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ANNUAL GENERAL MEETING, JANUARY 27TH, 1881.

W. J. Stephens, Esq., M.A., Vice-President, in the Chair.

Dr. Alexandri of the University of Pisa, and Mr. Whittle, were introduced as visitors.

PRESIDENT'S ADDRESS.

On behalf of the President, the Vice-President read the following address:—The time has again come round when the duty devolves upon me to deliver the Annual Address to the members of this Society. In doing so, I must first congratulate you on its steady and substantial progress. During the past year we have issued a volume which will bear comparison with any scientific serial for the extent and importance of the matter contained. It has been most favourably received by the colonial Press, and many letters from scientific friends in Europe bear testimony to the high estimation in which our publication is held. The volume for the past year will, I am sure, be equal in interest to the last. The numbers of our members are also on the increase. Our exchanges with other Societies have augmented to that extent that we see the necessity of having rooms and a library of our own; and when that is effected we shall receive valuable aid from some of our members who have already promised donations of books. The attendance at our meetings has been increased. It is not at any time numerous, but in this particular we must not expect a different result from what is experienced by learned Societies in Europe. Proportionably the attendance is small in all those meetings where purely technical science is dealt with. We do not professs to give popular lectures. Our object is the advancement of Natural History by original investigations. We deal with the dry technicalities of scientific diagnosis, and seldom is our knowledge of facts sufficient in Australia to enable us to

wander into the more interesting field of generalisation or theoretic speculation. Thus we cannot expect to have around us more than the few who have mastered the language of Science, or who have gone far enough with observation to appreciate the careful investigations of others. It is to be regretted that the number of these is so few. But we hope to see a growing taste for these pursuits, and there is evidence of it. There are few men who do not share the regret of Thomas Carlisle, who, in one of his works, plaintively exclaims:—"For many years it has been one of my constant regrets that no schoolmaster of mine had a knowledge of Natural History, so far, at least, as to have taught me the grasses that grow by the wayside, and the little winged or wingless neighbours that are continually meeting me with salutation that I cannot answer as things are." Even a moderate knowledge of Natural History makes nature such a living book that all the pleasures of the mind become manifoldly increased. The learned J. Stuart Mill, when philosophy had landed him upon a cold dull pyrrhonism, said that once curiosity was satisfied life was not worth having. Had he been a little of a Naturalist I think he would scarcely have felt this, for curiosity is never satisfied in this domain of knowledge. Each step in advance increases the prospect of fields beautiful and new, and the voice of nature is ever living. To use the idea of Macaulay, we may say it is a philosophy which never rests. "That which was in the distance yesterday is its goal to-day, and will be its starting-place to-morrow."

The retrospect over the progress of our little Society brings me to a subject which forces itself very much upon my mind on this occasion, and that is the general progress of scientific investigation in the Australian Colonies within the last few years. The time has not yet come when anything like a history of our advancement in this respect can be attempted. We can, however, make comparisons which will show us how original thought and investigation have gone on amongst us. Australia has had

singular advantages in its scientific history. Some of the most eminent names on the roll of fame have been first known through what they did on Australian shores. Sir Joseph Banks, Robert Brown, Sir Joseph Hooker, Gould, Jukes, Swainson, and many others are instances of this. I reserve for separate mention the illustrious author of the 'Horæ Entomologicæ,' Mr. William Sharp Macleay. At a time when the natural sciences were almost in their infancy it is with satisfaction and just pride we read the name of this illustrious Naturalist so often quoted. His reputation was world-wide and his investigations all stamped with the mark not only of genius, but with that accuracy and caution which alone give a permanent foundation to scientific fame. All that he acquired—and it was much—will always be associated with Port Jackson, the oft-quoted scene of his labours. We may say that he was truly the pioneer of Natural Science in Australia. just as Sir Thomas Brisbane was the pioneer of Australian Astronomy and Meteorology, and the Rev. W. B. Clarke the father of Australian Geology.

But while the East Coast of Australia thus received its share and more than its share of attention, the South and West, the Centre and the North, were comparatively neglected. This was unfortunate in many ways. Great as the interest is which attaches itself to any portion of our continent, yet the East Coast possesses these novel features in the least degree. The reason of this is that the East Coast shares its peculiarities with other and often well-known provinces. Thus, on the North Coast, there is a large intermixture of the Asiatic element. Some of the plants have been known since the days of the Portuguese navigators. Its molluscan fauna is almost entirely Indian or Philippine. These characters are less marked as the coast is followed to the Southward, but then they become mingled with some belonging to the Pacific Islands, New Zealand, &c. But the South Coast is in every respect Australian. Its flora has few foreigners, and its fauna, whether marine or terrestrial, has scarcely any at all.

This isolation extends even to the sea-fish, to a certain extent. Though the differences between Port Jackson and Port Philip as regards temperature and situation are slight, yet the common marine fishes are of different species. It is a remarkable fact also, that the Geology of the South and East Coasts are different. In the East we have the main cordillera of our continent, which varies but little in its character from Cape Howe to Cape York. We have a central granitic axis with the usual porphyritic and diabasic or dioritic dykes, and cappings. These metamorphic or volcanic rocks are flanked by highly-inclined palæozoic schists and slates, Devonian rocks less inclined, altered, or not fossiliferous appear in places. These are succeeded by the upper and lower coal measures. The whole are capped unconformably by almost horizontal sandstones, known in New South Wales as the Hawkesbury formation. This is the order and character of the range wherever I have visited or crossed it; and this is the sequence shown by all geological surveys. The Hawkesbury sandstone is fully developed in various places, and can be seen in its best sections around the Endeavour River and on the upper waters that flow into the Gulf of Carpentaria. On the Pacific side of the range there are small outlines of the mesozoic rocks in various places north of Cape Moreton. They generally occur on lowlands or where the main axis is less marked as a centre of disturbance. These exceptions are so small that they do not affect the general truth that our cordillera is palæozoic in age, and has been upheaved at the close of the palæozoic period.

On the South Coast the Geology is quite different. There is no main axis. A few isolated ranges crop up in different parts of the coast. These are never of large extent, except in the case of the range which begins at Cape Jarvis. The palæozoic rocks are not absent, but they occupy quite an insignificant position in comparison with the immense development of tertiary formations. The methods applied to the Geological investigation of the Eastern range are quite useless here. In palæontological research,

as is well known, fossils of the earlier periods are common to the whole world. In tertiary palæontology it is different. Geographical provinces for molluscan life are as distinct, or nearly as distinct, as they are now. It thus happened that what was done on the East Coast was no help whatever to raise the veil from the Geology of the South Coast, and our southern Geology remained a sealed book until recently. Even now only a few pages have been discovered. It has been my good fortune to be connected a good deal with the development of our Australian Geology. I have thought it might not be unbecoming in me to relate in this address some facts connected with its history. Though they belong to personal experience, they are the property of our scientific history as well, and I do not think I overrate their interest by recording them here. In 1855 I first saw some of the tertiary fossils of South Australia. They were partly a collection from the River Murray, and what I saw daily exposed in the limestone quarries near Government House in Adelaide. No one could tell me much about them. I was referred to the narrative of Sturt's journey down the River Murray in 1830. In those delightful volumes I found two lithographic plates of fossils taken from the River Murray. Beyond this there was no information to be had. An attempt had been made by Captain Sturt to identify some of the fossils with European tertiary remains but the identifications were all incorrect except in the genera. The only beds I had seen were the limestones at the quarries just mentioned. Fossils were plentiful in them, but they have been now nearly all removed. It was some months before I could examine other beds. These were the limestone cliffs at Mount Gambier and Mosquito Plains, where sections continually occur in caves and extinct craters over hundreds of square miles. The whole of the stone exposed is one mass of fossils. I can scarcely describe my surprise when I first came to examine these rocks closely. Shells are not numerous, but the rock for 100 feet or more is made up of minute organisms—bryozoa for the most part,

but largely intermixed with foraminifera and brachiopoda. When we consider what numbers of these organisms are required to make up one cubical inch of such stone, the countless hosts in hundreds of square miles is a bewildering thought. In the days when I first examined these strata everything was in keeping with such silent records of geologic time. The cliffs and caves were untouched, except by the hand of time. The country, then called the new country, was scarcely settled upon, and one might travel all day without meeting even a blackfellow. The variegated cliffs were in their original state in those silent forests or plains. In some few places weathering had exposed surfaces like the Dover cliffs, and quite as white and dazzling. For the most part the strata were weathered into rounded steps or terraces, coloured yellow, red, or orange, and dotted over with the bushes and creepers that grew abundantly upon them. Every one who knows the graceful forms assumed by the calcareous bryozoa will understand the world of wonder and beauty that was revealed by a close inspection of the stone. It was easy to gather abundant material for speculation, but I searched in vain for any clue by which I could give them a name.

Palæontology was not then the science it is now. D'Orbigny, Reuss, Hagenow, Michelin, and Busk had hardly given their labours to the world, and their works were not accessible in the Australian Bush. I did not care so much about giving a name to all these remains as to be able to give a place in geology to the strata which contained them. What age were they? Tertiary I scarcely doubted, though there was much about them which recalled the chalk or upper cretaceous of Europe. But to what place in the tertiary deposits to assign them I did not kow. I made a large collection of the fossils, and sent them to London, to Sir Charles Lyell, who had from the beginning given me great help in my Geological studies. I had become acquainted with him through Dr. Buckland, Dean of Westminster. I mention both these names, for surely Geology owes more to them

than anyone in the history of its progress. They are justly the pride of British Science—Sir Charles Lyell for his brilliant genius in systematising Geology, and the Dean for the way he made the science attractive and popular. My parcel of fossils was not long without an answer. The letter of Sir Charles has an interest which will warrant my giving it in extenso. It ran as follows:

"Your letter preceded the packet of fossils by some six weeks, but they have come to hand safely. I am very much interested in them, and so are all to whom I have shown them, especially Mr. Busk, who is our greatest authority on *Bryozoa*, both living and fossil. I have placed my collection in his hands, and he promises to make them the subject of a paper to be read before the Geological Society. I must leave it to himself to tell you whether they are new or not. With regard to the question you ask as to the age of these Australian beds, I find it very difficult to give you a reply. You are certainly right in regarding them as tertiary, but their position will depend upon their relation to the existing marine fauna in Australia. This is a matter which can only be undertaken by Naturalists in Australia. I am informed that very little is known of the marine zoology of the seas around your continent. Since your fossils arrived I have made inquiry about a good collection of typical Australian marine shells, but without success. Dr. Gray informs me that the best authentic specimens in the British Museum are from the North Coast. Of those said to be from South Australia the localities given are not always to be relied upon. This may seem disheartening to you, but if you will view it rightly it will open a most encouraging field for your inquiries. What I should advise you to do is to make yourself thoroughly acquainted with the marine zoology of South Australia, Without troubling yourself with specific names, collect wherever you can and examine collections of marine objects. Compare them with all the fossil forms you know. By such means you will soon be in a position to tell more of the age of your tertiary beds than the most learned

of our Palæontologists in Europe could tell you. You will add in a valuable degree to the store of scientific knowledge, and for a young Geologist I cannot well conceive a more inviting position. I hope to hear more of your labours, and I will be happy to render you any assistance in my power. Since writing the above I have been informed by my friend Mr. Ramsay that there is a geological survey about to be established in Victoria, South Australia *(sic)*, under the direction of Mr. Selwyn, a young Geologist of great promise. Probably you can put yourself in communication with him.—Yours, &c., CHARLES LYELL."

Here then, was a task for Geologists, if ever we were to pronounce positively on the age of our tertiary formations—to ascertain what was the marine life of our South Australian Coast, and so by comparison gradually to comprehend the history of the great tertiary deposits. I trust I shall not intrude too much of detail into this address if I briefly state the manner in which Sir Charles Lyell's advice was followed. I was alone upon the field with no professional aid near, so that for many years South Australian Geology made no progress beyond what an amateur could effect. I had before me an easy path by which to commence inquiry. All round the coast from Cape Northumberland to Cape Jaffa there was a series of raised beaches; for twenty miles inland the soil for sixteen feet or so in depth was one mass of shells. They were quite loosely imbedded in a light shell sand, and were but little changed in appearance, and for the most part retaining their colouring in a faint but easily traceable way. It was not difficult to collect a large number of species, and they were easily compared with the shells of the coast near. I found only one point of difference, and that was that the fossils were generally of larger size in the same species. At that time I concluded that when the fossils had been entombed the climate had been warmer; but now I think differently. Since I have examined the fauna of our tropical shores I find that an increase of temperature affects diversely those species of

our southern shores which stray into the northern seas. Some undoubtedly grow larger, such as *Acmæa marmorata;* others are dwarfed and stunted in their growth, such as *Littorina pyramidata;* while others, such as *Acmæa septiformis*, are not affected at all by heat. I do not pretend to solve the problem presented by these shells, but I am quite convinced that our latest pliocene or post-pliocene deposits contain shells of larger size than those which occur on our coasts now. I did not find any species in the deposits which I could not also find on the shores, but the converse of this did not hold good. There were a good many shells on the beach which were not to be found as fossils, though they may, of course, have existed in pliocene times. They were rock species, and we could not expect to find them in these sandy beds.

By these fossils a start was made in classification. Here, at any rate, was one series of deposits that were of latest tertiary age. They were lying conformably on the older limestones with nothing in common with them—not even one shell, as far as I could discover. I may mention here the difficulty I experienced in naming the ordinary mollusca, except as to genera. If this was a difficulty with the recent beds how much more so was it with those of an older origin. Professor Busk named a few of the *Bryozoa*, while Professor Rupert Jones, of the Military College at Sandhurst, rendered me constant assistance. Professor P. Martin Duncan described a good many of the corals. By these aids much information was collected, though I hardly attempted to definitely name any of the horizons. I thought I could leave that and the determination of species to a more advanced state of knowledge than we possessed, and so, in 1863, I published my first work on the Tertiary Geology of Australia. I did not attempt to name any species, which is a matter of regret to me now. I expected aid from European men of Science, which never came. In 1865 Mr. George French Angas published in the 'Proceedings of the Zoological Society of London' a list of the South Australian Marine Mollusca, and described many new species. This did not

enumerate half or perhaps a quarter of those living on our coast, but it was a great help. From that day it may be said the work of classifying our rocks was begun in a systematic manner. I refrain from referring in detail to what was effected by the Victorian Geological Survey, or by Professor M'Coy in the Exhibition reports, or my own paper before the Geological Society of London in 1859. Mr. Selwyn, in his report of the Geological Survey of the Cape Otway district, made the first attempt at the classification of the tertiary deposits of Victoria, but the palæontology was not attempted until the publication of the 'Decades,' by Professor M'Coy, some years later. I had described a few species of *Brachiopoda* and *Echini* with some *Pectens* in the Transactions of the Philosophical Society of Adelaide in 1865, but the number of copies printed was so small that they were scarcely known out of the Colony, and many of my species were redescribed by foreign authors. Dealing with the *Echini* was especially difficult. The whole class was in much confusion until the 'Revision' of Agassiz appeared, and even then our Australian species were not known. In 1866 I published for the Government of South Australia an essay on the classification of the whole tertiary deposits. My idea of the age of the beds was founded less upon palæontological considerations than upon the position of the beds with reference to more recent deposits. In some respects my suggestions have not been generally accepted, and now that I am in possession of better evidence I am not inclined to insist on them. In 1870 Professor P. Martin Ducan undertook to review the whole question of the age of our tertiary beds. His essay appeared in the journal of the Geological Society, and was of a most finished and elaborate character. His knowledge of the position of the beds was derived from Mr. Selwyn's reports, but, as is usual with those not familiar with the country, he confused many widely separated formations, and made no geographical distinction between Mount Gambier, in South Australia, and Hamilton, in Victoria, places more than 100 miles

apart, whose formations are widely distinct in every respect. In an ingenious manner he made some generalisations drawn from comparison between the fossil corals and what he believed to be the coral fauna of Australia. For the latter he had nothing to depend upon but the very doubtful habitats in the work of Edwards and Haime. It was not to be expected that such conclusions would be of any value. Professor Duncan subsequently made a review of the tertiary fossil *Echini* of Australia, comparing them with existing forms on our coasts. In both these essays it was abundantly evident that any conclusions must be imperfect without a better knowledge of our living fauna. The difficulty which I had experienced in the beginning was still the obstacle. It seemed very clear that the problem would never be solved unless the line of inquiry indicated by Sir Charles Lyell were followed. In 1877 I tried to aid this by a complete census of the marine mollusca of Tasmania, in which Colony I had named and described a very large number of tertiary fossils occurring in a small patch of tertiary age on the north coast of that island. But whatever individual effort may have done, I think we owe more to the Linnæan Society within the last few years than to all that has been previously effected. Since its establishment we have seen what I must be excused for calling immense strides made in the knowledge of the marine zoology of our coasts. We have now very complete information on our Mollusca and Crustacea, our Fishes, Corals, Urchins, and Bryozoa. If the problem of the age of our tertiary beds were to be dealt with now, general conclusions could be formed which subsequent discoveries will not disturb to any great extent. Such an attempt has been made by Professor Tate, of Adelaide, as well as in essays of my own in the Transactions of the Royal Societies of Tasmania and New South Wales. Professor P. Martin Duncan in his essay deprecates the use of such terms as Pliocene, Miocene, and Eocene by Australian Geologists, and prefers the terms Upper, Middle, and Lower Cainozoic, as tending less to mislead in our present imperfect

knowledge. If I understand the objection, it refers to the danger of error from supposing that what we call Pliocene or Miocene was coeval or contemporaneous with formations in Europe bearing the same name.

Professor Tate has well pointed out that the terms suggested by Professor Duncan mean neither more or less than the terms used in Europe, and there is just as much implied by their employment. In this brief sketch of the history of Australian Tertiary Palæontology I have shown, I think, how much the Science has been retarded for want of such researches as our Linnæan Society is specially instituted to encourage. I may add that the progress in every department of Natural Science in Australia has been surprising since its influence has been felt. It has not only stimulated observation, but has given that kind of encouragement to systematic and technical records which has made the only real progress that can be made in Australian Natural History.

I should like, in concluding this address, to give a glance at the progress of Natural Science during the past year, after having dealt with the Australian history of our department of Science. But even a glance at one year's work is more than space will permit me to give. It will, however, be in keeping with the matter of this address if I refer to the researches of Mr. Sorby on the metamorphism of calcareous rocks. His observations were made public in his presidental address last year to the Geological Society of London. They have a most important bearing on our Australian tertiary rocks, but to make this clear I must state some further facts relating to them. In my first acquaintance with the Mount Gambier limestones I noticed that some shells were found only as casts—those by far the majority. A few *Pectens* and *Brachiopoda* were preserved with the shelly matter unchanged. Corals, except the *Oculinaceæ*, were preserved as casts only, while the *Echini* were always crystallised into calcite, and so were their spines. These peculiarities were only seen in

the Mount Gambier limestone; but however far apart the localities where the deposits were represented they never varied in character. The formation is very extensively spread over thousands of square miles of country, from the River Murray to Gippsland, but it does not always crop out on the surface. It is covered by a formation in which all the shells are well preserved, and where such things as casts are unknown. I do not propose to dwell on the strong contrasts these deposits present, but merely draw attention to the fact that in the lower Bryozoan limestones the majority of the shells and corals are always found as casts, and a few have the shelly matter unchanged. I was astonished at finding that the rule held good in the same formation in as remote a locality as the Middle Island of New Zealand (Oamaru). It appears that the same phenomenon is occasionally seen in Europe and there the same shells (*Pectens*, *Brachiopoda*, &c.) resist the solvent, and are found entire. I must refer my readers to the address of Mr. Sorby for a full account of this most singular case of metamorphism, and for the details of the ingenious and and brilliant researches which have led to its explanation. The results are briefly these: Mr. Sorby has found, by careful analysis that much of the carbonate of lime in Shells, Corals, *Bryozoa*, *Echini*, &c., is present in a mineral or crystalline state, and not merely organically combined. There are, I need hardly say, two well defined forms for the crystals of carbonate of lime—one calcite, and another arragonite. It is in the latter form that the mineral is found for the most part in shells, &c., the exceptions being few. But arragonite is a very unstable form of the combination of carbonic acid and lime, and thus it is easily decomposed, and dissolves away or changes into calcite. The latter mineral is a very stable form, and though the pseudomorphs of calcite in arragonite casts are numerous, the contrary never happens, that is to say, arragonite is never formed at the expense of calcite crystals. Furthermore, Mr. Sorby has found that Shells, Corals, &c., which invariably occur as casts, are those

in which the carbonate of lime exists in the form of arragonite or the unstable compound, while the permanent shells and corals such as *Pectens*, *Bryozoa*, *Oculinaceæ*, &c., are the forms in which the carbonate of lime originally exists in the form of calcite. The reason for this distinction is still veiled to us, and I suppose will be found to depend on the explanation, which we have still to discover, of the allotropism of the carbonate of lime. I may mention that the metamorphism to which I refer seems to depend on the extent to which the beds are calcareous. In the Murrayian deposits (to use the appropriate distinctive term of Professor Tate) or Middle Miocene, as they are represented at Muddy Creek, Western Victoria, there is no metamorphism, but the beds, though very calcareous, are largely mixed with the siliceous and ferruginous remains of submarine volcanic rocks.

In conclusion, I may congratulate the members on the extensive and untouched fields of investigation which are open to us in this country. It is hard to turn into any path of Science without being met half-way, as it were, with new and important discoveries. A few days ago at Cleveland, in Moreton Bay, I came across a basaltic bed, which had been partly cut away for road purposes. Underneath I found a bed of shells, all of existing species, and such as inhabit Moreton Bay at present. Here was direct evidence of the age of our modern dolerites of the East Coast. They are Post-Pliocene, and this was the first clue to their age from marine fossils which have been found on the seaboard on this side of the Continent. I think it will show hereafter that our so-called Pliocene fossil fruits are of an earlier date, since we cannot suppose the change to have been so complete in the vegetable kingdom, and none to have taken place in the marine fauna, and that probably our dolerites of the interior are of Miocene age. I intend to treat the subject more at length. I merely indicate it now to show how easily we may add in an important manner to the facts of Science in Australia. I must again congratulate my fellow workers in this Society on their

industry and zeal. They have laboured so indefatigably that I can look back to the period of my presidency as one which has largely added to the reputation for usefulness and efficiency which the Linnæan Society has gained."

A very cordial vote of thanks was accorded to the Rev. J. E. Tenison-Woods for his very instructive and interesting address. The Treasurer's statement showed:—Balance from 1879 and receipts, £335 1s. 1d.; expenditure, £291 11s. 4d.; balance at credit, £43 9s. 9d.

The Rules were amended, on the motion of the Hon. W. Macleay, increasing the number of the Hon. Secretaries to two and the Members of Council to eight.

The following gentlemen were then elected the Office Bearers and Council for the year 1881.

President:

Dr. James C. Cox, F.L.S., C.M.Z.S.,

Vice-President:

Rev. J. E. Tenison-Woods, F.G.S., F.L.S.

Hon. Secretaries:

The Hon. W. Macleay, F.L.S.,
W. J. Stephens, M,A.

Hon. Treasurer:

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Hon. James Norton, M.L.C.
J. Brazier, C.M.Z.S.
P. Pedley.
Hon. P. G. King, M.L.C,

Plates X. and XI. of this Volume are omitted, the Paper which they were designed to illustrate having been lost.