Phyllotheca*, &c. The whole series of bands is just below the horizon of the New Town Coal Measures. The beds in which the nodules are found are grey and blue-grey in colour, traversed by thin layers of darker hue, thus giving rise to a banded structure; they may be described as a calcareous sandstone of fine texture, fairly tough, and showing little or no tendency to split along the planes of banding.

In general the nodules have the shape of double-convex lenses, giving in the most perfect forms a circle in plan and two intersecting circular arcs of different curvatures in elevation. The equatorial planes of the nodules were almost invariably parallel to the bedding planes; in the case of those nodules having bounding surfaces of different curvature the surface of greatest curvature was generally found to be the one lying uppermost. The larger nodules have an equatorial diameter about four inches long, and the lens at its thickest part is about half an inch through; on fracturing, the interior shows a crystalline structure, the surfaces exposed having a steel-blue sub-metallic lustre.

An analysis of the crystalline part of one of these nodules, kindly made for me by Mr. Ward, A.R.S.M., Government Analyst, gave the following result:—

Carbonate of Lime	44·0	per cent.
Silica, &c., insoluble in acid	50·6	,,
Total Iron, taken as Peroxide...	4·7	,,
Carbonate of Magnesia and loss.	0·7	,,
	100·0	

The specific gravity is 2·5.


1 DEAN 2 3 4 5 6
1 DEAN 2 3 4 5 6 7 8

Mr. Ward writes—"The nodule appears to consist of a fine sand cemented by crystalline carbonate of lime."

Slides of the nodules were prepared parallel to and cutting transversely the equatorial plane. In natural light the slide shows a confused micro-granular structure, the component grains being transparent, opaque, and grey; on rotating the slide, a slight change of tint, due to variation of absorption, is noticed. With crossed nicols, large areas of the slide extinguish simultaneously, and it is seen that adjacent crystalline aggregates appear to grow into each other, there being no trace whatever of anything like a definite crystal boundary, or of the twinning characteristic of tabular calcite crystals. Minute angular grains of quartz and opaque matter are irregularly dispersed through the calcite aggregate.

The nodules in which the most perfect geometrical form is developed show little or no crystalline structure on fracture; bands running parallel to the equatorial plane of the nodule are seen to traverse the broken face, and occasionally the area between two consecutive bands, presents a crystalline appearance very similar to that shown in the larger nodules. The nodules of perfect form are rather less than two inches in diameter, and they pass by stages into smaller ones of roughly spherical shape. These smaller ones show a banded structure, but exhibit when broken no traces of crystallisation.

When the containing rock is broken the nodules are separated from the cavities in which they repose without the slightest difficulty. After the rock has been blasted, the nodules may be found lying in all directions, with scarcely a trace of the bed-rock adhering to them. The cavities and the exterior of the nodules, especially those of larger size, are frequently stained red. The nodules appear to occur most numerously along the bedding planes; in one slab, the largest dimension of which was about fourteen inches, seven cavities were counted.

The bed-rock is in places traversed by narrow irregular fissures containing calcite.

CONTRIBUTION TO THE PHYSIOGRAPHY OF TASMANIA.

By Col. W. V. Legge, R.A.

[Read 1st December, 1902.]

[Plate.]

No. 1.—Pine Island, Great Lake.

Pine Island is one of the five or six islets which, at wide intervals, dot the surface of the magnificent sheet of water known as the Great Lake.

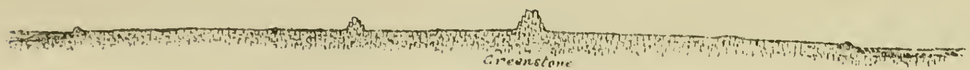
Considering the shallowness of its waters and its extremely irregular outline, it is singular that there are so few islands in this lake. Those that do exist are all of small area.

Pine Island is situated in the north-eastern corner of the great bend of the lake, the eastern shore of which skirts the foot of the so-called "Sand-bank Tier," a rugged talus-strewn range, about 4 miles in length. The local name has its origin in the sandy shore which bounds this part, and along which the water is remarkably shallow, running out for about half a mile, with a depth of not more than a couple of feet.

During a recent visit, I was much struck with the singular character of the shore of this island; and the desirability suggested itself of writing a short descriptive account of the spot for the information of our Fellows, and in the hope that a satisfactory explanation of the causes which have led to the formation which I noticed, may be arrived at from a discussion on it.

The distance from the head of the lake, where the boat belonging to the "Improvement Association" of Deloraine is kept, is about four miles, and on the afternoon of my trip, in March last, we sailed down (my son and myself), accompanied by Police Trooper Archer, in about half an hour.

The long, low outline of the island is visible from the starting-place, and as we neared it the basaltic "tors," which rise from its centre, became conspicuous. It is said to have been formerly covered with timber, the King William Pine having been chiefly in evidence, but the only signs of this that now exist are the gaunt and bleached trunks of one or two "Cider" gums and one pine. At the "Cove," on the eastern shore, there are several large



IDEAL SECTION ON AB. ; SCALE 30 IN TO 1 MILE

PLAN, ENLARGED 12 TIMES
FROM 1 IN TO MILE MAP

SECTION OF TERRACE
SCALE, 12 FT TO 1 IN

PINE ISLAND.

W. V. L.
del.

JOHN VAIL, GOVERNMENT PRINTER, TASMANIA.

fallen trunks of pines lying partly in the water: further evidence of the ravages of fire! The stupid practice of setting fire to the country by shepherds and others, which obtains in the western wilds of this country, is probably answerable for the desolate state of this islet at present. On nearing it, however, scattered green bushes are seen, chiefly near the margin, and these are the only prominent signs of botanical life until one lands, when the surface is found to be fairly covered with the usual coarse vegetation and low bushes found in all open tracts of this upland region.

At about half a mile distant the singular character of the shore becomes apparent, the entire coast-line consisting of a raised terrace, rising about 7 feet from the water, and looking as regular and uniform in structure as if it had been built artificially. In looking for a landing-place we were able to examine the structure of this curious terrace, and found the rocks composing it to vary from somewhere about one ton in weight to stones of nearly one cwt. The face forms a regular slope of 35° or steeper in some places with an almost concave profile, and stands on a formation of small rocks below the surface, projecting outwards about four or five feet as a rule, and skirted by a flat bottom of shingle, the water being not more than three feet deep. The water is shallow all round the island, as indeed it is throughout the better part of the great bay at the north of the lake.

The contour of the west side is circular, the terrace sweeping round in regular curves to the northern and southern sides, which run almost due east to the eastern end, where the terrace is broken by a little cove of shingle, which my son visited, but which I did not, myself, see. The island is about 600 yards long, 250 broad at the widest part, and contains about 30 acres. The shape is roughly given in the accompanying sketch, enlarged from the 1-inch to the mile map of the lake. On landing, we found the group of "tors" we observed in the distance to consist of six or seven mounds of basalt, rising more or less perpendicularly from the surrounding and, in some directions, almost level land, the whole describing a crescent across the centre from west to east. The highest of these eminences was in the centre of the island, and rose to a height of 45 feet above the water, and 30 feet from the ground at its base. The others, at a distance of about 30 to 50 yards from each other, were smaller, the groups at the west end of the crescent being sub-divided into detached rocks. The class of rock, both in the "tors" and the boulders which form the terraced show, is greenstone, of which the entire structure of the island also consists, as here and there the same formation projects through the shallow soil. In view of this fact some clue is obtained as to the cause of the terraced formation of the shore.

The island lies almost in the middle of the strait—about $1\frac{1}{2}$ mile wide—which connects the two great water tracts at the north of the lake, namely, the large "North-West Bay" and equally wide "East Bend"; and from all points of the compass, save two—north-east and south-west—it is exposed to the full force of the waves, with several miles of water behind them. The prevailing gales on the lake are from the north-west, south-south-west and south-west, and an extremely violent sea rises with them. After a hard winter, when the ice is from three to five inches thick, it generally breaks up during these gales, and drives in huge floes, with great violence, on the shore of the island. It seems, therefore, reasonable to suppose that, during the course of the centuries, the effect of wave and ice pressure has been sufficient to cast up what was formerly a foreshore of scattered stones and boulders into rampart, or terrace, now existing. Once this began to assume the elevated character of a roughly-formed terrace, there is no doubt that the ice movement and force of the waves would gradually mould it, little by little, into its present form. The formation of the rampart is equally regular on the south-west and north-west sides, the latter part being somewhat less exposed to heavy weather. Round the whole island, with the exception of the cove or break on the east side, the rock bank is almost of uniform height.

As the botany of these high regions is interesting, it may be proper to remark on the vegetation which we found clothing the islet. The surface is practically level, there being a gentle rise from the shore towards the "tors" in the centre. The soil is, for the most part, covered with a dwarf form of the ordinary cattle or "thatch" grass (*Poa cæspidosa*), thickly interspersed and patched with the Epacris-like bushes *Pultenæa rubumbellata*, *Bechia gunniana*, and *Comesperma retusum*. The second of these was in flower at the time of my visit, and gave colour to the sward. We noticed that the dead tussocks of "thatch" grass (*Poa*) were partly covered with a curious earthy-looking deposit lying on them in thick patches, and on closely examining them found, to our surprise, that the covering was a lichen. The grass is killed in the usual way, by cold and age, as in the lowlands on our cattle-runs, and is apparently then fastened on by this curious lichen. Of flowering grasses, we gathered the tall Alpine Holy grass (*Hierochloë redolens*), the *Craspedia richei*, whose tall stalk and downy, button-shaped flower towered above the dwarf *Poa* grass; we also gathered two other species (*Hypochœris radicata* and *Prasophyllum fuscum*). On the northern shore, near the bank of stones, and here and there elsewhere, isolated bushes of the "Mountain Pittosporum" were found, and these were the tallest shrubs on the island. The Pepper tree (*Drimys aromatica*), with its red stems and berries, was more plentiful than the last, and grew in company with the pretty little bush *Bellendena montana*, which has green leaves, with a red obverse surface. The "Yellow Bush," so well known on the mountain plateaus of Tasmania, with its intensely hard wood, is found on the island, as well as round the shores of the lake; but I have not seen it anywhere so plentiful as on Ben Lomond. Other small shrubs make up the vegetation we observed, and are included in the list at the end of this note, and for the identification of all of which I am indebted to Mr. Rodway.

As regards the zoology of this lonely little tract, one would naturally expect to find it devoid of life; but Mr. Archer assures me he once saw on it the largest specimen of a Porcupine (*Echidna*) he ever came upon; the inference of which discovery is, that this animal must be a permanent inhabitant of Pine Island, or crossed over on the ice previous to a thaw. Whip-snakes are also said to be denizens of it.

The only bird seen was the ubiquitous Pipit, or Ground Lark (*Anthus australis*). The little Gull breeds, at times, plentifully on Garden Island, near the Police Station, and no doubt affects this one, but we had not time to look for evidence in the shape of old nests, many of which we came upon in the former islet.

The list of grasses and shrubs observed on Pine Island is as follows—

SHRUBS.

Drimys aromatica	Pepper Tree.
Pittosporum bicolor	Pittosporum.
Orites revoluta	Yellow-bush.
Pultenœa rubumbellata......	Native Wallflower.
Bellendena montana	Mountain Roebel.
Coprosma nitida	Mountain Currant.
Comesperma retusum	Purple Broom.
Olearia myrsinoides	Rough-leaved Daisy-tree.
Ozothamus Hookeri	Hooker's Scent-bush.
Bœchia gunniana	Gunn's Bœckia.
Hakea microcarpa	Small-fruited Hakea.

GRASSES.

Hierochloë redolens............	Tall Holy Grass.
Poa cæspidora............	Thatch Grass, Dwarf.
Craspedia richei	Soldiers' Buttons.
Hypochæris radicata	Deep-rooted Dandelion.
Prasophyllum fuscum	Brown Fly-Orchis.
Prasophyllum patens.........	Fly Orchis.
Brachycome sp.	Mauve Daisy.
Helichrysum bracteatum ...	Coarse-flowered Everlasting.
Celmusia longifolia	Mountain Aster.
Eriochilus autumnalis	Autumn Orchis.

THE TOURMALINE-BEARING ROCKS OF THE HEEMSKIRK DISTRICT.

By G. A. Waller and E. G. Hogg, M.A.

[Read 1st December, 1902.]

The Heemskirk district was visited some weeks ago by one of the authors in the course of his official duties as Assistant Government Geologist. Most of the field observations then made have already been published in the report on the district recently issued by the Mines Department*, but the necessity of writing these reports as soon as possible after the examination of the district in question is completed precludes the possibility of a minute examination into the microscopical character of the rocks prior to publication. In the case of the Heemskirk district, not only are the field observations of more than ordinary interest, but the additional evidence afforded by micro-examination of the rocks is important. The authors, therefore, think that a short description of the rocks, both as regards their microscopical characters and their field relations, may not be out of place among the proceedings of this Society. It may also be mentioned that, since the publication of the Mines Department report, other portions of the district have been examined, so that some of the field observations here recorded are published for the first time.

Mt. Heemskirk is situated on the West Coast of Tasmania, about 24 miles north of the entrance to Macquarie Harbour. The district may be regarded as extending along the coast from Trial Harbour on the south to Granville Harbour on the north. The major axis of the mountain range runs approximately parallel to, and about 4 miles distant from, the coast. Mt. Agnew is the most southerly and the highest peak of the range, and rises about 2800 feet above sea-level. The mountain range is composed almost entirely of granite, which extends along the coast from a little north of Trial Harbour to beyond Granville. To the south and east of the granite the Silurian slates and sandstones outcrop, and these have suffered metamorphism near their contact with the granite.

* Report on the tin ore deposits of Mt. Heemskirk, by G. A. Waller, Assistant Government Geologist.

The Normal Granite.

The rock which we have termed the normal granite consists of a medium to coarse-grained biotite granite. It is much more widely distributed than the other types, and appears to be of more uniform composition. The rock shows, on microscopic examination, the following minerals:—Orthoclase, plagioclase felspar, biotite, quartz, tourmaline, iron pyrites, and apatite. The felspars have suffered much decomposition; the clouded appearance of the plagioclase felspar makes the determination of its character very difficult, but the low angle of extinction points strongly to its being oligoclase. It has preceded the orthoclase in the order of crystallisation. The biotite is very pleochroic, and contains on the whole very few inclusions; it appears to have undergone very slight alteration, but it is occasionally somewhat bleached, and a small amount of resorption with separation out of opaque material has taken place. Apatite in small grains is rare, and small masses of iron pyrites, destitute of crystal boundaries, are present. The main interest of the slides centres round the remaining minerals, quartz and tourmaline. The tourmaline occurs as short slender opaque rods, traversing the quartz grains in all directions. The rods, as a rule, are quite straight, but in some few instances they are curved; a radiant structure is very characteristic, the centre of radiation being sometimes a minute speck of opaque matter; in other cases the rods appear to radiate from the line of separation of two quartz grains, and the rods then show a tendency to lie parallel to this line of separation; no case was observed of a rod crossing the line of separation and penetrating both of two adjacent quartz grains.

The distribution of the rods in the quartz is very capricious; they crowd some grains and are comparatively rare in others, while sometimes the same grain may be rich in them in one part while the remainder of the grain is absolutely destitute of them. In one marked case a quartz grain is crowded with needles, and carries a moderate amount of minute opaque specks, while the remainder of the grain, though in optical continuity, is devoid of rods, and almost devoid of opaque specks. The phenomenon would appear to point to the presence here of quartz of two generations, the younger quartz having been deposited from a solution free from tourmaline, and having crystallised round an eroded grain of the older quartz in optical continuity with it. The presence of veins containing iron pyrites in the vicinity seems to support the hypothesis that this normal granite has undergone a small amount of metasomatic change.

Tourmaline Granites and Aplites.

These rocks occur in considerable quantities in many parts of the district, especially in the vicinity of known tin-bearing deposits. Tourmaline granites occur in the form of dykes and masses in the normal granite, and in the latter condition often extend over areas of some hundreds of acres. The tourmaline aplites, or fine-grained tourmaline granites, occur as irregular masses and nodules in the tourmaline granites, and also as dykes, both in the tourmaline granites and in the normal granites. Dykes, nodules, and masses of non-tourmaline-bearing aplite are also found in the normal granites, and dykes of the same rock traverse the tourmaline granite.

The tourmaline granites exhibit a large amount of variation, both in the proportions of the several minerals contained and also in the size of the constituent grains. We have only two somewhat imperfect slides of these rocks at our disposal, so that our description must be principally confined to macroscopical characters. The minerals which may be seen with the naked eye comprise the following:—Felspar, quartz, tourmaline, muscovite, and a dull green mica (probably biotite which has been partly altered to chlorite).

The most striking characteristic of the rock is in connection with the distribution of the tourmaline. This occurs in patches or bundles of radiating needles or prisms, from 1 up to 3 inches in diameter, usually associated with quartz. As the granite becomes finer grained, and approaches to the aplites in structure, the tourmaline loses its radiating character, and, together with quartz and a little felspar, forms more or less well-defined balls or nodules (quartz tourmaline nodules), which occur sometimes distributed at regular intervals through the granites, and sometimes collected together in masses. The groundmass of the rock consists of a medium to fine-grained crystalline granular mixture of quartz, felspar, and two micas. Small miarolitic cavities may be often observed, into which the crystal faces of quartz and felspar protrude. Under the microscope the felspar is seen to consist both of orthoclase and plagioclase, both much decomposed. The quartz differs from that of the normal granite, in that it contains no microscopic rods of tourmaline, the whole of the latter mineral appearing to be concentrated in the quartz tourmaline nodules.

With the exception of a little muscovite, there is no mica present in our sections. It may be said that the mica is generally present in much smaller quantities than in the normal granites, and in some cases it appears to be entirely absent.

From the above description it will be seen that the tourmaline granites differ from the normal granites in the following particulars:—

(1.) The greater amount of variation exhibited by the tourmaline granites, both in the mineralogical composition and in the size of the constituent grains.
(2.) The frequent presence of miarolitic cavities.
(3.) The presence of macroscopic bundles of radiating tourmaline or of quartz tourmaline nodules.
(4.) The absence of microscopic rods of tourmaline in the quartz.
(5.) The presence of small quantities of muscovite, which appears to be absent from the normal type.
(6.) The lesser abundance of biotite.

The tourmaline aplites, as has already been stated, occur in irregular masses in tourmaline granites, and as dykes in both the tourmaline granites and the normal granites. In neither case is there any sign of parting at the contact between the aplite and the granite. In the case of the dykes the walls are well defined, but there is no distinct plane of division, the one rock appearing to "grow into" the other. This phenomenon is ascribed by Rosenbusch* to the fact that the aplite was introduced into the fissures while the granite was still in a highly heated condition. In the case of the masses the contact is even less sharp, and it is sometimes impossible to say within two or three inches where the aplite begins and the granite ends. Occasionally the masses of aplite throw out irregular apophyses into the surrounding granite. The whole appearance of the masses gives the impression that they were formed while both magmas were still liquid, and one may ascribe the irregular shape of some of them to movements in the still molten magma. The aplites are usually much richer in tourmaline than the tourmaline granites. The mineral is, however, confined to the quartz tourmaline nodules, which are often very abundant, and generally are almost perfect spheres. The quartz tourmaline nodules withstand the decomposing action of the atmosphere for a longer time than the sur-

* H. Rosenbusch. Elemente der Gesteinslehre, p. 215.

rounding rock, and this causes them to stand out on the weathered surface, giving the rock a very remarkable appearance. From the same cause the subsoil in some localities is largely composed of these nodules.

Under the microscope the groundmass of the tourmaline aplites consists essentially of orthoclase, plagioclase, and quartz, with small quantities of both biotite and muscovite. The plagioclase is oligoclase-andesine, or albite. Measurements of extinction angles on sections cut approximately perpendicular to the twining lamellæ give results ranging from 9° to 16°. Some of the quartz appears to have preceded the felspar in order of crystallisation. Some of the grains have defined crystal edges, and they often protrude into, or are included in, the felspar crystals. Like the tourmaline granites, the quartz contains no microscopic rods of tourmaline. One section was prepared, showing the junction between a quartz tourmaline nodule and the surrounding rock. As the centre of the slide is approached, grains and hypidiomorphic crystals of tourmaline make their appearance; they are, for the most part, yellow-brown in colour, and show faint pleochroism. As the centre of the nodule is approached, the felspar—which is almost entirely plagioclase—dwindles, and the rock appears to be entirely constituted of quartz and tourmaline. The quartz occurs sometimes in the form of hypidiomorphic crystals surrounded by tourmaline, which is almost entirely without crystal boundaries; the tourmaline is blue in colour, and moderately pleochroic.

Other slides of nodules show an intensely pleochroic tourmaline of blue colour; the crystals are sometimes of tabular habit, and enclose grains of quartz in such a manner as to give rise to a pœcilitic structure. A small amount of much-altered plagioclase felspar is also present; it has preceded the tourmaline in the order of crystallisation. Rods of tourmaline are absent from the quartz of these nodules. Although not observed in the slides, a small quantity of tin oxide appears to be always present in the quartz tourmaline nodules. A small prospect was always obtained by crushing and vanning the stone, while a bulk assay taken from the nodules occurring at the Federation Mine yielded 0·2 per cent of metallic tin.

The tourmaline aplites may be said to differ from the tourmaline granites in the following particulars:—

(1.) They are finer grained.

(2.) They contain quartz tourmaline nodules in greater abundance, and in larger and more perfectly developed spheres.

(3.) Some of the quartz has preceded the felspar in order of crystallisation. The structure may be described as partly panidiomorphic.

Normal Aplites.

Many of the aplites do not contain quartz tourmaline nodules. They occur in the form of dykes in the normal granite and in the tourmaline granite, and as masses and nodules in the normal granite. One case was observed in which a small dyke of aplite contained a central seam of large crystals of quartz and felspar (pegmatite) with small cavities or druses, into which the crystal faces project. In many other cases miarolitic cavities were observed irregularly distributed through the dykes. Microscopically, the normal aplites closely resemble the groundmass of the tourmaline aplites. They are somewhat even-grained rocks, composed essentially of orthoclase, plagioclase felspar, with a little biotite and accessory tourmaline and apatite. The felspars are much decomposed; the plagioclase felspar, which is relatively less abundant than in the normal granite, appears to be oligoclase-andesine, or albite, and has preceded orthoclase in order of crystallisation. The quartz is more abundant than in the normal granites, and in some cases the grains carry rods of tourmaline quite similar in appearance to those described in connection with the normal granite. Their disposition is very capricious, as they are numerous in some grains and quite absent from others. The biotite shows bleaching and resorption phenomena; apatite occurs as an inclusion in biotite. Some of the quartz has defined crystal edges; it also appears as eyes in the orthoclase. When present in the latter form, tourmaline rods are absent.

Quartz Tourmaline Reefs.

The rocks which have now been described form in part the wall rocks of numerous quartz tourmaline reefs which occur throughout the district. We propose to use the term "reef" in the sense in which it is used locally, and by most mining men in Australia, viz., to denote any non-clastic tabular deposit composed largely of silicious material irrespective of its supposed mode of formation. Until comparatively recent years the filling-matter of fissures was regarded as being divisible into two well-defined classes—one formed by cooling from a molten condition, the other formed by precipitation from aqueous solution; and these classes are still known as dykes and veins respectively. It is, however, now generally conceded that it is impossible to draw any sharp line of division between these two types, and our investigation of the quartz tourmaline rocks of the Heemskirk district affords evidence of this fact. We find that there are both quartz tourmaline dykes and quartz tourmaline veins, and also types which occupy an intermediate position. As it is often difficult to decide at once to which class any given deposit belongs, it is evident that a general term is desirable, and the term "reef" appears to us to be quite suitable.

Quartz Tourmaline Veins.

It is a well-recognised fact that fissure veins are often not merely "fissures filled with mineral matter;" the material forming the vein may have been either deposited in an open cavity formed by the fissure, or it may have been deposited as a replacement of the wall-rock, or of some of the constituents of the latter. In the quartz tourmaline reefs of the Heemskirk district the greater part of the material has been deposited as a replacement of the wall rock, and only a very small portion as the actual filling of the fissure. These two portions of the vein we propose to distinguish by the terms "vein rock" and "vein stone," the former denoting that portion of the vein which has been formed as a replacement of the wall rock, and the latter that portion which has been deposited along the plane of the fissure, and generally in an open cavity.

The quartz tourmaline veins consist of tabular deposits composed essentially of quartz and tourmaline, traversing both the granite and the surrounding Silurian strata. There is a central seam or fissure filled usually with tourmaline, or quartz and tourmaline (the vein stone), and on either side of this is a granular rock composed of quartz, quartz and tourmaline, or quartz and white mica (muscovite or lithia mica) and tourmaline (the vein rock). Both the vein stone and the vein rock may carry tin oxide. The former is sometimes very rich in tin, the ore being often beautifully crystallised; in the latter the tin oxide occurs in crystalline grains, and is often finely disseminated. Pyrites appears to be an invariable constituent wherever the veins have been explored below water-level. It occurs in bunches in the vein stone, and also disseminated through the vein rock. In some cases the vein rock consists almost entirely of granular quartz and pyrite, the latter having the appearance of replacing the felspar of the granite. Besides those already mentioned, most of the other minerals which are of common occurrence in tin veins are present in small quantities, viz., bismuthinite, molybdenite (rare), arsenopyrite, chalcopyrite, galena, and zinc-blende (both of these rare, and in very small quantities), fluorite (in small quantities), and smoky quartz.

The vein rock differs very greatly in the amount of tourmaline present. Often it is composed almost wholly of quartz, but at other times the only quartz present appears to be that which formed the original quartz of the granite, the whole of the felspar being replaced by tourmaline. In other cases the felspar has been replaced by white mica, with or without the addition of quartz and tourmaline. The vein rock then forms a typical greissen. The tourmaline is of two varieties, the black or iron tourmaline and the green or alkali tourmaline. Although tin ore is associated with both varieties, the green tourmaline appears to be much the more favourable indication for tin.

The veins vary in width from a few inches up to 20 or 30 feet; in the latter case there are usually a number of parallel fissures filled with tourmaline running through the vein rock, and the mineralisation has evidently spread outwards from these fissures until the adjacent zones of replacement met in the centre. Often bands or lenticular bodies of unaltered granite exist within the reefs between two such zones. The veins generally run in parallel groups, but often there are several main directions of strike in the same locality. When the veins cross one another there is usually no faulting, pointing to the fact that the fissures were produced by contraction of the granite on cooling. The proof of the metasomatic nature of the vein rock is very conclusive, and may be deduced both from the field evidence and from the examination of thin sections under the microscope. When the veins occur in granite, the vein rock is granular, and the size of the grains is the same as that of the adjacent granite or aplite; there is no parting between the granite and the vein rock, the one seeming to pass over into the other. When the veins traverse sedimentary rocks, the vein rock, or metamorphosed wall rock, retains the original laminated structure. Original differences in porosity or composition have led to deposition of quartz along certain layers, and tourmaline along others, with the result that a black-and-white striped rock is produced, of very striking appearance. Perhaps the most striking field evidence of replacement is to be seen when a vein passes through a granite or aplite which is rich in quartz tourmaline nodules. The nodules are seen in the same abundance and of the same size in the vein rock as in the adjoining wall rock. When the nodules are absent from the wall rock, they are also absent from the vein rock. It is quite evident that the quartz tourmaline nodules, which consist of the same material as was contained in the solutions, were not attacked by them, but remained unaltered while the surrounding felspar of the granite or aplite was replaced.

Microscopic examination of the vein rock entirely confirms these conclusions. Two slides were prepared from a vein-stone poor in tourmaline, replacing granite, which contains quartz tourmaline nodules. The vein stone also contains nodules, but these were not sliced. Both slices are almost entirely made up of quartz, which is present in two forms. It occurs either as large grains, having the usual aspect of the quartz of the tourmaline granites (containing no microscopic rods of tourmaline), and as very small grains confusedly arranged, so as to produce a mosaic structure. A small amount of pleochroic hypidiomorphic tourmaline, enclosing small grains of quartz also occurs either entirely within or nearly surrounded by the mosaic quartz. The tourmaline and mosaic quartz are evidently replacements of the felspar of the granite. There is a tendency of the mosaic quartz to extinguish simultaneously over fairly well-defined areas. The junction of two such areas may be a straight line or an irregular line, suggesting strongly that the orientation of the quartz grains was conditioned by the position of the original felspar grains of the granite, the straight lines representing the contact planes of two adjacent members of a polysynthetically-twinned felspar.

Three sections were cut of quartz tourmaline rock replacing normal granite in which quartz tourmaline nodules were absent. These slides are composed of quartz, tourmaline, and a small amount of opaque matter, disseminated through the former mineral. The two types of quartz which have already been described as occurring in the quartz rock are also present in these slides. The large grains contain a little opaque matter and fluid pores arranged somewhat in linear fashion, and opaque rods of tourmaline showing radiant structure of exactly the same nature as those described as occurring in the quartz of the normal granite. There can be no doubt that these grains represent the original quartz of the granite. The mosaic or secondary quartz is of the same nature as that described in the quartz rock, but is less abundant, and in one of the slides is absent. The tourmaline occurs as idiomorphic crystals of prismatic habit in the secondary quartz, and as confused, ragged masses, sometimes fibrous in structure, and then showing tendency to radiant arrangement. We believe that this tourmaline is a replacement mineral after felspar and biotite, no trace of either of which minerals can be seen in the slides. Contrary to what was observed in the case of the replacing quartz, however, the felspar crystals have not determined any special orientation in the case of the tourmaline. In the slide in which replacing quartz is absent the original quartz grains do not seem to have entirely escaped change. They appear to be corroded around the edges, and to some extent replaced by tourmaline; this appearance is nearly absent from the slides, which contain secondary quartz.

One slide was prepared of greissen, occurring as a replacement of a granite or aplite, containing quartz tourmaline nodules. The rock consists of quartz, tourmaline, and a fibrous mica; the quartz appears for the most part in the form typical of the quartz of tourmaline granite, but there is in addition a small number of minute grains of quartz surrounded by a confused mesh of mica; the mica is in fibrous crystals, sometimes arranged with radial structure; it shows no pleochrism, but there is a considerable amount of absorption of light as the slide is rotated. It polarises in very high colours, and appears to have the optical properties of muscovite. Tourmaline occurs in small quantities as hypidiomorphic pleochroic crystals, but it is not present in the form of rods in the quartz grains. The mica would appear to be for the most part a replacement after felspar, but the occurrence of small nests and meshes of mica in the larger grains of quartz shows that the latter mineral has also suffered replacement. In the slide are a few very minute crystals of a highly refractory substance, which may be zircon; the material of the slide surrounding these specks is frequently coloured brown. One slide was prepared of quartz tourmaline rock, replacing slate which appears originally to have possessed a finely laminated structure. The laminæ have been for the most part replaced by grains of pleochroic tourmaline arranged linearly, and are separated from each other by minute grains of clear quartz.

The vein stone was not examined microscopically. It often consists almost wholly of tourmaline, but is sometimes very rich in tin oxide. The tourmaline often occurs in large bunches of radiating prisms or needles going up to 6 or 8 inches in length. Occasionally, however, a good deal of quartz is present, and this is especially the case where the veins traverse the sedimentary rocks. The tourmaline appears to gradually decrease as the distance from the granite increases, until finally only quartz veins are to be seen. With the disappearance of the tourmaline, disappears also the metamorphism of the wall rock, which is so characteristic of the veins, both in the granite and in its immediate vicinity.

Quartz-tourmaline Dykes.

These interesting dykes were, we believe, first observed by Mr. F. J. Ernst. They are found traversing both the granite and the sedimentary rocks, and are distinguished from the veins by the fact that their structure is not dependent upon the character of the wall rock, since they traverse granites, aplites, and sedimentary rocks without undergoing change. They have no central fissure, and the walls are generally sharp and clear-cut, even more so than the aplite dykes. They are usually of uniform composition throughout, consisting of a somewhat finely granular mixture of quartz and tourmaline, with sometimes a little felspar. When they traverse sedimentary rocks, they often contain included angular fragments of the country-rock. In the slides of this rock which were prepared the only minerals observed were quartz and tourmaline. The former mineral occurs as irregular grains, containing a very small amount of minute opaque specks. Tourmaline is present in well-formed crystals of prismatic habit, as grains, and as clusters of grains and crystals. The larger crystals of prismatic habit have a marked pleochroism, but as the crystals dwindle in size the pleochroism gradually diminishes, and cannot be detected in the smallest crystals. The tourmaline has preceded the quartz in order of crystallisation; radiating prisms of small size frequently penetrate the quartz grains, the centre of radiation being often one of the larger tourmaline crystals. The tourmaline rods previously alluded to are quite absent from the quartz of this rock.

In many cases the wall rock of the dykes has suffered metamorphism in a similar manner to that of the tourmaline veins, but to a lesser extent. In several instances, where the dykes occurred in granite, it was observed that the latter had been converted into quartz-rock or quartz-tourmaline rock, for a short distance (generally not more than a few inches) on either side of the dyke. In other cases, even along the same dyke, the wall rock had remained apparently unaltered. It is conceivable that this metamorphism may have been produced by vapours which traversed the fissure, prior to the introduction of the quartz-tourmaline magma, but it seems more probable that it was caused by emanations from the dyke-rock itself.

Two interesting instances of variation in composition were noted in the dykes traversing the Silurian strata at the Gentle Annie Rise, to the east of Mount Heemskirk. In one case of a dyke $2\frac{1}{2}$ inches in width, a portion of the tourmaline had segregated towards the centre of the dyke and formed a central seam about $\frac{3}{4}$ inch in width, the remainder of the dyke being composed of the normal quartz-tourmaline mixture. In another case of a somewhat larger dyke, the quartz had segregated, and for a foot or fifteen inches the dyke channel was filled with white quartz almost free from tourmaline. The latter instance seems to point to the fact that the quartz-tourmaline dykes may change to quartz veins as well as the quartz tourmaline veins.

Several observations were made at the Gentle Annie Rise of small quartz and quartz-tourmaline veins being cut through or faulted by quartz-tourmaline dykes. These observations are perhaps not yet sufficiently numerous to establish the relative ages of the two kinds of reefs definitely, but it may be said, that in some cases at least, the dykes are younger than the veins. This conclusion is of great importance, for it proves that the quartz and quartz-tourmaline veins were formed before the close of the period of eruptive action of the granite.

Conclusions.

We may now state briefly the conclusions which we think are justified by the facts which were observed in this district with regard to the origin of these tourmaline rocks and the associated tin-bearing veins.

It appears perfectly evident that the tourmaline is an original constitutent of the granite magma, since in one form or another it is contained in all the rocks which have been examined. There appears, however, to have been a continued tendency for the tourmaline to segregate together and separate itself from the rest of the magma. In the normal granite, it occurs only in microscopic rods in some of the quartz, and must represent an extremely small percentage of the total composition of the rock. But even here there is a tendency for the tourmaline to come together and form minute bundles of interlacing or radiating rods. In the tourmaline granites, the tourmaline is much more abundant, and forms macroscopic bundles of radiating needles, and even granular nodules of quartz and tourmaline. This great increase in the amount of tourmaline present is, we believe, to be accounted for by some process of differentiation or segregation in the original granite magma, while the presence of tourmaline in separate bundles and nodules may be accounted for by a further process of magmatic segregation from the already differentiated tourmaline-bearing magma. The tourmaline-aplite magma may have separated from the tourmaline-granite magma in the same way as the tourmaline-granite magma separated from the normal granite magma. The presence of irregular masses of tourmaline-granite in the normal granite, and of tourmaline-aplite in tourmaline-granite, is we think, convincing evidence that the three types of rock have originated from one and the same magma, and that the differentiation has taken place before, and not after, the consolidation of the magma. A definite order of consolidation of the three rocks may be observed. Dykes of tourmaline-granite occur in the normal granite, but not in the tourmaline-aplite, while dykes of tourmaline-aplite occur both in the tourmaline-granite and in the normal granite. It is evident therefore that the order of consolidation was (1) normal granite, (2) tourmaline-granite, (3) tourmaline-aplite.

The composition of the quartz-tourmaline nodules at once suggests that the quartz-tourmaline reefs are in some way connected with these. In many places the nodules appear to have a tendency to come together and unite to form larger masses of quartz-tourmaline rock. At greater depths, where the cooling of the magma would proceed more slowly, this might well take place, and the quartz-tourmaline magma thus formed might be the origin of the quartz-tourmaline dykes. The presence of the veins, however, suggests that a further separation first takes place within the quartz-tourmaline magma, namely, a separation into a highly aqueous and a less aqueous magma. The former would be virtually a saturated solution, and in this would be concentrated the heavy metals originally contained in the magma, since, from the common occurrence of these metals in mineral veins, we know them to be specially soluble in heated waters. Assuming, now, that such masses of quartz-tourmaline magma were intersected by fissures formed by the contraction of the granite in cooling, the more highly aqueous portion, being the more fluid, would be first erupted, and owing to its highly-heated condition and the presence of such powerful mineralising agents as boron, fluorine (both of these are present in tourmaline), hydrogen sulphide and water would have a very powerful chemical action on the wall of the fissures, producing the complete metamorphism of the wall rock, which has already been described. The more viscous quartz-tourmaline magma might be erupted later and form quartz-tourmaline dykes.

It will be remembered that the quartz-tourmaline veins traverse both the normal granite and the tourmaline granite and aplites, while in several instances the quartz-tourmaline dykes were observed to fault the quartz-tourmaline veins. The relative ages of all of the tourmaline-bearing rocks, described in this paper appear therefore to be as follows,—(1) normal granite, (2) tourmaline-granite, (3) tourmaline-aplite, (4) quartz-tourmaline veins, (5) quartz-tourmaline dykes.

Royal Society of Tasmania,

(FOUNDED 14th OCTOBER, 1843).

REPORT FOR 1902.

ANNUAL MEETING.

The sixtieth annual meeting of the Royal Society of Tasmania was held in the Society's rooms on Thursday evening, February 26, when there were present: Mr. R. M. Johnston, F.S.S. in the chair), the Bishop of Tasmania (the Right Reverend Dr. Mercer, M.A.), Messrs. T. Stephens, M.A.F.G.S., A. G. Webster, Bernard Shaw, L. Rodway, and E. L. Piesse, Professor Neil Smith, M.A., Hon. Dr. Butler, M.L.C., and others.

Annual Report.

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

The Council of the Royal Society of Tasmania have pleasure in presenting this report for the year 1902, being the sixtieth annual report of the society.

Meetings.—Eight regular meetings, and one special, have been held during the year. The number of papers read was 22, as against 19 the preceding year. The first meeting of the session was opened by the new president, His Excellency Sir A. E. Havelock, G.C.S.I., G.C.M.G., who was very cordially welcomed by the large gathering of members on his accession to the chair. His Excellency then delivered an interesting address to the Fellows, and has taken the chair at all the meetings during the year, besides showing in many ways his practical interest in the working of the society.

Papers.—The papers read during the session have shown no falling off in variety, nor in importance. Subjects treated were:—Ichthyology, Conchology, Entomology, Botany, Geology, Mineralogy, Forestry, Astronomy, Geography, Health and Economics. The papers dealing with health subjects and the consequent discussions, were of special value at the present time, when the necessity of underground drainage is being brought so prominently before the citizens.

The subjects and authors of the papers read are as follow:—

Ichthyology.—1. "Notes on a new fish (Pseudochrinus rodwayi)." 2. "Description of a new species of goby (Gobius hinsbyi)." By R. M. Johnston, F.S.S.

Conchology.—3. "Note on Tasmanian Conchology," by Chas. Hedley, F.L.S. 4. "Notes on some of Tenison-Wood's types in the Tasmanian Museum," by W. L. May.

Entomology.—5. "Notes on some remarkable Tasmanian invertebrates," by A. M. Lea.

Botany.—6. "Note on Eucalptus linearis." 7. "The gum-topped stringy barks in Tasmania." 8. "Note on a species of Eucalpt new to Tasmania," by J. H. Maiden, F.L.S. 9. "Some Additions to the Bryological flora of Tasmania," by W. A. Weymouth.

Geology and Palæontology.—10. "Discovery of Graptolites in Tasmania," by T. S. Hall, M.A. 11. "Notes on recorded and other minerals occurring in Tasmania," by W. F. Petterd, F.Z.S. 12. "Notes on some Tasmanian Calcareous nodules," by Professor Hogg, M.A. 13. "On the Quartz Tourmaline rocks of the Heemskirk district," by Professor Hogg and G. A. Waller. 14. "Trachydolerite in Tasmania," by W. H. Twelvetrees, F.G.S.

Forestry.—15. "Suggestion for the establishment of a Tasmanian School of Forestry and Agriculture," by W. Heyn. 16. "On the advantages of Forest conservation," by C. B. Target. 17. "Tasmanian timbers, their qualities, uses, etc.," by A. O. Green.

Astronomy.—18. "Practical Astronomy in Tasmania," by Professor A. McAulay, M.A.

Geographical. — 19. "Contributions to the Physiography of Tasmania," by Col. Legge, R.A.

Health.—20. "The disposal and purification of sewage," by E. H. Wilkinson. 21. "Typhoid in Hobart and Melbourne, and the influence of drainage in its prevalence," by Dr. Jameson.

Economics.—22. "Tasmania as a manufacturing centre," by R. E. Macnaghten, B.A.

New Room. — The new room, used last session, was very much appreciated by members, who now for the first time since the establishment of the fine library, find all the books placed in an easily accessible position, while the facilities for study are also much increased.

Library.—The usual number of scientific exchanges have been received during the year.

Centenary of Tasmania.—During the present year Tasmania will have completed the hundredth year of her existence as a British colony, and it would be quite fitting that the Royal Society, which has always taken an interest in matters historical, should initiate, or co-operate with, a movement to celebrate an event of so much national importance.

Obituary.—It is again the painful duty of the Council to record the loss by death of one of its members. Mr. A. Mault, who for many years had practically helped in the working of the society, and had contributed many valuable papers, passed away in November last.

Changes in the Council.—The vacancy on the Council caused by the death of Mr. Mault has been filled by the appointment of the Right Reverend Dr. Mercer, Lord Bishop of Tasmania.

Fellows.—Ten Fellows have been elected during the year.

Finace.—Balance from 1901, £103 9s. 4d. The income of the society from subscriptions has been £170 10s., and the expenditure £227 18s 3d, leaving a balance of £46 1s 1d.

The chairman moved the adoption of the report.

Mr. T. Stephens seconded the motion, and said the report bore testimony to the energy and zeal of their indefatigable secretary, and the way in which he had worked during the year. (Hear, hear.) He suggested that the former practice of printing an alphabetical list of the Fellows in the annual report be revived.

The motion was agreed to.

Mr. Stephens then moved,—"That the Council be requested to have the report printed and published, with an alphabetical list of Fellows, balance-sheet, and minutes of this meeting, according to the former practice, as appeared in the report for 1891."

Mr. Bernard Shaw seconded the motion.

Mr. Webster moved, as an amendment, that instead of printing and publishing the list of Fellows, the list be posted up in the Society's room.

After discussion, Mr. Stephens's motion was agreed to, with the addition of the words, "and that a list be prepared and exhibited in this room."

Election of Members.

Four retiring members of the Council — the Bishop of Tasmania, Mr. Russell Young, Mr. Bernard Shaw, and Professor Neil-Smith, were unanimously re-elected, on the motion of the Hon. Dr. Butler, seconded by Mr. Rodway.

The Press

Mr. Stephens moved a vote of thanks to the Press for the valuable services rendered to the Society during the year.

The secretary seconded the motion, and said that it was 19 years that evening since he arrived in Tasmania, and during that time the Press had been very liberal to the Royal Society. Sometimes as much as four columns appeared in "The Mercury" of the proceedings of the Society. The papers also rendered great aid in forwarding the interests of the Museum. The accurate manner in which the proceedings of the Society, often of a technical nature, were reported in "The Mercury" was a credit to the Press of Tasmania.

The chairman warmly supported the motion, which was passed with applause.

Diamond Anniversary.

The secretary drew attention to this being the 60th anniversary of the Society, and the first meeting in their new room.

The chairman mentioned that in October next it was proposed to celebrate this, and at the same time the centenary of the State. He believed His Excellency the Governor was interesting himself in the matter of commemorating the same.

Freycinet Peninsula.

Mr. Stephens drew attention to a letter in "The Mercury," from Dr. Barrett, of Melbourne, advocating a reservation on Freycinet Peninsula as a National Park. He would like to see the Society take the matter up by commending Dr. Barrett's proposal to the favourable consideration of the Government.

The chairman said a paper was read before the Society on the subject some years ago.

Mr. Bernard Shaw said it was about 5 years ago that a paper was read for which he supplied some material. A considerable quantity of alluvial tin had been found there, and it might become an important mining centre. He detailed disturbing elements in connection with the proposal.

After discussion, Mr. Stephens said he would revive the question before the Council on some future occasion.

The meeting then terminated.

Statement of the Funds of the Royal Society for the Year 1902.

1902. RECEIPTS.	£	s.	d.	1902. EXPENDITURE.	£	s.	d.
Balance	103	9	4	By Salaries	56	0	0
Subscriptions	170	10	0	" Sundries	171	18	3
				Balance	46	1	1
	£273	19	4		£273	19	4

I have this day examined the books and vouchers of The Royal Society of Tasmania, and found same to be correct and in accordance with Balance-sheet herewith.

H. W. W. ECHLIN,
Auditor.

Hobart, 17th Feb., 1903.

Statement of the Funds of the Morton Allport Memorial Fund for the Year 1902.

1902.	£	s.	d.	EXPENDITURE.	£	s.	d.
Balance...	15	12	9	Expenditure during 1902, *Nil*	0	0	0
Interest	10	4	0	Balance per Savings Bank, January 26th, 1903	25	16	9
	£25	16	9		£25	16	9

LIST OF FELLOWS OF THE ROYAL SOCIETY OF TASMANIA.

* Fellows who have contributed Papers which have been published in the Society's Transactions.

*Abbott, Francis
Allwork, Dr. F.
Anderson, Dr. G. M.
Archer, W. H. D.
*Atkins, C. J.
Barclay, C. J.
Bennison, Thos.
Bidencope, J.
Booth, Chas.
Boyd, Dr. P.
*Brown, Hon. N. J.
Burgess, Hon. W. H.
*Burbury, F. E.
Butler, Hon. Dr.
Butler, Francis
Clark, His Honor Judge
Clarke, Rev. Geo.
*Clarke, Dr. A. H.
*Counsel, E. A.
Crosby, Hon. Wm.
*Crouch, Dr. E. J.
Cox, Col. C. B.
Davies, Hon. C. E.
Davies, J.G., C.M.G.
Dobson, Senator H.
Drake, Dr. F. H.
Evans, T. M.
Kay-Ewan, E. D. Mc
Finlay, W. A.
Foster, H. D. (Life Member)
Giblin, Dr. W. W.
*Green, A. O.
Griffith, H.
Grove, F., C.E.
*Harrison, M.
*Hogg, Prof. E. J.
Holden, Dr. L. A.
Horne, Wm.
Hudson, Chas.
Ireland, Dr. E. W. J.
Jameson, Mrs. (Life Member)
*Johnston, R. M., F.L.S.
*Kingsmill, H. C., M.A.
Knight, H. W.
*Legge, Col. W. V., (Rd.)
Lewis, Sir Elliott
Lewis, Major R. C., D.S.O.
Lines, Dr. D. H. E.
Lodge, F., B.A.
Macfarlane, Senator Jas.
Macfarlane, John
Macgowan, Dr. E. T.
MacLeod, P. J., B.A.
*Mault, A.
*McAulay, Prof. Alex.
*May, W. L.
Maxwell, Eustace
McClymont, J. R., M.A. (Life Member)
Middleton, A. E., C.E.
Mitchell, J. J. (Life Member)
*Moore, G. E.
Mulcahy, Hon. E.
Murphy, His Grace Archbishop
Nicholas, G. C.
Nicholls, Hon. H., M.E.C.
*Patterson, R.C.
Parker, A. C.
*Petterd, W. F., C.M.Z.S.L.
Petersen, C. B.
Philp, J. E.
Piesse, E. L., B.A.
Propsting, Hon. W. B.
Read, Dr. G. F.
Read, R. C.
Reid, F. W.
Roberts, H. L.
*Rodway, L.
Rogers, R. J.
Rule, C. H.
Salier, F.
Scott, Rev. Jas., D.D.
Scott, Dr. R. G.
Shaw, Bernard
Shoobridge, Rev. Canon
*Simson, Aug.
Smith-Norton, J. W.
*Sprott, Dr. Gregory (Life Member)
*Stephens, Thos.
Sticht, Robt. (Life Member)
*Swan, E. D.
Swan, C. C.
*Target, C. B.
Thorpe, A.
Twelvetrees, W. H., F.G.S.
Walch, C. E.
*Wallace, W. H.
*Waller, G. A.
Watchorn, A.
Watson, H.
*Ward, W. F.
Webster, A. G.
Whishaw, Dr. R. K.
*White, O. E.
*Wilkinson, E. H.
Williams, Prof. W. H.
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Woflhagen, Dr. J. E.
*Woollnough, Rev. J. B., M.A.
Wright, Howard
*Young, Russell

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PAPERS & PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA,

FOR THE YEAR

1902.

(ISSUED JUNE, 1903.)

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Papers & Pro