low water, and included among the species commonly known as "Bullies." The new variety introduced is 14in. in length, very handsomely coloured, and differs in the character of the tentacular appendages, and other essential points, from the species hitherto described. It was proposed to distinguish it by the title of *Clinus Johnstoni*. A third fish apparently belonged to the tribe of the Squammipinnes or scale-finned fishes. It had been anticipated that it was identical with the single known representative of this group, *Scorpis Georgianus*, that has hitherto been taken, and that very rarely, in Tasmanian waters. On a closer examination of the structural details it was however, found to differ esesentially from that form, and belonged to the genus *Glyphidodon*, and be referable to *G. Victoriæ*, or Rock Perch of the Melbourne fishermen, not hitherto included in the Tasmania fish fauna.

Life-sized coloured illustrations of the several fish described, executed by the author of the paper, were exhibited to the meeting.

The second paper described the capture of the example of the New South Wales crayfish (*Palinurus Hügellii*) in the vicinity of the Schouten Islands. Other specimens were reported to be occasionally taken by the fishermen, who, thinking from their colour (greenish brown) that there is something wrong with them, usually throw them overboard. The points of distinction between this type and the ordinary market species of this colony, *Palinurus Edwardsii*, were pointed out by Mr. Saville-Kent, who, in conclusion, presented this and other of the specimens previously mentioned to the Museum.

Mr. R. M. JOHNSTON said the specimen was most closely allied to the real trumpeter. He was not sure of the number of teeth in the real trumpeter, but from casual observation he believed it varied.

Mr. MORTON (the curator) said he was sure the trustees of the Museum would be deeply thankful to Mr. Kent for presenting the fish and crustaciæ on the table, and he trusted they would be the forerunners of many other valuable donations which Mr. Kent, from his position, would be able to make. By these means a collection of all the known species in Tasmania would be got together. He had been examining a number of real trumpeter recently, and in no case was the dentition similar to the specimen presented.

A circular was read from the Royal Society of Victoria and the Geographical Society of Australia, asking the co-operation of the society in acquiring Antarctic information and pursuing Antartic discovery.

On the motion of Mr. SPRENT, the consideration of the paper was postponed till next meeting, when he hoped to bring up a paper embodying the reliable information that could be gathered.

On the motion of Mr. B. SHAW, seconded by Mr. C. J. ATKINS, a vote of thanks was passed to the Fellows who had contributed papers, and the donors of books and specimens.

SEPTEMBER, 1886.

The usual monthly evening meeting was held at the Society rooms on Monday, September 13, Mr. Jas. Barnard in the chair. There was a large attendance of Fellows, and many visitors, including a number of ladies.

The following gentlemen were elected corresponding members of the Society :—Mr. R. L. Jack, Government Geologist of Queensland ;

Dr. B. Carrington, M.D., F.R.S.E., Eccles., Lancashire, England, and Mr. W. H. Peason, Manchester. Drs. Hardy and Wolfhagen, of Hobart, were elected Fellows of the Society.

The following donations to the library were announced :—

American Agriculturist, August.

Annals and Magazines of Natural History, No. C III., July.

Athenæum, June.

Boletim da Sociedade de Geographia de Lisbon, 5th series, No. 9, 10.—From the Society.

Bollettinodella Societa Geografica Italina, serie II., vol. XI.—From the Society.

Bulletin de la Sociéte Royal de Botanique de Belgique Tome Vingt—Cinqinème Fascicule Premier Année, 1886.

Bulletin de la Sociéte Imperial des Naturalistes de Moscow, No. 1.—From the Society.

Bulletin du Musée Royale d' Histori Naturelle de Belgique Tome IV., No. 2.—From the Society.

Catalogue of the Library of the Linnean Society of New South Wales.—From the Society.

Field Naturalists' Club of Victoria, sixth annual report, 1886.—From the Society.

Geological Magazine, July.

Journal of the Bombay Natural History Society, No. 3, vol. I., July.—From the Society.

Journal of the Society of Arts, June.

Mineral Statistics of Victoria for the year 1885. Report of the Secretary of Mines to the Hon. J. L. Dow.—From the department.

Nature, June.

Proceedings of the Canadian Institute, Toronto, third series, Vol. III., No. 4, June, 1886.—From the Society.

Proceedings of theLinnean Society of New South Wales (second series), Vol. 1, Pt. the second.—From the Society.

Provincial Medical Journal, Vol. 5, No. 55.—From the Editor.

Sociéte de Geographic, Nos. 12, 13, 1886.—From the Society

Studien über Thonschiefer Gangthonschiefer und Sericitschiefer. 1 Thonschiefer und Gangthonschiefer des Oberharzes, by Von Herrin A. Von Groddeck in Clausthal.—From the author.

Statistical Register of the colony of Victoria for the year 1885, Pt. II, Population, Pt. III. Finance, etc.—From the department.

Transactions and Proceedings of the New Zealand Institute, 1885. Vol. XVIII. Do. do. Index. Vols. I. to XVII.—From the Institute.

Transactions of the Asiatic Society of Japan. Vol. XIV., Pt. I.—From the Society.

Uber die Gesteine der Bindt in Ober Ungarm. By Von. A. Groddeck.—From the author.

Verhandlungen der Gesellschaft Für Erdkunde Zu Berlin Band. XIII., No. 6.—From the Society.

Victorian Naturalist. Vol. III., No. 4. Aug.—From the Society.

Zur Kenntniss der .Zinnerzlagerstätten des Mount Bischoff in Tasmanien. By Von. A. Groddeck.—From the author.

THE PROPOSED ANTARCTIC EXPLORATION.

A letter was read from the Premier covering a communication received from the Premier of Victoria, enquiring whether the Government of Tasmania would be disposed to join in the cost of dispatching an expedition to the Antarctic regions in the interests of science and commerce. The Premier noticed that the subject would engage the attention of the Fellows, and desired an expression of their views theron.

Mr. C. P. SPRENT then read a paper on the subject. He commenced by referring to what had been done in the Arctic Seas, and British enterprise and British adventure had been in the van, and to the vast field for discovery that lay around the South Pole. Since the last voyage to the Southern Polar regions, 43 years ago, science has made great strides, yet, beyond a few facts regarding a portion of the coast line, very little was known about those regions. But Baron Müller had introduced the consideration of a new scientific voyage, and the subject had been taken up, leading to the proposal the society was now met to consider. As one of the few members of the Geographical Society of Australasia, he had been requested to place those proposals more fully before the Royal Society. Mr. Sprent then gave a rapid *resumé* of the earlier Antarctic voyages, pointing out the courses sailed and the land discovered on a large chart prepared for the purpose. He then gave an account of that English expedition of 1839-40, pointing out that Ross had achieved the remarkable reputation of having discovered the South as well as the North Magnetic Pole. Having given account of what had been done, he proceeded to point out that the Antarctic regions presented the exactly opposite characteristics of the Arctic regions. The Great Northern region was connected with the continents of Asia and North America, but the great Southern region was cut off from any communication. It was doubtful whether the Antarctic region was a continent or a collection of islands joined together by ice. The balance of testimony was in favour of the latter supposition. The icebergs of the South were different from those of the North. Antarctic summer was colder than the Arctic There was a want of information regarding the cold of the Antarctic region, but there was some evidence that it was colder than the Arctic. The geology of the Antarctic land was only known through scattered fragments, obtained, in some instances, from such strange places as the stomachs of penguins. So far as he was aware no fossils had been obtained, and very little stratified rock has been seen. The rocks were chiefly volcanic, and the specimens obtained included greenstone, granite, basalt, hornblende, slate, mica slate, schists, etc. Seeing that no one had set foot in Antarctic land there was no evidence as to whether any land animals existed there. Whales, seals, and albatrosses were numerous, though the officers of H.M.S. Challenger reported that the Americans were fast thinning off the seals. In concluding an excellent *résumé* of what is known regarding the Antarctic regions, Mr. Sprent said :—"It now remains for me to answer the two questions that must inevitably be asked when any proposals for further exploration in the Antarctic are put before the people of these colonies :—1. What is the good to be expected from it? 2. Why not leave it to others to try? In answer to the first question we may reply that, independently of any commercial advantage that may result we must look to the scientific knowledge to be acquired, and it is now generally conceded that the value of scientific investigation is not to be measured by mere pecuniary results. There is a numerous body of scientific men, whose business it is to acquire information, to collect facts in various lines of enquiry, and to establish principles. No one can tell what the ultimate results of any particular scientific investigation may be, what practical advantages may accrue from pursuits which at one time seem purely theoretical. The advantages derived by the world at large from the application to every day use of steam, electricity, magnetism, heat, sound, followed after long investigation of principles. Surgery, medicine, chemistry, hygieny, are all benefiting by the labours of men who were looked upon in their day as enthusiastic theorists. Literature, art, and science are not calculated solely for money profit. In this Society we have a zealous band of workers energetically striving to increase our knowledge of

geology, botany, and natural history of the island we live in ; their labours do not add to the value of our exports, nor add to the pecuniary wealth of the people ; but they are none the less valuable, and we look with pride on our little volume of transactions as our modest contribution to the ever-accumulating stores of scientific knowledge. The programme for the proposed Antarctic voyage, as sketched out by our Victorian *confrères*, presents a varied and numerous array of subjects for investigation, subjects on which additional information will be welcomed by the scientific men of all countries. The commercial advantages, too, are sufficiently promising to have induced the Victorian Premier to lend his powerful support to the movement, and I notice that the Premier of Queensland approves of the project, although he doubts if the time is opportune ; and seeing that the Geographical Societies of England, Germany, Italy, and Denmark, are all anxious to see the work undertaken, I think we may rest assured that some good results will follow, and that we shall be in good company if we join in the work. Lastly, it is incumbent on Australia to take part in this exploration. We aspire to be the leading power in these Southern Seas; we are gradually setting up a Monroe doctrine of our own ; and we are working ourselves into a perfectly hysterical condition at the bare thought of Frenchmen or German poaching upon what we consider our preserves. All this may be very good policy if we can persuade other nations to see things as we do, but we must make up our minds to act as well as talk, and that it is useless for us to expect the whole force of the British Empire to be exerted in favour of our schemes, unless we can prove that our aim is calculated to promote the welfare of the Empire as well as our own. If we expect to be the ruling power in these seas, the sooner we show ourselves upon them, the sooner we shall see our claims recognised, and it is only by fostering a spirit of adventure and enterprise that a maritime power can be built up. The great commercial Empire of Great Britain was forwarded by adventurers, who, in the days of Queen Elizabeth, made their way into newly-discovered lands, establishing themselves in the most promising regions, and defying all efforts to dislodge them. If we wish to build up a maritime power we must follow their example, and if we wish to preserve the islands of the Pacific for our commerce we must turn our attention to forming an Australian navy, and show the Mother Country that we are able to hold what we may acquire. Australia has already shown the Mother Country that she is prepared to share the dangers as well as the benefits of our connection ; let us now show her that we are ready to send an Australian Contingent to share her work of science ; if we do we may be certain that in this line there is more lasting honour to be gained than in fighting the battles of the Old Country against half armed savages. No time is more opportune for such a demonstration than the present, when the colonies are so prominently before the public of the world. We have shown the rapid progress of our commerce, and the vastness of our resources ; we have proved that in manly sports we can hold our own with all comers ; now let us show that the old Anglo-Saxon love of adventure is strong within us, and that although during our infancy we were content to share the benefits of scientific work, in our manhood we are ready to share the toil. The scientific world is anxious to see a renewal of Antarctic exploration, and nothing would be more gratifying to them, nothing will be more calculated to give the world an earnest of our desire to help, than for Australia to take up this work ; certain it is that it would be a standing disgrace to Australia if she took no part in the exploration of the seas that wash her own coast, and if Australia determines to undertake this work, I trust that this time Tasmania will act with them." (Applause.)

Mr. J. B. WALKER said he had been requested, in order to test the matter and ask the Government to take part in any expedition that might be sent out by the Australian colonies, to move the following resolution :—"That in the opinion of this meeting it is desirable in the interest of science and commerce that the exploration of the Antarctic regions should be reviewed, and that in the event of the Australia colonies taking part in the despatch of an expedition for that purpose that Tasmania should contribute towards the cost." He quite concurred in Mr. Sprent's remarks as to the responsibilities Australia incurred if she intended to hold the empire of the Southern Seas. If she wanted the position she should take up the responsibilities that were attached to that position. We should do our share towards the scientific resources of these Southern regions as England had done in the North. Tasmania should not be the only colony to stand apart from such an enterprise as she had done in the case of the Colonial Exhibition. The space to be explored was double the size of Australia, and certainly presented great opportunities for scientific research, and presented such opportunities to us in a way in which they were not open to any other part of the world. It was 50 years since the last expedition was sent out, and since then much has been done to render such an exploration feasible. He would leave it to those Fellows, better able than he was, to explain the scientific gains which might be anticipated as the result of such an expedition, but desired to point out some commercial advantages that might result in the way of opening up a new industry in whale fishery. He pointed out the 25 years ago the late Dr. Crowther despatched a vessel to Kerguelen Island, in the whaling interest, so that it would be seen that Tasmania had taken up the matter before, though not very successfully.

Mr. A. MORTON (Secretary of the Royal Society), in seconding the motion, said he was sure they had all listened with great pleasure to Mr. Sprent's interesting paper, and he thought the meeting was entirely in accord with the resolution. It was pleasing to notice that the Royal Society of Tasmania was the third scientific society in the colonies to take up the matter. Victoria led the way, Tasmania followed, and he believed New South Wales would shortly consider the same question. As they all knew, in about 15 months the centenary of, we might say, Australasia would be celebrated, and it would be a fitting time for her to show the world that she had arrived at her maturity, and was able to take her place with the nations in organising a scientific expedition. Before America was a hundred years old she had sent out expeditions to the Arctic regions, and no fitter celebration of our centenary could be devised than a successful venture of this kind. He pointed out that the Premier of New South Wales had brought forward a proposal to celebrate the hundredth birthday of Australasia, and as the British Association had been invited to hold their meetings in the colony in the year 1888, such an expedition successfully carried out would show them and the world what the Australian colonies could do. He, for one, though preferring to explore in warmer latitudes, would be very glad to take part in a scheme which would be so beneficial scientifically and commercially. The colonies had the means and the men ; let them have the will, and success was certain. (Hear, hear.)

Mr. A. MAULT suggested that the motion should be slightly amended, to read that Tasmania would give a general co-operation and not only contribute towards the cost. It would be better for Tasmania to be represented and to take a more active part than in merely contributing towards the cost. In these days, when federation was the common hope, an Australian navy was the great want, and such an expedition as that proposed was the kind of training to make good men.

The Rev. J. B. WOOLLNOUGH, in support of the view that such expeditions nourished a spirit of adventure and made hardy men, referred to the fact that France used the shores of Iceland as a nursery for her marine, both commercial and fighting.

The resolution was then amended to read: "That in the opinion of this Society it is desirable in the interest of science and commerce that the exploration of the Antarctic regions should be continued, and that Tasmania should co-operate with the other Australian colonies in the despatch of an expedition for that purpose, and that the council communicate this resolution to the Premier.

The CHAIRMAN, in putting the resolution, said his name having been mentioned in the early part of the paper, he might be pardoned if he indulged in some reminiscences connected with the return of the first expedition under Captains Ross and Crosier. It seemed that he enjoyed the distinction—if it be a distinction—of being one of the only two remaining members of the original Tasmanian Society, founded by Sir John Franklin; the other member being our esteemed honorary secretary and vice-president, Dr. Agnew. He had the privilege of sitting next to the distinguished commander of the expedition at the hospitable board of Sir John Franklin, and hearing from his own lips the account he gave of the discovery of a volcano on Mount Erebus—an appropriate name—12,400 feet above the level of the sea, in active eruption, and Captain Ross described it as a magnificent spectacle; and at a distance of about 20 miles there was also an extinct crater on Mount Terror at an altitude of 10,000 feet. The ships sailed here along a wall of ice fully 150 feet high for nearly 500 miles, when further progress was stopped by a complete barrier of ice. The description of these discoveries had left an indelible impression on his mind. Referring to the Society, the Chairman designated it as unique in its character, as the members were not called upon to make any contribution to its funds, but the whole expense, including the printing of its transactions, was defrayed by the generous liberality of its President and his noble-minded lady; and, indeed, the Society had a rosy time of it, as its members were entertained at Government House monthly at dinner before adjourning to the library for the reading of papers. Of course the number of members was then only a handful, or rather "table-full." Those papers are contained in the "Tasmanian Journal of Science," and many are of first-rate excellence, and well worth reading at the present time. The Chairman then referred to the excellent and exhaustive paper which had been read by Mr. Sprent, and expressed his full concurrence in all that had been advanced in support of the projected expedition, and especially agreed with the remarks of Mr. Morton that such an undertaking would commend itself to the people of New South Wales as one worthy to celebrate the centenary birthday of Australasia. In conclusion, he hoped that the expedition would be successfully carried out in the interests both of science and commerce.

The resolution was then agreed to.

The Rev. GEO. CLARKE moved a vote of thanks to Mr. Sprent for the very able and interesting paper he had read for their instruction. He hoped Tasmania would always take a part in such matters, and never again incur the disgrace that attached to her for not being represented at the Colonial Exhibition. There were special reasons why Tasmania should co-operate in the movement, for Hobart would be the probable point of departure.

The Rev. T. M. O'CALLAGHAN seconded the motion, which was carried by acclamation.

MISCELLANEOUS.

A woodcut engraving of Sir John Hooker, the botanist of the Erebus, in his study at work, was handed round for inspection.

The Secretary drew attention to some specimens of Fijian pottery

presented by Sir Henry Wrenfordsley, which were on the table. The jugs and cups were copies of European work, but there was one original specimen of ceramic art.

SPECIAL MEETING.

A special meeting of the Royal Society was held on Monday evening, September 27, for the purpose of continuing the debate upon Mr. A. Mault's paper on an underground drainage system for Hobart.

Mr. JAS. BARNARD occupied the chair, and there was a large attendance of Fellows, besides several visitors from the other colonies.

The debate was resumed by Mr. R. A. Bastow, who read the following paper in reply to Mr. Mault's :—

Mr. Chairman and Fellows of the Royal Society,

At the monthly meeting of this society, held on the 10th of last month, a paper was read by Mr. A. Mault on the drainage of Hobart. It was then intimated that I might have some remarks to make on that important subject, and I have now the honour of placing them before you.

In that paper many statements were made, which, if true, would be anything but pleasant to the residents of Hobart as matter for contemplation, notably, that all the once limpid watercourses of the city are now converted into common sewers, a fact that is patent in all cities and towns of any importance; that we have in our midst about 3,500 horrid cesspits, stinking, pestilential, seething masses of corruption, continually giving off gases of a most disgusting nature and poisonous in a high degree, but we are pleased to be able to say that the tenure of such state of affairs is rapidly shortening, and will soon be determined; that the contour of the city is such, that it is impossible to drain many properties without passing through the adjoining owner's premises, but here again, if no other course can be adopted, we have an excellent provision in section 137 of the Public Health Act, whereby drains may be made through private premises, and that the profitable conversion of the contents of pails into manure is problematical. These deserve serious consideration and most careful inquiry from every point of view, peradventure we may at least find out one system, or parts of many, that may be the simplest, the cheapest, the most efficient, for the preservation of the public health.

The official report to which Mr. Mault refers contains an elaboration of an extended system of sewerage, which, if it could be carried out, would undoubtedly be an immense improvement on the existing state of affairs. Inspecting the streets of this city, as it is my duty every day, in wet as well as in fair weather, if one fact stares me in the face strongly amongst others, it is that we require good underground drainage, and if the system of drains without the trough closets, as are laid down on the map accompanying the report, could be constructed for £60,000, and if the corporation had £60,000 laid by, and had nothing else to do with it, I do think that the citizens of Hobart would desire, and I scarcely think the corporation would then refuse to carry out, that great scheme of sewerage; or if the Central Board would take upon themselves to provide us with such a system of drains without trough closets, and would pay the costs, no doubt the citizens would be very much obliged to them; or if they could induce our Government to take the risk and foot the bill of such an undertaking, the inhabitants of Hobart would for ever bear them in grateful remembrance.

I have been careful to introduce the four "ifs" in the preceding paragraph, for thereon hangs the possibility of the scheme being carried out. But the municipality has not £60,000, the system cannot be

carried out for £60,000, and neither the Central Board nor the Government, if they are separable, will pay off our scores.

It has just been stated that the system cannot be carried out for £60,000. In order to justify such a statement, we must glance at a few of the details. Of course we are all aware that Mr. Mault's report is but a sketch, and that the figures are not intended to be taken as absolutely exact, but in these my remarks I have, rightly or wrongly, nevertheless as correctly as I am able, with the time I have at my command, arrived at somewhat different conclusions as far as regards cost of sewers.

Noticing only in the estimate for sewers. No. 1. Egg-shaped brick culvert, 3ft. 6in. by 2ft. 8in. inside measurement, it is priced at 42s. per lineal yard; and as excavation, shoring, bedding, centreing, bricks, cement, filling-in, and ramming and metalling, are not mentioned as being in part excluded, I take it that the 42s. is meant to include all the expense attached to each item in that No. 1 estimate.

I presume that the largest sewer will be constructed with its crown 4ft. below the surface at the very least, the depth of the excavations then required will be 9ft., and the width will be at least 5ft.; that will amount to five cubic yards of excavation in a treacherous subsoil, probably at times cutting through solid rock; this, with the shoreing, filling in, ramming, metalling, and carting away, should be worth at least 7s. 6d. per cubic yard, or £1 17s. 6d. per lineal yard. The bricks for the sewer would cost £1 7s. 9d., the cement for the sewer and sewer bed £1 7s., and calculating only 15s. for bedding, centreing, and laying the bricks, we have a total of £5 8s. 6d. per lineal yard for No. 1 sewer, or more than double the price mentioned in the report.

But if the localities where this sewer is indicated have a subsoil of blue metal or sandy or unmade ground (for according to Mr. Mault's map much ground of this nature will be met with in laying No. 1 sewer), I have it on excellent authority that the cost would be, not 42s. per lineal yard, nor yet my estimate of £5 8s. 6d., but 200s. per lineal yard.

If the remaining prices are similarly low, the total estimate of £60,000 must be considerably increased.

Usually, the streets in which underground sewers are laid have the gas and water mains laid at the same time, and the streets are then paved with setts; this protects the sewers from being choked with street detritus, and the same course should be here adopted. The systems of sewers and pipes should be laid at or near and under the side channel, so that any interference with the carriage way when once made would be unnecessary. But to pave 37 miles of street would be an enormous outlay for a scattered city like Hobart, sufficient to make the most extravagant pause and consider whether the existing sewers may not, with repairs and additions, be made to serve all our purposes for many years. A thorough inspection and subsequent repair, or, where required, a renewal of the existing sewers is without doubt desirable, but it would not be judicious to rush into the magnificent expense of large English cities when we do not possess their magnificent resources.

If underground sewers were laid in the principal natural watercourses that are as yet without them, and if good cement-concrete side channels were laid, with their inlets to the underground sewers properly trapped and regularly flushed, automatically or otherwise, it is probable that not much, if any, nuisance would arise therefrom.

* It appears, according to Mr. Mault's report, that there are about

* It has just been ascertained that in this city there are now only 1,278 cesspits existing. The pail closets number 2,965, and waterclosets 514. Oct. 13, 1886. R.A.B.

3,500 cesspits yet existing, and it has been recommended to have these replaced by brick trough closets, such as are in use at Liverpool. The cost of these has not been stated; but they could not be erected, and furnished with pipes, junctions, trough, brick walls, and other fittings, as shown on sketch, under the sum of £18 for each one, or a total cost of £63,000, this expense resting upon the owners of the houses to which the closets are added, and exceeding Mr. Mault's total estimate for underground sewers by £3,000. But, considered apart from the cost, such receptacles as advocated in the report, unless punctually attended to, would prove very offensive, and, however much attention they might have, accumulations would collect on the sides and edges, which practically could never be cleansed. Referring to waterclosets generally, my experience in Manchester has taught me to regard them with a very jealous eye. They appear to be directly opposed to the first principles of sanitary science, and should only be tolerated in large and lofty buildings where the adoption of the dry system is practically impossible, and then they should be separated by an open air space, and the ventilating and other pipes carefully supervised.

We are aware that the patent wash-out pan looks cleanly, and is in a certain sense convenient, but speaking as a sanitary surveyor, and using metaphor, it is typhus and typhoid fever garbed as an angel; I should not have to go away from Hobart to reduce this metaphor to hard fact. In the city of Manchester this has been proved scores of times. The officer of health for that city states in his report for 1869, with regard to waterclosets and grids, that "no trap as ordinarily constructed is proof against the passage of sewer gases. The water which forms the valve becomes saturated with the gases (sulphuretted hydrogen, etc.) from below, and gives them off again above into the cellars or other apartments. There is no such thing as permanent retention of gases by water except under pressure. There is constant absorption on the one side, and constant elimination on the other."

The noxious quality of evolved sewer gas, assisted as it is in its evolutions by the bungling of plumbers, causes more sickness and death in first-class houses than the generality of the inhabitants of such houses dream of.

I would here mention that there is room for legislation with regard to allowing workmen to interfere with lead-piping in houses unless they are duly qualified and authorised.

It is certain that the "residuum" would not rise to the occasion in the use of the trough. Bundles of rags, and vegetable and animal refuse, would assuredly find their way into the trough pipe, just as they do in the pail or the cesspit, but in the former they are not easily removed; we should then have stoppage, nuisance, and expense to all connected with that sewerage area, both above and below the stoppage.

As Liverpool is a water-closeted city and Manchester is a dry-closeted city, it would perhaps be useful to compare the death rates as far as we can obtain them. The infant mortality per 100,000 persons under 5 years of age, from 1851-1860 was for Manchester 11·7, for Liverpool 13·2; under 1 year of age, Manchester 26·1, Liverpool 27·7; from 1861-70, under 5 years of age, for Manchester 11·1, for Liverpool 13·9; under 1 year of age, for Manchester 25·0, for Liverpool 30·5. These are from the figures of the Registrar-General, as quoted in the report of the officer of health, Manchester, 1876, p. 35. The death-rate per 1,000 for the whole town of Liverpool in 1880 was 27·3; for the city of Manchester 25·99, this including 659 deaths which occurred at Crumpsall workhouse near to Manchester, and which should not have been included. By these facts the system of Liverpool soil pipes stands condemned.

I should have included the death- rates of these centres of population for the succeeding years if the Registrar-General's reports had been in the Parliamentary Library.

In case of epidemic raising, there can be no doubt but that a system of drainage to which all the closets of the city are connected is a most favourable condition to its rapid spread. We again bring forward trough-closeted Liverpool as an example. When small-pox had become rife in London and Liverpool in 1872, it became certain that Manchester would not escape, as the intercourse with Liverpool especially was constant and active. The City Council then issued printed instructions to 19 sanitary inspectors, and I copy the following as instructions Nos. 2 and 3 :—

2. "He shall represent to the inhabitants of each house that small-pox has for many months past been exceedingly prevalent and fatal in London and Liverpool, and in several other large cities and towns; that during the week ending Saturday, May the 20th, the deaths from small-pox were in London 267, in Liverpool 50, in Newcastle 14, and in Manchester 10. That the annual death-rate from small-pox in Liverpool is equal to 5 out of every 1000 persons living in Liverpool.

3. "He shall also represent to them that small-pox is rapidly increasing in Manchester and Salford, owing partly to the infection being brought from Liverpool, and partly to the spread of infection from persons already suffering from small-pox in Manchester and Salford; and that unless measures are taken to check the spread of the infection it is likely to be as bad, that is, as prevalent and fatal in Manchester as it is in Liverpool and London." The Liverpool system of soil pipes again stands condemned. Had Liverpool been furnished with dry closets in place of waterclosets it is probable that neither Liverpool nor Manchester would have suffered so severely from epidemic. In the latter city, where dry closets were adopted, the spread of small-pox was rapidly and efficiently checked.

It is a patent fact that the general public are perceiving the dry closet to be the natural process to be adopted, and if those who have such dry closets and do not burn coal could be by law compelled to use ashes, or other material as an absorbent, there would be an end to all nuisance from the closet. A small amount of ashes or dry earth will completely deodorize and absorb the moisture in the pail, and this may be dried and used over and over again if necessary. The pail cannot be used to contain all the slops of a household, but these may be profitably carried into gardens or orchards by a system of sub-irrigation carried out on a small scale. The slops should be led from the house to the garden through a water-tight pipe, and from it three or four rows of sub-irrigation drain pipes should be laid about a foot deep in the soil and ⅜ of an inch apart. The rows of pipes thus laid should be used on alternate days, and it would be found that the soil will greedily absorb all the slops of a large house, if this means is adopted. An earthenware (Field's) flushing tank at the house would automatically deliver the slops to the extent of the pipes. This system is thoroughly described in "Our Homes, and how to make them healthy," by Shirley F. Murphy, p. 671., the chapter in question being written by William Eassie, C.E., F.I.S., F.G.S.,etc. A small drainage scheme of this nature was carried out by Mr. Bailey Denton for 13 houses, a mansion, and a farm homestead near Leatherhead, Surrey, with great success. The irrigated land is in close contiguity to the mansion, but no nuisance is experienced from it. Previous to these alterations the slops decomposed in the neighbouring ditches, and caused considerable nuisance. In many cases in this city a rough and ready system of this character is adopted, and serves the purpose admirably, but where the contour of the ground prevents the adoption of such a method the house

slops must of necessity run into the side channel, and it should then be regularly or automatically flushed, nuisance will then be prevented. Some time ago I stated in this room that the great reduction in typhus and typhoid fever cases and deaths in the city of Manchester was synchronous with the alterations effected in the closets of the city, from the cesspit to the dry system. The following are the years in which the Health Committee have been at work, and the results are interesting as a record of lives saved by sanitary operations :—

Year.	Deaths from Typhus and Typhoid Fever.	Rate per 1,000 of population.
1868	635	1·83
1869	403	1·16
1870	392	1·13
1871	282	·80
1872	242	·68
1873	232	·66
1874	188	·53
1875	177	·51
1876	225	·63
1877	164	·46
1878	115	·32
1879	68	·18
1880	98	·24
1881	75	·21
1882	116	·33
1883	76	·21
1884	73	·21

The deaths from the five principal zymotic diseases within the same years decrease gradually from 2,342 deaths in 1868 to 720 deaths in 1884. It would, therefore, appear that the sanitary operations in that city must not be characterised as a disastrous failure, but as a glorious success.

In section 51 of Mr. Mault's report it is stated that the yearly cost of street sweeping and pail collecting for the city of Manchester is £87,000. Mr. Mault has been misinformed. The absolute cost of the department for 1884 was £86,814, and for that sum the following work was done :—£17,000 was spent in maintaining and looking after those afflicted with infectious disease ; 1,092 cases were taken to hospital ; 1,814 houses were disinfected and thoroughly cleansed ; 11,947 articles of bedding were disinfected ; 675gal. of medicine (diarrhœa mixture) were distributed at the police stations for the poor ; 6,691 barrels of water were used on the streets ; 270 horses, 100 carts, and 30 sweeping machines were kept at work ; 120 vans were washed every day ; 300 miles of courts and alleys were kept clean ; 900 miles of footpaths, and 475 miles of streets containing 64,283,502 sq. yards of carriage way were kept clean ; 52 public urinals were cleansed twice each day ; 90,000 street grids were opened and cleaned ; 54 private slaughterhouses were regularly cleared of refuse ; 50,000 dustbines were emptied once, twice or thrice, each week ; 66,000 closet pails were removed, emptied and washed, all once, some twice and some thrice, each week ; 217,274 tons of refuse matter were taken to the depôts and disposed of at a cost of £43,526 10s. 6d., and 117,455 tons of this consisting of street sweepings and pail contents. So that the sweeping and pail collecting, is but a small part of the sanitary operations of Manchester, and could not possibly cost £87,000 nor yet one half of that sum.

The report of the superintendent of the Health department, Manchester, for the year 1878 contains the following night and day soil account :—

Dr.			
To wages paid, night carters	£1,440	4	7
Ditto, barrowmen	3,371	5	10
Ditto, night yardmen ...	81	6	8
Ditto, tipmen	316	9	2
Rent of wharf, Bollington ...	5	0	0
Commission	239	15	2
Carriage	3,726	10	7
Wages paid, day yardmen ...	3,338	0	9
Ditto, vanmen and carriers...	12,448	13	0
Ditto, receptacle cleaners ...	1,287	17	0
General expenses	10,726	15	8
Total	36,981	18	5
Cr.			
By sale of manure	5,392	6	2
Balance	31,589	12	3
Total	36,981	18	5

The population was 341,414 last census, and according to this estimate of population the above outlay, equal to about 1s. 10d. per head, for not only pail collection and street-sweeping, but for the collection of all refuse within the city for one year. Applying that rate per head to the City of Hobart, with a population of 24,000, the total annual cost for sweeping streets, pail collecting, and the removal of all additional refuse, would amount to £2,200 per year, or £800 per year in excess of the present cost, not one quarter of the probable cost as estimated by Mr. Mault, viz., £9,000.

In section 14 of the report the annual cost of scavenging Hobart is stated as £2,000. The exact cost of this department is £1,347 10s. 11d.

I have a small plan of sanitary works, at Warrington, on the wall before you. Of this complete little work, W. Sedgewick Saunders, M.D., F.S.A., in his report to the Committee of the Honorable the Commissioners of Sewers of the city of London, 1884, and ordered by them to be printed, says:—"I think it must be conceded that in the new system we have before us a new line of departure of singular promise, and that by waiting for its full development we have been spared the risk and cost of failure, even if we cannot claim the honour of being the pioneers of a system destined in the opinion of all competent and disinterested sanitarians, to supersede the present vicious methods of disposing of house refuse;" "not only did they see a work consisting of poisonous and disgusting elements dealt with and satisfactorily disposed of, without nuisance of any kind, but learnt that products having a marketable value can be, and are, produced without any infraction of true hygienic principles, whilst at the same time they may have the effect of materially reducing the expenses."

I think that a similar system could be advantageously adopted in Hobart for dealing with refuse. The evaporation to dryness of semi-liquid excreta would afford excellent and portable manure, and the total destruction by fire of all other noxious waste material would probably be found to be cheaper and more efficient than any other process of dealing with refuse matter. I am glad to say that Mr. George Coppin, M.L.A., Victoria, and a member of the Victorian Central

Board of Health, entirely approves of the dry system, after having made special investigation of the subject in his recent visit to England.

But if we presume that underground drainage effected, and even dry closets adopted, the mortality of Hobart or any other colonial city will be reduced to the minimum rate, we shall arrive at a wrong conclusion.

Although I do not know much about waterworks, I do know this, that they are quite as important a factor in the public health as sewers, and they are at the present time receiving close attention. I should like to have referred to other subjects touching the public health, but there is not time. Old and dilapidated buildings should be demolished; all the cesspits in the public schools of the colony should be abolished; the streets should be paved with wood (Tasmanian wood), and then there would be an end to costly metalling; new slaughter-houses should be erected; infectious diseases should be energetically dealt with, and infected houses cleansed.

Filthy houses (where freshly vaccinated children have erysipelas or abscesses, and the fault is laid on the vaccine in place of being laid on the filthy house), require strict sanitary supervision, and many other measures too numerous to mention this evening, although of vital importance, all require consideration. These cannot be done by a waive of the hand, but they may be considered systematised, and gradually enforced, and with each step that is taken we may expect that the standard of health will rise.

At the conclusion of his paper, which was received with cheers, Mr. Bastow added, in reply to questions, that the system of altering the old cesspits into the dry-closet system was not completed when he left Manchester. With regard to the fact that water system was adopted in the Manchester Town Hall, he pointed out that the officer of health was appointed in 1868, and the health department was created the same year. The contract for the building of the town hall had commenced before then, and all the plans and specifications were completed some years before. If that had not been so, he would not have opposed the earth-closet for a building like that, which was seven or eight storeys high.

Dr. Perkins: But there are 11,000 waterclosets in Manchester at the present time.

Mr. Bastow: I believe that is so. Waterclosets are allowed to be built with the sanction of the Health department.

Mr. Morton instanced the case of Norwich, where the sewerage system was expected to cost £28,000, but after spending the second hundred thousand they were no better than when they commenced. With regard to sewerage affecting the fish at the fisheries exhibition, papers were read of the terrible results to fish in every river in Europe. He did not agree with Mr. Bastow's suggestion to pave the streets with wood, while, in Hobart, there was such a good supply of metal, and felt certain it would be very much dearer, while other use could be found for the timber all over the colonies.

Mr. E. Swan desired to know something of what was being done outside of the two Lancashire towns of Manchester and Liverpool. He would like to know what was being done in sanitary matters at Paris and other Continental cities.

Dr. Wolfhagen said it was undoubtedly a fact that typhoid was very prevalent in Hobart about autumn, and the fact required some consideration. In Edinburgh there was a lower death rate than any other European cities, except some to the extreme north. There the sewerage was taken out of the town and allowed to flow over some meadows, but there was a project to carry it by extensive sewers into the Frith of Forth. At Edinburgh the circumstances were very

similar to Hobart, where the city was built on several hills and close to the sea. Edinburgh was much more to the point in considering what should be done in Hobart than Manchester.

The Rev. J. B. WOOLLNOUGH said he was not an expert, but only an outside sufferer, with a great deal of experience, and very little knowledge. He was opposed to underground drainage, because it gave back the gases, whereas the land retained them. It was better to send these things to the soil, which wanted them, than to the water, which did not want them, and did not know what to do with them. He had lived in the Thames Valley, where the question had been fought for years, and was still being fought. They were there called upon to do something, and did something which was not right. At the Army and Navy Club in London he recollected there had been a difficulty with the water system, and in taking up a few boards the usual state of affairs was discovered ; and he had no doubt it would be as bad under Marlborough House and at other large mansions. He had never met a perfect watercloset, and it seemed to be hopeless to expect one. Whatever might be said about the troubles of the earth system, they knew what they were. Each box stood by itself, was comparatively harmless, and could not go far wrong ; but with the water system there was no knowing the extent of the mischief, as the evils of one place was carried around to the neighbours.

Mr. WARD gave some analyses of sewerage and the proportion of solids to be dealt with in disposing of sewerage under the watercloset system.

Mr. C. H. GRANT said he recollected when he first began to take an interest in engineering works, the Board of Health was established in England under Government auspices. It was very unfortunate indeed in its first efforts, as Mr. Mault would probably recollect. They created a special fever known as the "Croydon fever." At Eastburn, where they proposed to show what a system of public drainage should be, they were almost equally unfortunate. As a matter of fact no special disease had ever been attributed to the pail system. At Paris he recollected when he used to visit that city the pail system was carried out, and it certainly was not pleasant the way it was done. In Melbourne, too, it was very objectionable sometimes in the night. But these matters could probably be managed better than they were in those places.

The CHAIRMAN said, before calling upon Mr. Mault to reply, he desired to say something from his own experience. He did not think either system could be adopted to the entire exclusion of the other. It depended much upon the way in which the domestic arrangements were constructed, which was the best. He had the advantage of a garden and used a pit with pipes leading to it, from which the excreta was disposed of in the garden. It depended upon what conditions existed to determine which system was preferable.

Dr. HARDY thought Mr. Bastow had taken unfair illustrations in making out his case. To decide the question for Hobart by reference to any other place it was necessary to find a hilly town with great natural facilities, and with an immense body of open salt water around it. It was almost absurd to quote Manchester, where they had a ditch they had defiled, or even London, with the circumstances existing in Hobart. It was a new fact to him that small-pox was spread by the drainage. He believed typhoid and such diseases were, but had never heard of small-pox being carried about by the drains. He believed that Hobart ought to have a model death rate, something very far below anything in the other towns of Australia.

Mr. J. H. B. WALCH, in reference to Mr. Swan's question about other cities, pointed out Adelaide, where, since the establishment of underground drainage, the death rate had lowered considerably. Dr.

Taylor, of Adelaide, in acknowledging the receipt of Mr. Mault's report, said he had no doubt, from his experience of what had been done elsewhere, that of Hobart, with its natural facilities, could be made under that system, one of the best-drained cities in the world.

Dr. PERKINS said, in speaking about Hobart, he had never said anything about its healthiness or unhealthiness; he had simply quoted the death rate, and left people to draw their own inferences. If they draw fallacious inferences, it was their fault. He was well aware of the many circumstances that affected the death rate—old age, the proportion of the sexes, and other influences that operated against taking the death rate as a test of the sanitary condition of a town. With regard to what Mr. Morton had said about Edinburgh, he had resided five years in that city, and knew that the water system was almost universal. It certainly had some vile places, one of which was known as the "Forty Twas," but the system adopted by the city was the drainage and water system. It was certainly a fact that typhoid had broken out in the better part of Edinburgh while it was absent from the poorer part, but to argue from that that it was the water system which introduced the typhoid fever was a great error, and arose in the first instance from the opinion of some doctors that typhoid was solely a sewer gas fever instead of being taken in with the drinking water as well. He quoted an extract from Dr. Parkes, an eminent authority on hygiene, who gave the statistics of the decrease in deaths for zymotic diseases on the continent by the institution of underground drainage, and contended that cholera had been abolished by that system. Only last year an Australian town had saved a total of 139 lives by an underground system of drainage. If such a magnificent and successful result followed from the initiation of underground drainage, was it fair to raise such objections as a want of proper flushing or many other absurd and trivial objections against it? He was prepared, as a member of the Board of Health, to adopt what was best under all circumstances, for each particular town. It did not follow because the water system was best for Hobart, that it should therefore be advocated for every other town in the colony. He was prepared to receive impressions from all quarters of the world, and to advocate that which was best for any particular place. The two systems had not been fairly contrasted during the debate. Mr. Woollnough did not consider, when he stated how objectionable he found the waterclosets, that they were usually placed inside a house, where the earth closets were placed outside. When they came to consider the earth system there were all sorts of details to be settled. In speaking of the watercloset system, Mr. Bastow had said "they are contrary to the first principles of sanitary science." But by all principles of sanitary science the water system was the best. Sewerage was something to be carried away as speedily as possible, not something to make money out of. It was because water carried away all this matter at once that it fulfilled the laws and maxims of sanitary science. These were not his own opinions, but the opinions of all authorities on hygienic science. Then sewerage was not a matter of mere human excreta; there were the refuse and slops of the kitchen, the stable, cowshed, and household slops. The only defect in the earth system, which was admirable from some points of view, was that it did not make provision for the disposal of various liquids of an objectionable nature, which, having no provision made for them, were poured down the gutters. Flushing did no good, for the housekeeper poured them down again, and they were left to fester in the sun, and in the end, after polluting the air, find their way to the sea. He could not see how any other system than the water system could be adopted in Hobart, if it was desired to make it a sweet and wholesome city. It was no pleasure to him to say Hobart was not a

sweet and wholesome city, being a native of it and having his home there. He would be proud to find it the best in Australia, so far as its sanitation was concerned. There had been a great deal of criticism of Mr. Mault's scheme, but no alternative system had been submitted that would deal with all the slops. Liverpool could not be compared with Manchester, because the large number of sailors arriving there, brought contagion from all parts of the world ; but the death rate of Liverpool had fallen since the underground system of drainage had been carried out from 31 to 24 per thousand. Still Liverpool, from a sanitary point of view, had not all the advantages. Taking Hastings, a town with 33,000 inhabitants, which had a death rate of 17 per 1,000, they found that the perfect system of underground drainage had been carried directly into the sea there for £53,000, or less than Mr. Mault's estimate. Indeed, he believed if the drainage of Hobart could be accomplished for £100,000 he would not think it too much for such a boon. At Dover, where the death rate was the same as Rochdale, it had been reduced from 27 to 14, and Mr. Edwin Chadwick said if the same system of water closets and drainage carried out at Dover had been carried out at Rochdale the death rate there would have been reduced to 14. These facts went far to prove that with an underground system they were not likely to have all those diseases they heard so much about, but were likely to abolish them altogether. As a member of the Board of Health he desired to see Hobart placed in the position she ought to occupy—the first in a sanitary point of view among all the cities of Australasia.

Mr. MAULT in replying said he desired to approach the subject in the same liberal and open manner as had been adopted throughout the discussion, and though he felt warmly on the subject he hoped that he would not be taken to have any one-sided view of his own case. He thought they were to be guided in considering this question by a consideration of law, and he was sorry to find the Hobart Local Board had, while deciding not to adopt the scheme proposed, substituted one that has a direct infringement of existing laws. They deliberately propose that all the sewerage of the city shall be conveyed to the sea in the open gutters, notwithstanding that in the Police Act any person depositing any objectionable matter or liquid in the streets or gutters was liable to a fine or imprisonment. The main objections against his system were economic ones. Mr. Bastow commenced his paper by saying that if the Government would give £60,000, a system of underground drainage would be preferable. He did not under-estimate questions of cost ; but where danger to the life and health of a large number of people was being considered, the question of cost became secondary. Mr. Bastow, for the purpose of upsetting the estimate made, assumed certain erroneous data. For instance, Mr. Bastow had assumed a depth for the sewers, that had he looked at the plans he would have found would have taken them below the sea level. In support of his estimate he contended that at the prices under the Government works contract now in force, the works could actually be constructed for £40,360, exclusive of the cost of supervision. He had allowed £25,625 for two sizes of pipes, and he found out that at Launceston, where a good deal of that kind of work was being done, and at the price of labour there, these two pipes could be laid down for a little under £10,000. He instanced these cases to show that he had been careful to fully estimate. Nothing had been advanced against him by way of argument to prove that his estimates were wrong. The comparison as to the cost of the work, under the dry system at Manchester, with what it would be in Hobart, was altogether fallacious, owing to the much greater numbers in Manchester. The opponents of his system would furnish no estimate of the cost of carrying out any other. In consequence of this he was obliged to furnish the figures for the other systems as well as his own. Nearly

all his remarks had been addressed to a question which had not been debated at all—the question of conveyance. In the Thames Valley the question was not one of conveyance, but of ultimate disposal to the sewerage. By some speakers they were asked to adopt the pan system because of a few trifling private experiences of private individuals, and to forget that 900,000 houses in London had been fitted with water-closets drained into sewers, causing the death rate to decrease from 28 to something less than 20 per 1,000. Mr. Grant was quite correct in attributing the fever at Croydon to pipes, but it was to water pipes, not drain pipes. The fever was most distinctly traceable to imbibing poisonous water, and Croydon was now one of the most notorious successes of the drainage system. Regarding the water question, he defied anyone to prove that 65 gallons a day was used without the most extravagant waste. He desired to point out that sewer gas was never generated in running sewers, but only in stagnant sewers. The gas never generated where water was running at the rate of 2½ft. per second, and one in 300ft., or one in 250ft., would give that flow. In Hobart it was impossible to get so flat a grade as that except very near the exits. Adelaide was unfavourably situated in this respect, and the people there were put to large expense in consequence. Faults in ventilation had been made, but they had been remedied by ventilating shafts, etc., and those who were strongest against it were now most in favour of the underground system in Adelaide. He had considerable experience in sanitary matters, but he never in all his experience came across such an excellent body of by-lays as those drawn up in Adelaide. In that city when the drainage works were commenced the population was 41,241, and the deaths from preventable diseases amounted to 4·14 per thousand; when while the works in 1885 were completed the population was 43,969,and the deaths from preventable diseases was 1·52 per thousand—a saving of 113 lives. In Hobart, taking the registration area, the population was 28,648 in 1881, and the deaths from preventable disease was 2·06; and in 1885, with a population of 29,987, the death rate from the same causes was 2·53. Hobart should not rest content with being in as favourable a condition in sanitary matters as other cities; it should be above all from its natural position and facilities for becoming such. He did not expect to see his scheme adopted without opposition. He knew there were many points for consideration about which he was desirous of knowing more; but he advocated it as the best that could be adopted for the health of the city.

On the motion of Mr. C. J. Atkins, seconded by Mr. C. H. Grant, a vote of thanks was passd to Mr. Mault for his valuable paper.

OCTOBER, 1886.

The usual monthly evening meeting was held on Monday, October 11, at the Society's rooms, Mr. James Barnard in the chair. There was a good attendance of Fellows, and a number of visitors.

Very Rev. Chas. Leslie Dundas, Dean of St. David's, and Mr. H. B. Bruford, Hobart, were elected Fellows of the Society.

The following donations to the library were announced :—
American Agriculturist, September.
Annals and Magazines of Natural History, vol. 18, No. 104, August.
Athenæum.