

## JUNE, 1893.

The monthly meeting of the Royal Society of Tasmania was held at the Museum on Tuesday, June 13, Mr. J. Barnard (senior vice-president) occupying the chair. There was a moderate attendance of members and several ladies.

## ADMISSIONS.

The following gentlemen were balloted for and elected Fellows of the Society:—Messrs. T. E. Stewart Abbott, M.R.C.S., L.S.A., W. T. Strutt, F. W. Piesse, Colonel Cox, C.B., and Mrs. C. Eddie (Launceston).

## SOME ADDITIONS TO THE MOSS FLORA OF TASMANIA.

Mr. W. A. Weymouth read a paper dealing with Tasmanian mosses (1) new to science; (2) known species now first recorded for Tasmania; and (3) a few already recorded for this colony, but either rare or not previously described. He said:—The determinations are by European specialists. One of these, Dr. O. Burchard, of Hamburg, has reported 65 new species, a list of which was received from him by the Secretary of this Society in January, 1892. None of these determinations having up to date been supported by descriptions for publication, I have hitherto refrained from calling your attention to them; and only a few that have been revised and confirmed by another authority are included in this paper. Professor V. F. Brotherus, of Helsingfors, who has for some years been engaged upon the mosses of Australia, and more recently upon those of Tasmania also, has just published in Part II. of "Some new species of Australian Mosses, described by V. F. Brotherus," original descriptions of six new species from this colony. My versions of these descriptions are given below. Following them are other new species, for which descriptions will be forthcoming later on. One of the most interesting of our mosses is *Pleurophascum grandiglobum* (Lindberg), which up to the present has been recorded only as collected by Mr. R. M. Johnston near the Picton River. I can now add that in January, 1892, Mr. L. Rodway handed me a fine specimen obtained by Mr. Wm. Fitzgerald in the neighbourhood of Mount Zeehan. In December of the same year Professor Brotherus sent me one collected by Mr. T. B. Moore on the highlands of Mount Tyndall (from Mr. R. A. Bastow I have since also received a bit of this); and in May of the present year the Rev. John Bufton sent me some obtained by himself at Port Davey. I would call the attention of the Fellows present to the mounted examples on the table; and would especially mention that Mr. L. Rodway, to whom I am indebted for ever ready help with microscope and pencil, has kindly undertaken to illustrate some species by drawings of their several parts. (Here followed names, descriptions, and other particulars.)

Mr. RODWAY said that some of the specimens he had examined for Mr. Weymouth were very rare, of unusual interest, and not found in any other part of the world. He had made sketches of some for him, and suggested that these should be reproduced in the Society's transactions if possible. (Hear, hear.) Where bryologists could not obtain specimens, light correct sketches would greatly enhance the value of the journal. (Hear, hear.)

## DISCOVERY OF GLACIATION IN TASMANIA.

Mr. T. B. MOORE, F.R.G.S., contributed some supplementary notes to his paper, read at the April meeting on "The discovery of glaciation in Tasmania.

## GLACIAL ACTION IN TASMANIA.

This was the subject of an interesting paper by Mr. A. Montgomery, M.A., in continuation of the discussion on Mr. Moore's paper on "The discovery of glaciation in Tasmania." Mr. Montgomery stated that having himself come upon evidences of ice action in February last in the neighbourhood of Mount Pelion, and being at that time ignorant of Mr. Moore's discovery four months earlier, he had intended in any case to submit a few observations on the subject of glaciation. Before passing on to what he personally saw, Mr. Montgomery made some remarks on Mr. Moore's paper. He said it was by no means a new discovery, as Mr. Moore appeared to think, that there were glaciers among our western highlands, for Mr. R. M. Johnston, and, if he was not mistaken, the late Mr. Sprent also, noticed the existence of large erratic blocks in the valley of the Mackintosh River, and inferred from these that they must have been brought down by ice. Messrs. Dunn and Moore's and his own later finding of striated boulders, smoothed surfaces, *roches-moutonnées*, and moraine drifts, only confirmed the correctness of the views of these earlier observers. Mr. Moore was, therefore, in error in ascribing to Mr. Dunn the honour of being the discoverer of evidences of glacial action in Tasmania, though perhaps he was the first to bring forward indisputable proof. The country described by Mr. Moore round Mounts Sedgwick and Tyndall and Lake Dora was very similar to that round Mount Pelion. The conglomerates he spoke of as Devonian were of much interest, and the further examination and fossil evidence of their age would no doubt add an important chapter to our knowledge of the geology of the colony. In his journey from Barn Bluff to Zeehan, Mr. Montgomery said he noticed conglomerates of three distinct ages. To Mounts Sedgwick and Dundas, mentioned by Mr. Moore as capped with diabase greenstone, might be added Barn Bluff, Mounts Pelion, Ossa, East Pelion, the DuCane, Eldon, and Oakley Ranges, as all showing the same feature. While not saying that ice was the only considerable agent in cutting out the valleys, the shape of many of them, and the contour of the hillsides suggested that the present configuration of the surface was largely due to glacial erosion. The first place Mr. Montgomery came upon plain proof of ice action was near East Mount Pelion, between a branch of the River Forth flowing from that mountain and from Lake Eyre, and another small feeder running in a deep gully at the foot of the Oakley Range. The high narrow plateau lying between Mount Pelion and Barn Bluff also showed in its every contour the former presence of glaciers. On the slopes of Barn Bluff there were two more lines of moraine ridges separating flat valleys which had been the beds of adjacent glaciers. Going from Barn Bluff towards Granite Tor, the rolling hummocks and rounded ridges continued to be met with on the high lands, and descending suddenly and abruptly from these were huge deep ravines and valleys. The lakes at the head of the west branch of the Murchison River, and on the divide between it and the Henty, Lakes Spicer, Dora, Beatrice, Rolleston, Julia, Selina, also probably indicated the former presence of glaciers, and he thought they must come to the conclusion that the whole of the deep gorges among the western mountains, now occupied by the headwaters of the Pieman, Henty, and King Rivers, had at no very distant period of time been occupied by rivers of ice. He admitted the want of evidence to prove widespread glaciation in the eastern parts of the colony, and mentioned the matter rather because it seemed an almost necessary consequence of admitting the prevalence of ice in the western highlands that it should also have existed in the east, than on account of any direct proof. At the head of the King River, on the western slope of Mount Reid, there had been discovered a deep lead presenting suggestive features of ice action. In glancing at the causes of glaciation,

he said it might be due to the greater elevation of the land and geographical changes, resulting in a redistribution of sea and land, diversion of ocean currents, and so on, or it might be due to astronomical causes as so lucidly explained by Sir Robert Ball in his recently published little book on "The cause of an ice age." It was probable that the refrigeration of the climate of Tasmania, which led to the gathering of glaciers on its high mountains, was due to the causes insisted on by Dr. Croll and Sir Robert Ball. While inclined to believe that the ice-covering was more extensive than Mr. R. M. Johnston was disposed to allow, he agreed with him in the main, and did not think that the whole country could have been ice-bound. Many of our indigenous animals existed in the colony before the probable date of the glaciation, and if the latter had been extreme would have been killed out altogether; in which case, if he was right in referring the cold period to a time subsequent to the severance of Tasmania from the Australian continent, there would have been no chance of a fresh stock having been obtained from the mainland after the climate again became milder. Outside this colony evidences of glacial action had been found in the Australian Alps and on the beach near Adelaide. A quotation from the Challenger reports showed that Kerguelen Land had been at no very ancient date completely covered by heavy ice. Mr. Jack, in referring to this, points out that if the Antarctic ice cap were extended to cover Kerguelen Land, there would be no improbability of its also reaching the shores of Australia. The whole subject, said Mr. Montgomery in conclusion, was most interesting, and had numerous aspects on which more light was required, and fresh proof of the extent and date of the glacial action all over the Southern Hemisphere would be eagerly looked forward to.

#### THE GLACIER EPOCH OF AUSTRALASIA.

Mr. R. M. JOHNSTON, F.L.S., read an elaborate "Review of the evidences of former glaciation in Australasia, with critical observations upon the principal causal hypotheses which have been advanced to account for glacial epochs generally." In introducing the subject, he said:—The study of the geology of the globe we live in presents many fascinating subjects. In its *cosmical* aspect we may confine ourselves to speculations as to its mode of origin from nebular matter to the final stages which culminated in its specific differentiation as a subordinate among many other members of the solar system. In its *geognosy* we may revel in the nature and complexity of the combinations of the elements which constitute its varied rocky materials. In its *geotectonic* or *structural* aspect we may enter upon questions relating to the nature of and the manner in which the architecture of the earth's crust has been developed, modified, or transformed. In its *dynamical* aspects we may inquire into the complex causal forces which are, or have been, engaged in producing disturbances, movements, and changes in its physical structure. In its *stratigraphical* aspect we may devote our attention in tracing the chronological sequence and relationship of the various formations which comprise its visible crust or shell. In its *physiographical* aspect we may dwell upon its surface feature of mountain, valley, plain, plateau, lake, canon, river bed, or ocean abyss, and try to understand the causes which have operated in producing its sculptured form, and, finally, in its *palaeontological* aspect, we may trace the history of the organic life forms whose remains are found preserved in the rocks, their succession or evolution, and their relationship to the corresponding succession of rocks. The geological field is thus wide and varied, and we may become so absorbed in the investigation of any one division of the several aspects referred to as to forget the claims and importance of the others. It is well, therefore, from time to time, that we should have our attention aroused to the claims and interests of branches of geological study outside of that to which each of us respectively may

happen to be too deeply immersed. We, therefore, cannot realise the benefit of such papers as those of Messrs. T. B. Moore and A. Montgomery, M.A., which arouse us from our own favourite grooves, and recall our attention, for a time at least, to that large and important phase of dynamical geology known as glacial action. This phase also at once inevitably leads on to consideration as to its cause or cosmical aspect; to its effects as in its stratigraphical and physiographical aspects, and to the period of its manifestation as in its chronological aspect. Before we enter upon the question of evidence as to the occurrence of a former climate in Australasia sufficiently intense to be designated "A Glacial Epoch," we must briefly consider the character of the evidence by which we infer its actual occurrence. It is obvious that we cannot directly approach the subject of the earth's temperature at a former period, for the original cooled air and the frozen water cannot be conceived to be stored up and preserved for our observation, as in the case of ancient forms of life preserved in the rocks. But while directly we can gain no information as to temperature, we have abundant evidence preserved of the effects, which, according to our present knowledge, can only have been produced by an intensely low temperature acting upon watery vapours while subjected to the universal law of gravitation. It is therefore clear that it is in the preserved dynamic effects of moving masses of snow or ice and negatively in the poverty or total absence of life forms that we have the best, if not the only, means of inferring the severity of the climate of a former period. After a lengthy and detailed illustration of the subject in all its aspects and bearings, assisted by a specially executed diagram, Mr. Johnston concluded by observing that it was sufficient in "respect to evidences bearing upon causes of glaciation, in Australia and Tasmania at least, to justify me in adopting for the present the following conclusions:—1. That the Glacier Epoch of Australasia was probably comparatively mild in its effects, manifesting itself mainly by increased rainfall in lowlands, and by establishing local glaciers in the alpine regions of Southern Australia and Tasmania, and in greatly extending the spread of the existing snowfields and glaciers of the New Zealand Alps. 2. That probably, in Australia, the local glaciers of the Alps melted before reaching the 2,000ft. levels within the valleys which descended continuously from the elevated snowfields; and in Tasmania it is most probable that only on the western slopes of our western highlands was there sufficient precipitation to yield glaciers, any of which did not reach the sea, and probably were melted within their own valleys before reaching the 1,000ft. level. 3. That the date at least of our most refrigerated period was probably isochronous, and mainly caused by the maximum cycle of eccentricity of the earth's orbit with winter in aphelion, probably near to the beginning of our Neogene Period, say 850,000 years ago. 4. That if the latter be true, it proves that the astronomical theory by itself (*i.e.*, without concurrence of geographical conditions) would not adequately account for the ice age of Europe and North America, nor for the absence of marked glacial phenomena among the earlier tertiary deposits of Europe, at points of time concurring with the earlier cycles of eccentricity of the earth's orbit with winter in aphelion. I do not expect that my conclusions will be accepted at present by many geologists who have already attained to crystallised views on the matter, but even these may be prepared to allow that, granting the premises assumed by me, my conclusions follow as a logical necessity."

Messrs. T. STEPHENS and O. H. GREENE having made some observations on the papers read and the subjects dealt with, the usual votes of thanks to the contributors were passed, and the meeting concluded.